



British Museum (Natural History).

This is No. **3** of 25 copies of  
the "Catalogue of Chiroptera" (Second  
Edition), Vol. 1, printed on special  
paper.







CATALOGUE  
OF THE  
CHIROPTERA  
IN THE  
COLLECTION  
OF THE  
BRITISH MUSEUM.

SECOND EDITION

BY  
KNUD ANDERSEN.

Volume I: MEGACHIROPTERA.

LONDON:  
PRINTED BY ORDER OF THE TRUSTEES.  
SOLD BY  
LONGMANS & Co., 39 PATERNOSTER ROW, E.C.;  
B. QUARITCH, 11 GRAFTON STREET, NEW BOND STREET, W.;  
DULAU & Co., LTD., 37 SOHO SQUARE, W.;  
AND AT THE  
BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, S.W.

1912.

[*All rights reserved.*]

PRINTED BY TAYLOR AND FRANCIS,

RED LION COURT, FLEET STREET.

# PREFACE.

---

THE Catalogue of Chiroptera in the British Museum by Dr. G. E. Dobson, published by the Trustees in 1878, proved to be, as was expected, a work of great utility to zoologists, the systematic arrangement of these animals having been previously in a state of the utmost confusion. The Catalogue was therefore generally welcomed, and as a consequence soon ran out of print and became almost unobtainable. Moreover, the stimulus it gave to the study of Bats rapidly tended to render it obsolete, and a new edition has therefore long been a desideratum.

But owing to the difficulties of the subject and the necessity that the writer should be able to give his whole time to the work, undistracted by official duties, it has not previously been possible to arrange for the publication of a second edition.

Two or three years ago, however, the Trustees were fortunately able to secure the services of Dr. Knud Andersen, who had already made a special study of Bats, and who has been able to devote himself uninterruptedly to the preparation of the present work.

This Edition is in reality a completely new and original Monograph of the Order Chiroptera, for materials, methods of work, and ideas on species have all so radically changed since 1878, that nothing remains of the first edition—good as that was for its date—but the title.

So great is the increase in the general knowledge of the subject and also in the material examined and described, that whereas in

1878 one volume was found sufficient for the whole of the Order, rather less than one fifth of it being devoted to the Megachiroptera, a volume of somewhat greater size is now needed for the Megachiroptera only, while a corresponding enlargement will probably take place in the part dealing with the other groups of the Order.

The Author indicates in his Preface that the number of specimens belonging to the Museum has greatly increased since 1878, while in addition he has been able to examine all the chief collections of Chiroptera in Europe, notably those of Paris, Berlin, and Leyden, and to borrow a large part of that of the U.S. National Museum at Washington. The thanks of the Trustees are due to the Authorities of the various Museums who have helped him in this respect. The volume also owes much to Mr. Oldfield Thomas, F.R.S., who has interested himself in its progress since its commencement, and has assisted the Author by discussing difficulties from time to time as they arose, and in other ways.

SIDNEY F. HARMER,  
*Keeper of Zoology.*

British Museum (Natural History).  
February 22nd, 1912.

## AUTHOR'S PREFACE.

---

*SPECIMENS EXAMINED.*—In 1843, when J. E. Gray published his 'List of the Specimens of Mammalia' in the British Museum,' the Megachiroptera were represented in the National Collection by 69 specimens. Thirty-five years later (Dobson's 'Catalogue of Chiroptera,' 1878) the number had increased to 425. After another period of thirty-four years (this Catalogue) the total reaches 1470. The skins enumerated in this volume amount to 956, the specimens preserved in alcohol to 444, and the skulls to 1228. Exactly half a century ago (Gerrard's 'Catalogue of the Bones of Mammalia in the British Museum,' 1862) the number of skulls was only 39; in 1878 it was 82. That the number of specimens is now three and a half times, but that of skulls fifteen times, greater than in 1878 is due to the fact that during the preparation of this Catalogue the skulls have been extracted from nearly all the old skins in which they had hitherto been left as well as from about 60 per cent. of the alcoholic specimens. In Dobson's time there were separate skulls of only half the number of species of Megachiroptera then in the Collection, whereas now every species and subspecies in the Museum, with one exception (*Pteropus arnensis*), is represented by at least one and often by a series of skulls.

Besides the specimens preserved in the British Museum I have had for inspection a large number from other Collections, and during two visits (in 1907 and 1909) to the Museums of Leyden, Berlin, and Paris I had the privilege of going through nearly the whole of the series of Megachiroptera in those Collections, so that the total number of specimens examined for the purpose of this Catalogue amounts to about 2400.



*Number of genera, species, and subspecies.*—The growth of our knowledge of the existing forms of Megachiroptera, since Linnean times, is shown in the subjoined table:—

	Genera.	Genera and Subgenera.	Species.	Forms.
1758. Linné .....	†	.....	1	
1810. E. Geoffroy † .....	2	.....	12	
1825. Temminck † .....	2	.....	20	
1837. Temminck † .....	5	.....	37	
1867. Peters † .....	9	..... 11	49	55
1870. Gray † .....	14	..... 15	57	71
1878. Dobson .....	10	..... 13	70	78
1899. Matschie † .....	20	..... 35	120	142
1907. Miller † .....	30			
1912. This Catalogue .....	35	..... 38	186	228

Of the 228 forms described in this Catalogue 207 (91 per cent.) are represented in the Collection, of the 35 genera 32 (91 per cent.). The following twenty-one forms are at this moment desiderata (the three missing genera, all monotypic, are marked with an asterisk):—

<i>Pteropus hypomelanus geminorum</i> , p. 106.	* <i>Pterotes anchieta</i> , p. 486.
„ <i>pallidus</i> , p. 136.	<i>Epomophorus pousarguesi</i> , p. 543.
„ <i>pumilus</i> , p. 157.	<i>Myonycteris (Phygetis) brachycephala</i> , p. 582.
„ <i>ulanus</i> , p. 177.	<i>Cynopterus brachyotis minutus</i> , p. 625.
„ <i>merianus</i> , p. 178.	„ <i>major</i> , p. 629.
„ <i>vanikorensis</i> , p. 184.	„ <i>princeps</i> , p. 633.
„ <i>aldabrensis</i> , p. 213.	* <i>Ptenochirus jayori</i> , p. 645.
„ <i>tuberculatus</i> , p. 309.	* <i>Chironax melanocephalus</i> , p. 660.
„ <i>campyrus pluton</i> , p. 353.	<i>Syconycteris australis</i> , p. 781.
„ <i>macrootis</i> , p. 396.	<i>Notopterus neocaledonica</i> , p. 799.
<i>Acerodon lucifer</i> , p. 432.	

All forms, including those not represented in the Collection, have been examined by me.

† All Chiroptera were in the tenth edition of the 'Systema Naturæ' referred to one genus, *Vespertilio*.

‡ E. Geoffroy, 'Description des Roussettes et des Céphalotes, deux nouveaux genres de la famille des Chauve-souris'; Ann. Mus. d'Hist. Nat. Paris, xv. pp. 86-108 (1810).

Temminck, 'Monographies de Mammalogie,' i. pp. 166-204 (1825).

Temminck, *op. cit.* ii. pp. 49-112 (1837).

Peters, 'Ueber die Flederhunde, *Pteropi*, und insbesondere über die Arten der Gattung *Pteropus* s. s.'; MB. Ak. Berlin, 1867, pp. 319-333, 865-872.

Gray, 'Catalogue of the Monkeys, Lemurs, and Fruit-eating Bats in the Collection of the British Museum' (1870).

Matschie, 'Die Megachiroptera des Berliner Museums für Naturkunde' (1899).

Miller, 'The Families and Genera of Bats'; U.S. National Museum, Bulletin 57 (1907).

*Types of valid names (Eutypes).*—The types of the 228 species and subspecies of Megachiroptera are distributed as follows:—

	British Museum.	Berlin.	Leyden.	Paris.	U.S. National.	
<i>Eidolon</i> (3 forms) .....	1		1			Not traced, 1.
<i>Rousettus</i> (14) .....	9			3		Calcutta, 2; Lisbon, 1.
<i>Boneia</i> (1) .....			1			
<i>Pteropus</i> (103) .....	49	15	11	8	10	Calcutta, 1; Cambridge (Mass.), 1; Copenhagen, 1; Genoa, 2; Sydney, 1; ? Zi-ka-wei, 1; private possession, 1; not traced, 5.
<i>Acerodon</i> (9) .....	5	2	1			Chicago, 1; Dorpat, 1.
<i>Pteralopex</i> (2) .....	2					
<i>Styloctenium</i> (1) .....	1					
<i>Dobsonia</i> (13) .....	8			3		Brisbane, 1; ? Zi-ka-wei, 1.
<i>Harpyionycteris</i> (1) .....	1					
<i>Plerotes</i> (1) .....						Lisbon.
<i>Epomops</i> (4) .....	1		1	1		Lisbon, 1.
<i>Hypsignathus</i> (1) .....						Philadelphia.
<i>Epomophorus</i> (9) .....	3	1	1	1		Philadelphia, 1; Stockholm, 1; Stuttgart, 1.
<i>Micropteropus</i> (1) .....						Not traced.
<i>Nanonycteris</i> (1) .....			1			
<i>Scotonycteris</i> (1) .....		1				
<i>Casinonycteris</i> (1) .....	1					
<i>Myonycteris</i> (4) .....	3					Lisbon, 1.
<i>Cynopterus</i> (16) .....	6		2		5	Calcutta, 1; Vienna, 1; not traced, 1.
<i>Ptenochirus</i> (1) .....		1				
<i>Megarops</i> (1) .....			1			
<i>Dyacopterus</i> (1) .....	1					
<i>Balionycteris</i> (1) .....	1					
<i>Chironax</i> (1) .....			1			
<i>Thoopterus</i> (1) .....	1					
<i>Penthetor</i> (1) .....	1					
<i>Sphaerias</i> (1) .....	1					Genoa.
<i>Nyctimene</i> (13) .....	12					Not traced, 1.
<i>Eonycteris</i> (3) .....	1		1			Calcutta, 1.
<i>Megaloglossus</i> (1) .....						Hamburg.
<i>Macroglossus</i> (6) .....	3	2				Not traced, 1.
<i>Syconycteris</i> (7) .....	4	3				
<i>Melonycteris</i> (1) .....	1					
<i>Nesonycteris</i> (1) .....	1					
<i>Notopteris</i> (2) .....	1			1		

Summed up, this gives the following totals:—British Museum, 118, or more than half the number of all eutypes; Berlin Museum, 25; Leyden, 22; Paris, 17; U.S. National, 15; Calcutta, 5; Lisbon, 4; Genoa, 3; two each in the Philadelphia and Zi-ka-wei(?) Museums; one each in the Brisbane, Cambridge (Massachusetts), Chicago, Copenhagen, Dorpat, Hamburg, Stockholm, Stuttgart, Sydney, and Vienna Museums; one (*Pteropus tytileri*) is said to be in private possession; while ten have not been traced (most of

these, if not all, are almost certainly not in existence), viz. *Eidolon helvum* (once in the Museum Leverianum), *Pteropus hypomelanus tomesi* (once in the possession of Mr. L. L. Dillwyn), *Pteropus subniger* (Cabinet Réaumur), *Pteropus rufus* (Paris Museum), *Pteropus niger* (ancient Royal Cabinet, Paris), *Pteropus poliocephalus* (based on specimens in Leyden, Paris, and London, none of which can now be traced with certainty), *Micropteropus pusillus* (cotypes once in the Tomes Collection and Paris Museum), *Cynopterus sphinx* (ancient "Naturhistorie-Selskab," Copenhagen), *Nyctimene cephalotes* (described by Pallas), and *Macroglossus minimus* (Paris Museum).—That the sum total (234) is a little in excess of the number of recognized forms (228) is due to the fact that in a few cases the cotypes of one form are preserved in different collections.

The 228 forms have been described by the following fifty-seven writers (those, seventeen in number, who have described eutypes preserved in the British Museum are marked with an asterisk):—

Allen (G. M.), 1.	* Hodgson, 1.	Peale, 1.
Allen (H.), 1.	Hombroen & Jacquinot,	Peters, 20.
* Andersen, 57.	1.	Peters & Doria, 1.
* Anderson & de Win-	Jentink, 3.	Quoy & Gaimard, 3.
ton, 1.	Kelaart, 1.	Ramsay, 1.
Blyth, 1.	Kerr, 3.	Schlegel, 1.
* Bocage, 3.	* Lay, 1.	* Selater (P. L.), 1.
Brünnich, 1.	* Linné, 1.	Seabra, 1.
Desmarest, 2.	* MacGillivray, 1.	* Smith (A.), 1.
De Vis, 1.	Mason, 1.	Sundevall, 1.
* Dobson, 13.	Matschie, 8.	Temminck, 15.
Elliot, 1.	Mearns, 2.	* Thomas, 24.
Eschscholtz, 1.	Miller, 10.	* Thomas & Wroughton,
Geoffroy (E.), 7.	Milne-Edwards, 1.	2.
* Gould, 1.	Müller (S.), 1.	Tomes, 1.
* Gray, 16.	* Nicoll, 1.	Trouessart, 2.
Hallowell, 1.	* Ogilby, 1.	True, 1.
Heude, 2.	Pagenstecher, 1.	Vahl, 1.
Heuglin, 1.	Pallas, 1.	Zebebor, 1.

The types of 185 forms have been examined by me, and of ten other forms I have had paratypes for inspection. With regard to the remaining thirty-three forms, I have seen topotypes of nineteen, of two types I have had photographs of the skull and dentition, and two have been examined for me by others. This leaves only ten forms, but of six of these the types are, either certainly or probably, not in existence, leaving finally the following four, viz. *Pteropus papuanus*, *Dobsonia pannietensis*, *Epomops dobsoni*, and *Megaloglossus woermanni*, but in none of these four cases is there any doubt as to the identification of the species.

*Types of synonyms (Hypotypes).*—127 names (variants not counted) occur in the synonymy of the recognized forms of Megachiroptera. Eight are nomina nuda, and the types of thirty-nine names have not been traced. The remaining eighty hypotypes are distributed as follows:—

British Museum, 38; Berlin, 10; Leyden, 7; U.S. National Museum, 6; Paris, 5; Zi-ka-wei(?), 3; two each in the Museums of Frankfort-on-the-Main, Lisbon, Philadelphia, and Sydney; and one each in Calcutta, Dresden, Stockholm, and Vienna; while one is probably in private possession.

63 of these 80 types have been examined by me, while of two other forms I have seen paratypes. In thirteen other cases I have either had photographs of the skull and dentition of the types, or the types have been examined for me by local zoologists, or I have seen topotypes. The remaining two names are *Pteropus mascarinus* (= *Pt. rodricensis*) and *Odontonycteris meyeri* (= *Macroglossus lagochilus*).

*The Catalogue.*—Nominally this is a second edition of Dobson's 'Catalogue of the Chiroptera in the British Museum' (1878); in reality it is an independent work, except of course in so far as every work of this kind must be based on its predecessors. The descriptions are new, the technical names are fixed in strict accordance with the principle of priority, the synonymy is in most cases worked out on the basis of an examination of the types and paratypes, and all references to literature have been compiled by myself. It has been my object on the one hand to make the descriptions of the genera, species, and subspecies reasonably complete, on the other hand to avoid repetitions as far as possible. For the latter reason I have often preferred to give a differential rather than a full description, that is, I have confined the description of a given form chiefly to those characters by which it differs from its nearest fully described relatives. To render the Catalogue easier for reference the descriptions are, whenever required, subdivided into specially headed paragraphs (Diagnosis; Skull; Dentition; Palate-ridges; External characters; Sexual differentiation; Specimens examined; Range; Habits; Affinities; History in literature; Type, Nomenclature, and Synonymy, &c.). Detailed measurements are given of the skull and external dimensions, and as a rule also of the premolars and molars, of every form described.

In the Introduction to this volume (pp. xvii-ci) I have given a summary of the general characters of the Megachiroptera, of the principal variations within the Suborder of the cranial, dental, and external characters, of the mutual affinities of the genera, of the geographical distribution of the genera, species, and subspecies, and finally, a synopsis of the more important differential characters of the subfamilies and genera, and an artificial "key" to the genera.

The illustrations (85 in number; see list p. 835) are original, with two exceptions (fig. 32, p. 490, and fig. 51, p. 643), and figures are given of the skull and dentition of all genera and subgenera, except one (*Chironax*, p. 658).

As this is the first Vertebrate Catalogue in which the register numbers of the specimens have been published, it may be explained that of the four successive items composing these numbers, the first represents the year, the second the month, and the third the day when registration took place, the fourth being the individual number of the specimen; *e. g.*, 98.7.6.5 means 1898, July, the sixth, number five.

The same symbols are employed as have been customary in this series of British Museum Catalogues. "[P.]" reads "Presented by," "[C.]" equals "Collected by," and "[E.]" signifies "Received in Exchange."

The printing of the Catalogue has taken place, at intervals, between March, 1908, and March, 1912, but the 'Addenda' at the end of the volume carry the previously printed sheets up to date. The actual date of publication of the volume is March 23rd, 1912.

*Acknowledgments.*—My thanks are due, above all, to Mr. Oldfield Thomas, without whose generous support I should not have been able to devote practically the whole of my time, for several years, to this work.

I am also under special obligation to the Authorities of the United States National Museum, through Mr. Gerrit S. Miller, Jr., for the loan without limit of time of a considerable number of specimens (including many paratypes), chiefly of the genera

*Pteropus* and *Cynopterus*, which have been of great help to me during my work. Further, to Dr. F. A. Jentink, Professor P. Matschie, and Professor Dr. E. Tronessart for much kind assistance during my visits to the Museums of Leyden, Berlin, and Paris.

For the loan of type specimens, for information on types or other specimens in foreign Museums, or for assistance in any other way, I am indebted to Dr. N. Annandale, Calcutta, Dr. R. Anthony, Paris, the Authorities of the Bombay Natural History Society, Professor R. Collett, Christiania, Dr. A. Fritze, Hanover, Professor Dr. J. von Kennel, Dorpat, Oberstudienrat Professor Dr. Kurt Lampert, Stuttgart, Professor Dr. Einar Lönnberg, Stockholm, Dr. Ludwig Ritter Lorenz von Liburnau, Vienna, Dr. Marcus W. Lyon, Jr., Washington, Dr. P. Chalmers Mitchell, London, Mr. James A. G. Rehn, Philadelphia, Dr. E. Roediger, Frankfort-on-the-Main, Senhor A. F. de Seabra, Lisbon, and Viceinspector Mag. se. Herluf Winge, Copenhagen. The only two illustrations that are not original (see above) have been copied by kind permission of, respectively, the Council of the Zoological Society, London, and Herr Georg Reimer, publisher, Berlin.

In conclusion I desire to express my thanks to my artist, Mr. A. J. Engel Terzi, for the unremitting care and artistic skill bestowed by him upon the illustrations.

K. A.

British Museum (N.H.).

January 16th, 1912.





# CONTENTS.

## INTRODUCTION.

I. General characters of Megachiroptera .....	Page xvii
II. Plastic characters of Megachiroptera .....	xix
1. Rostrum, p. xix.	
2. Premaxillæ, p. xx.	
3. Infraorbital canal, p. xxi.	
4. Postorbital processes and postorbital foramina, p. xxi.	
5. Palate, p. xxii.	
6. Tympanic bones, p. xxiii.	
7. Facial axis, p. xxiii.	
8. Mandible, p. xxiii.	
9. Incisors, p. xxiv.	
10. Canines, p. xxvi.	
11. Premolars and molars, p. xxvii.	
12. Anomalies in dental formula, p. xxxi.	
13. Palate-ridges, p. xxxiii.	
14. Tongue, p. xxxv.	
15. Wing-structure, p. xxxv.	
16. Tail, p. xli.	
17. Calcar, p. xlii.	
18. Colour of fur, p. xlii.	
19. Size, p. xliv.	
20. Secondary sexual cha- racters, p. xlv.	
III. Interrelations of the genera of Megachiroptera .....	xlvi
IV. Geographical distribution of Megachiroptera .....	lv
1. Distribution of genera, p. lv.	
2. Distribution of species and subspecies, p. lvii.	
3. Remarks on the geographical distribution, p. lxxv.	
V. Synopsis of the subfamilies and genera of Megachiroptera (with a "Key" to the genera based on their dental and cranial characters only) .....	xcii

## CATALOGUE OF CHIROPTERA.

Order <b>CHIROPTERA.</b>		Page
Suborder I. <b>MEGACHIROPTERA.</b>		137, 816
Family <b>PTEROPODIDÆ.</b>		
Subfamily I. <b>Pteropodinae.</b>	Page	
[ROUSETTUS section.]	1	
1. Eidolon, <i>Rafin.</i> .....	2	
1. dupreanum, <i>Schl. &amp; Poll.</i> ..	7	
2. helvum, <i>Kerr.</i> .....	8, 809	
3. sabæum, <i>K. And.</i> .....	15	
2. Rousettus, <i>Gray</i> .....	16	
Rousettus, <i>Gray</i> .....	22	
1. leachi, <i>A. Smith</i> .....	25, 810	
2. regyptiacus, <i>E. Geoff.</i> ..	29	
3. arabicus, <i>And. &amp; de Wint.</i> ..	33	
4. leschenaulti, <i>Desm.</i> .....	35, 810	
5. seminudus, <i>Kelaart</i> .....	38, 810	
5 bis. shortridgei, <i>Thos.</i> .....	811	
6. amplexicaudatus, <i>E. Geoff.</i> ..	40	
7. minor, <i>Dobs.</i> .....	43, 811	
8. brachyotis, <i>Dobs.</i> .....	44	
9. celebensis, <i>K. And.</i> .....	46	
Stenonycteris, <i>subg. n.</i> ..	23	
10. kempi, <i>Thos.</i> .....	813	
10 bis. lanosus, <i>Thos.</i> .....	49, 813	
Lissonycteris, <i>subg. n.</i> ..	23	
11. angolensis, <i>Bocage</i> .....	51	
11 bis. smithi, <i>Thos.</i> .....	814	
3. Boneia, <i>Jentink</i> .....	55	
1. bidens, <i>Jentink</i> .....	58	
4. Pteropus, <i>Brisson</i> .....	61	
A. Pt. hypomelanus group.	98	
1. hypomelanus, <i>Temm.</i> ..	101	
a. geninorum, <i>Miller</i> ..	106	
b. enganus, <i>Miller</i> .....	107	
c. condorensis, <i>Pet.</i> .....	110	
d. canus, <i>K. And.</i> .....	113	
e. lepidus, <i>Miller</i> .....	115, 815	
f. annexens, <i>K. And.</i> ..	116	
γ. robinsoni, <i>K. And.</i> ..	815	
g. tomesi, <i>Pet.</i> .....	119, 816	
h. eaganus, <i>Mearns</i> ..	121	
i. macassaricus, <i>Heude</i> ..	124	
j. hypomelanus, <i>Temm.</i> ..	127	
k. luteus, <i>K. And.</i> .....	128	
2. speciosus, <i>K. And.</i> .....	132	
3. minus, <i>K. And.</i> .....	133	
4. pallidus, <i>Temm.</i> .....	136	
5. griseus, <i>E. Geoff.</i> .....	137, 816	
5 bis. pumilus, <i>Miller</i> .....	816	
6. satyrus, <i>K. And.</i> .....	142	
7. faunulus, <i>Miller</i> .....	143	
8. admiralitatum, <i>Thos.</i> ..	144	
9. colonus, <i>K. And.</i> .....	147	
10. solomonis, <i>Thos.</i> .....	148	
11. brunneus, <i>Dobs.</i> .....	149	
12. ornatus, <i>Gray</i> .....	153	
13. auratus, <i>K. And.</i> .....	156	
14. dasymallus, <i>Temm.</i> .....	159	
15. formosus, <i>P. L. Sclater.</i> ..	163	
15 bis. liops, <i>Thos.</i> .....	817	
16. subniger, <i>Kerr</i> .....	164	
B. Pt. mariannus group ..	172	
17. pelewensis, <i>K. And.</i> ....	173	
18. yapensis, <i>K. And.</i> .....	174	
19. ualanus, <i>Pet.</i> .....	177	
20. mariannus, <i>Desm.</i> .....	178	
21. lochoënsis, <i>Gray</i> .....	181	
22. vanikorensis, <i>Q. &amp; G.</i> ..	184	
23. tonganus, <i>Q. &amp; G.</i> .....	186	
24. geddiei, <i>Macgill.</i> .....	189	
C. Pt. caniceps group ....	192	
25. dobsoni, <i>K. And.</i> .....	192	
26. caniceps, <i>Gray</i> .....	194	
27. argentatus, <i>Gray</i> .....	197	
D. Pt. rufus group .....	200	
28. rufus, <i>E. Geoff.</i> .....	202	
a. rufus, <i>E. Geoff.</i> .....	204	
b. princeps, <i>K. And.</i> ....	208	
29. comorensis, <i>Nicoll</i> ....	208	
29 bis. voeltzkowi, <i>Matschie.</i> ..	818	
30. seychellensis, <i>Milne-Edw.</i> ..	212	
31. aldabrensis, <i>True</i> .....	213	
32. niger, <i>Kerr.</i> .....	215	
E. Pt. melanotus group ..	223	
33. melanotus, <i>Blyth</i> .....	224	
34. tytleri, <i>Mason</i> .....	227, 820	
35. niadicus, <i>Miller</i> .....	229	
36. modiglianii, <i>Thos.</i> .....	232	
37. natalis, <i>Thos.</i> .....	233	
F. Pt. melanopogon group ..	237	
38. melanopogon, <i>Pet.</i> .....	238	
39. aruensis, <i>Pet.</i> .....	241	
40. keyensis, <i>Pet.</i> .....	246, 821	
41. livingstonei, <i>Gray</i> .....	247	
G. Pt. rayneri group ....	250	
42. cognatus, <i>K. And.</i> .....	251	

	Page		Page
43. rayneri, Gray.....	253	5. Acerodon, Jourdan.....	412
44. rubianus, K. And.....	255	1. celebensis, Pet.....	417
45. lavellanus, K. And. ....	258	2. mackloti, Temm. ....	418
46. grandis, Thos. ....	259	a. mackloti, Temm. ....	419
47. chrysoproctus, Temm. . .	260	b. floresii, Gray.....	420
H. Pt. lombocensis group .	265	c. alorensis, K. And. ....	423
48. lombocensis, Dobs. ....	266	3. gilvus, K. And. ....	423
49. solitarius, K. And.....	269	4. humilis, K. And. ....	424
50. rodricensis, Dobs. ....	273	5. jubatus, Eschsch. ....	426
51. molossinus, Temm. ....	275	a. jubatus, Eschsch. ....	427, 824
I. Pt. samoënsis group ..	280	b. mindanensis, K. And. .	429
52. nawaiensis, Gray.....	280	6. lucifer, Elliot.....	432
53. samoënsis, Peale.....	284	6. Pteralopex, Thos. ....	432
54. anetianus, Gray.....	288	1. anceps, K. And.....	437
J. Pt. pselaphon group ..	293	2. atrata, Thos. ....	439
55. insularis, Hombr. & Jacq.	295	7. Styloctenium, Matschie ..	442
56. phæocephalus, Thos.....	298	1. wallacei, Gray.....	445
57. pselaphon, Lay.....	301	8. Dobsonia, Pabner.....	448
58. pilosus, K. And. ....	306	1. minor, Dobs. ....	460, 824
59. tuberculatus, Pet.....	309	2. exoleta, K. And. ....	461
60. leucopterus, Temm. ....	311	3. pannietensis, De Vis....	463
K. Pt. temmincki group ..	315	4. moluccensis, Q. & G....	464
61. temmincki, Pet.....	316, 822	5. magna, Thos. ....	466, 825
62. capistratus, Pet.....	319	6. peroni, E. Geoff. ....	467
63. personatus, Temm. ....	321	7. submana, K. And.....	471
L. Pt. vampyrus group ..	324	8. viridis, Heude.....	471, 825
64. giganteus, Brünn. ....	326	a. umbrosa, Thos. ....	825
a. giganteus, Brünn. ....	329	b. viridis, Heude.....	826
b. leucocephalus, Hodys. .	333	9. crenulata, K. And. ....	473
65. ariel, G. M. Allen.....	335	10. prædatrix, K. And. ....	474
66. lylei, K. And. ....	339	11. inermis, K. And. ....	475
67. intermedius, K. And. ..	340	12. nesea, K. And. ....	476
68. vampyrus, L.....	343		
a. malaccensis, K. And. .	346	[EPOMOPHORUS section.]	
b. vampyrus, L. ....	349	9. Plerotes, K. And. ....	483
c. pluton, Temm. ....	353	1. anchietae, Seabra.....	486, 827
d. edulis, E. Geoff.....	356	10. Epomops, Gray.....	487
e. natunæ, K. And. ....	358	1. franqueti, Tones.....	494
f. lanensis, Mearns ....	359	a. strepitans, K. And. ..	496
M. Pt. alecto group.....	363	b. franqueti, Tones....	497
69. aterrimus, Matschie ....	363, 822	2. bnettikoferi, Matschie ..	499
70. alecto, Temm. ....	365	3. dobsoni, Bucage.....	500
71. morio, K. And. ....	370	11. Hypsignathus, H. Allen ..	501
72. gouldi, Pet.....	370	1. monstrosus, H. Allen ..	506, 827
N. Pt. conspicillatus group.	375	12. Epomophorus, Bennett ..	514
73. chrysauchen, Pet. ....	375	1. wahlbergi, Sund. ....	521
74. conspicillatus, Gould....	378, 823	a. haldemani, Hallowell ..	522, 827
75. ocularis, Pet. ....	381, 823	b. wahlbergi, Sund. ....	526
O. Pt. neohibernicus group	384	2. labiatus, Temm.....	529
76. papuanus, Pet. & Doria ..	385, 823	3. minor, Dobs. ....	531
77. neohibernicus, Pet. ....	387	4. anurus, Heuglin.....	532
P. Pt. macrotis group ....	392	5. crypturus, Pet. ....	535, 827
78. epularius, Ramsay.....	392	6. gambianus, Ogilby.....	538
79. macrotis, Pet.....	396	7. angolensis, Gray.....	542
80. poliocephalus, Temm. ..	397	8. pousarguesi, Troness. ..	543
Q. Pt. scapulatus group ..	402	13. Micropteropus, Matschie ..	554
81. scapulatus, Pet. ....	403, 824	1. pusillus, Pet. ....	557
82. woodfordi, Thos. ....	407		

	Page		Page
14. Nanonycteris, <i>Matschie</i> ..	559	3. minutus, <i>K. And.</i> .....	701
1. veldkampii, <i>Jentink</i> .....	562	4. varius, <i>K. And.</i> .....	702
15. Scotonycteris, <i>Matschie</i> ..	563	5. cyclotis, <i>K. And.</i> .....	703
1. zenkeri, <i>Matschie</i> .....	567	5 bis. certans, <i>K. And.</i> .....	828
16. Casinycteris, <i>Thos.</i> .....	568	6. cephalotes, <i>Pall.</i> .....	703
1. argyris, <i>Thos.</i> .....	572	7. geminus, <i>K. And.</i> .....	709
[CYNOPTERUS section.]		8. major, <i>Dobs.</i> .....	710
17. Myonycteris, <i>Matschie</i> ..	576	9. scitulus, <i>K. And.</i> .....	711
Myonycteris, <i>Matschie</i> ..	578	10. lullulæ, <i>Thos.</i> .....	713
1. wroughtoni, <i>K. And.</i> ..	580	11. robinsoni, <i>Thos.</i> .....	714
2. leptodon, <i>K. And.</i> .....	580	12. ællo, <i>Thos.</i> .....	715
3. torquata, <i>Dobs.</i> .....	581		
Phygetis, <i>subg. n.</i> .....	579	Subfamily II. <b>Macroglossinæ.</b>	723
4. brachycephala, <i>Bocage</i> ..	582	[EONYCTERIS section.]	
18. Cynopterus, <i>F. Cuv.</i> .....	586	28. Eonycteris, <i>Dobs.</i> .....	728
1. sphinx, <i>Vahl</i> .....	598	1. spelæa, <i>Dobs.</i> .....	734
a. sphinx, <i>Vahl</i> .....	598	2. major, <i>K. And.</i> .....	736
b. gangeticus, <i>K. And.</i> ..	604	3. rosenbergi, <i>Jentink</i> .....	737
c. titthæcheilus, <i>Temm.</i> ..	605	29. Megaloglossus, <i>Pagenstecher</i>	738
2. brachyotis, <i>S. Müller.</i> ..	609	1. woermanni, <i>Pagenstecher.</i>	742
a. angulatus, <i>Miller</i> .....	611	30. Macroglossus, <i>F. Cuv.</i> ..	746
b. brachyotis, <i>S. Müller.</i> ..	614	1. minimus, <i>E. Geoff.</i> .....	755
c. javanicus, <i>K. And.</i> ..	622	a. minimus, <i>E. Geoff.</i> ..	757
d. insularum, <i>K. And.</i> ..	623	b. sobrinus, <i>K. And.</i> .....	760
e. ceylonensis, <i>Gray</i> .....	624	2. lagochilus, <i>Matschie</i> .....	762
f. minutus, <i>Miller</i> .....	625	a. lagochilus, <i>Matschie</i> ..	763
g. brachysoma, <i>Dobs.</i> ..	626	b. nanus, <i>Matschie</i> .....	765
h. scherzeri, <i>Zeilebor</i> .....	627	c. pygmaeus, <i>K. And.</i> ..	767
3. major, <i>Miller</i> .....	629	d. microtus, <i>K. And.</i> .....	767
4. horsfieldi, <i>Gray</i> .....	630	31. Syconycteris, <i>Matschie</i> ..	771
a. horsfieldi, <i>Gray</i> .....	631	1. crassa, <i>Thos.</i> .....	775
b. lyoni, <i>nom. n.</i> .....	632, 827	a. papuana, <i>Matschie</i> .....	777
5. harpax, <i>Thos.</i> .....	633	b. keyensis, <i>K. And.</i> .....	779
6. princeps, <i>Miller</i> .....	633	c. finschi, <i>Matschie</i> .....	779
19. Ptenochirus, <i>Pet.</i> .....	643	d. crassa, <i>Thos.</i> .....	780
1. jagori, <i>Pet.</i> .....	645	e. major, <i>K. And.</i> .....	780
20. Megarops, <i>Pet.</i> .....	646	2. australis, <i>Pet.</i> .....	781
1. ecaudata, <i>Temm.</i> .....	650	3. naia, <i>K. And.</i> .....	785
21. Dyacopterus, <i>gen. n.</i> .....	651		
1. spadiceus, <i>Thos.</i> .....	654	[NOTOPTERIS section.]	
22. Balionycteris, <i>Matschie</i> ..	654	32. Melonycteris, <i>Dobs.</i> .....	785
1. maculata, <i>Thos.</i> .....	657	1. melanops, <i>Dobs.</i> .....	789
23. Chironax, <i>gen. n.</i> .....	658	33. Nesonycteris, <i>Thos.</i> .....	790
1. melanocephalus, <i>Temm.</i> ..	660	1. woodfordi, <i>Thos.</i> .....	792
24. Thoopterus, <i>Matschie</i> .....	662	34. Notopterus, <i>Gray</i> .....	793
1. nigrescens, <i>Gray</i> .....	665	1. macdonaldi, <i>Gray</i> .....	797
25. Penthetor, <i>gen. n.</i> .....	665	2. neocaledonica, <i>Trouess.</i> ..	799
1. lucasi, <i>Dobs.</i> .....	669		
26. Sphaerias, <i>Miller</i> .....	671	Subfamily III. <b>Harpyio-</b>	
1. blanfordi, <i>Thos.</i> .....	674	<b>nycterinæ</b> .....	799
27. Nyctimene, <i>Borkhausen</i> ..	681	35. Harpyionycteris, <i>Thos.</i> ..	799
1. papuanus, <i>K. And.</i> .....	698	1. whiteheadi, <i>Thos.</i> .....	805
2. albiventer, <i>Gray</i> .....	700		

LIST OF ILLUSTRATIONS .....	835
ALPHABETICAL INDEX .....	839

# INTRODUCTION.

## I. GENERAL CHARACTERS OF MEGACHIROPTERA.

THE prototype of the Chiroptera must have possessed all the most primitive features preserved by any living or extinct form of Megachiroptera and Microchiroptera. Among its more important characters, therefore, must have been these:—

*Skull.*—In general shape probably essentially like that of a *Rousettus* or *Pteropus*, with the following differences: the bony palate was not produced backward behind the tooth-rows (compare Insectivora and Microchiroptera generally); the infraorbital canal long (cf. the *Notopteris* section of Megachiroptera, and some Microchiroptera); the postorbital processes undeveloped (as in the majority of Microchiroptera); the facial portion of the skull not, or only inconspicuously, deflected against the basicranial axis (as in nearly all genera of the *Epomophorus* and *Cynopterus* sections of Megachiroptera).

*Dentition.*—Dental formula probably  $\frac{i^1 i^2 - c p^1 - p^3 p^1 m^1 m^2 m^3}{i_1 i_2 i_3 c p_1 - p_3 p_4 m_1 m_2 m_3}^{\#}$ ,

this being the completest formula found in any bat ( $i^3$  may have been present, though lost in all known species); molar structure typically "Insectivorous," as in Microchiroptera with unmodified cheek-teeth.

*Fore-limbs and membranes.*—*Taberulum majus* and *minus* of humerus relatively small, the former not articulating with scapula (cf. Megachiroptera and some primitive Microchiroptera); deltoid crest of humerus weak (cf. Megachiroptera). Ulna not more reduced than in Megachiroptera. Articular surfaces of the bones of the hand (carpo-metacarpal, metacarpo-phalangeal, and inter-phalangeal joints) not more modified than in Megachiroptera; trapezium large (cf. Megachiroptera); second digit relatively independent of third, with three phalanges and a well-developed claw (cf. *Archaeopteropus*† and typical *Pteropodidae*). Wing-membranes from flanks and inserted posteriorly on first toe.

*Tail.*—Long and embedded in interfemoral (cf. *Archaeopteropus*,

\* On the homologies of the missing premolars in Chiroptera, see Oldfield Thomas, Ann. & Mag. N. H. (8) i. p. 345 (1908). On the missing upper incisor, K. Andersen, P. Z. S. 1908, p. 205.

† On *Archaeopteropus transiens* (Upper Oligocene, Monteviale, Italy) see Meschinelli, Atti R. Ist. Veneto, lxii. p. 1329, pl. ix. (1903). Note on its wing-structure, *infra*, p. xxxvii.

*Notopteris*, typical Microchiroptera), number of free caudal vertebræ probably at least ten\*.

The characters in which living Megachiroptera differ from the above scheme of the ancestral form may be divided into two classes, those that have become *fixed*, i. e. firmly and invariably established in all living genera, and those that are *plastic*, i. e. subject to variation from genus to genus.

The modifications common to all living members of the Suborder are these:—

(1) The bony palate is elongated behind the tooth-rows and the zygomatic process of the maxillary bone (the practically complete absence of the postdental portion of the palate in a single genus, *Casinycleris*, is without doubt a secondary modification, *Casinycleris* being closely related to a form (*Scotonycteris*) with normal Megachiropteran palate):

(2) Postorbital processes are developed:

(3) The molar structure is modified from the common Insectivorous type into the ordinary Megachiropteran type as follows

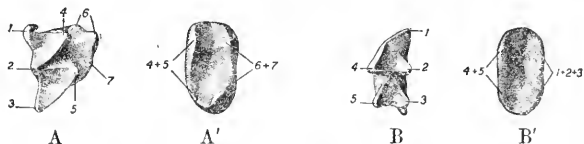


FIG. I.—Typical molar structure of Megachiroptera compared with that of Insectivora.

A. right upper  $m_2$ , B. left lower  $m_2$  of *Talpa europæa* (B.M. 8.7.7.4).

A'. right upper  $m_1$ , B'. left lower  $m_1$  of *Rousettus ægyptiacus* (B.M. 64.8.17.45).

A and B  $\frac{1}{2}$ , A' and B'  $\frac{1}{4}$ .

For explanation of numbering of cusps see footnote † below.

(fig. I.): in the upper molariform teeth cusps 1, 2, and 3† have disappeared, cusp 4 and the reduced cusp 5 form together a longitudinal ridge along the outer side of the teeth, cusps 6 and 7

\* Most of the characters enumerated above have already been suggested by Herluf Winge in his "Jordfundne og nulevende Flagermus (*Chiroptera*) fra Lagoa Santa, Minas Geraes, Brasilien; med Udsigt over Flagermusenes indbyrdes Slægtskab" (E Museo Lundii, vol. ii, pt. i. p. 27; 1892). For a highly instructive account of the modifications that have taken place in the development of the Chiropteran type from some primitive form of Insectivora, see pp. 18–23 of Winge's memoir.

† The molar cusps are named in accordance with Herluf Winge's theory ("Om Pattedyrenes Tandskifte, især med Hensyn til Tændernes Former," Vidensk. Meddel. naturhist. Foren. Kjøbenhavn, for 1882, pp. 16–18, pl. iii.). The three cusps, labial in the upper but lingual in the lower teeth, that form the tips of the W of a typical Insectivorous molar are termed, in antero-posterior direction, respectively 1, 2, and 3, cusp 2 being the oldest, homologous with the single cusp of a Reptilian tooth; the two cusps forming the bases of the W are named 4 and 5; and the "heel" of the upper molars, when single, cusp 6, when double, cusps 6 and 7.

a similar ridge along the inner side, the two ridges being separated by a median longitudinal depression; in the similarly shaped lower molariform teeth the inner ridge is formed by cusps 1, 2, and 3, the outer by cusps 4 and 5:

(4)  $i_2$  and  $m^3$  are lost:

(5) The second and, particularly, the third phalanx of the second finger are somewhat reduced in length.

The principal plastic characters of the Megachiroptera are discussed in the next paragraph.

## II. PLASTIC CHARACTERS OF MEGACHIROPTERA.

### 1. Rostrum.

Varies considerably in length, much less so in shape.

*Length*.—If measured from the front of the orbit to the extremity of the nasal bones, the cranial rostrum is:—

(1) Longest, *i. e.* from about  $\frac{2}{5}$  to nearly  $\frac{1}{2}$  of the skull, in *Hypsignathus* and some species of *Epomophorus*, in both genera relatively longer in males than in females; the male *Hypsignathus* is the longest-faced of all Fruit-bats:

(2) Medium or somewhat shortened, *i. e.* from about  $\frac{1}{3}$  to  $\frac{2}{5}$  of the skull, in:—(a) the genera of the *Rousettus* section; (b) all *Macroglossinae*; (c) within the *Epomophorus* section in the genera *Plerotes* and *Epomops*, and in some (the smaller) species of *Epomophorus*; (d) within the *Cynopterus* section only in *Myonycteris* and *Sphaerias*:

(3) Shortest, *i. e.* about  $\frac{1}{4}$ — $\frac{1}{5}$  of the skull, in:—(a) the following four genera of the *Epomophorus* section, *Micropteropus*, *Nanoonycteris* (rostrum rather more than  $\frac{1}{4}$  of skull), *Scotonycteris*, and *Casinonycteris*; (b) all genera of the *Cynopterus* group, except *Myonycteris* and *Sphaerias*.

Briefly summed up: a moderately long rostrum is characteristic of all Rousettine and Macroglossine Fruit-bats, a very short of nearly all Cynopterine genera, while the Epomophorine is the only section showing any degree of variation in the length of the rostrum, from that of *Plerotes* (moderate), on the one hand to that of *Hypsignathus* (longest known), on the other to that of *Casinonycteris* and allied genera (shortest).

No Fruit-bat with a very short rostrum (third stage above) has the full Megachiropteran number of cheek-teeth (the formula being either  $\frac{5}{5}$ ,  $\frac{4}{5}$ , or  $\frac{3}{5}$ ); but this rule cannot be reversed, that is, a reduction in the number of teeth is by no means always, not even usually, associated with a shortening of the rostrum, Fruit-bats with a moderately long or very long rostrum (second and first stage above) exhibiting any variation of the dental formula from the highest number of cheek-teeth ( $\frac{5}{5}$ ) to the lowest ( $\frac{3}{5}$ ).

*Shape*.—As a general rule the rostrum is conspicuously tapering



anteriorly, and the aberrations from this typical (Insectivorous-like) shape are, apart from *Hypsignathus*, but few and not very peculiar. The rostrum is unusually deep (truncate) in front in *Megarops* and *Nyctimene* (both of the *Cynopterus* section); in *Nyctimene* the medial portion of the nasals is produced forward and downward as a triangular projection firmly united with the anterior edge of the mesethmoid cartilage (evidently acting as a support of the nasal tubes; cf. fig. 61, p. 684). In Fruit-bats with weak dentition (narrow cheek-teeth) the rostrum is lower and thinner than usual; compare *Stenonycteris* (fig. 3, p. 49) with *Rousettus* (fig. 2, p. 17), *Pteropus scapulatus* (fig. 18, p. 404) with the average *Pteropus* skull, *Sphaerias* (fig. 60, p. 672) with the ordinary Cynopterine type of skull (fig. 48, p. 588), and all *MacroGLOSSINÆ*, except the more heavily-toothed *Eonycteris*. The only strikingly peculiar modification is seen in males of *Hypsignathus* (fig. 33, p. 502); the rostrum is greatly increased in size and particularly in depth, its dorsal and ventral profiles subparallel, its lateral surfaces concave (a large subcutaneous air-sac is present on either side of the rostrum), and a strong vertical crest runs from the nasals to the alveolus of the canine (supporting a cutaneous fold of the upper lip); in females of the same genus the rostrum is somewhat similarly, but much less excessively, modified.

## 2. Premaxillæ.

Vary in shape (breadth, degree of reduction), in direction, and in the mode of interconnection of the alveolar branches. The palatal branches of the premaxillæ are always absent.

*Breadth.*—The three MacroGLOSSINE genera *Melonycteris*, *Nesonycteris*, and *Notopterus* exhibit what is probably the most primitive form of the premaxillæ: the ascending branch is unreduced in breadth at its upper extremity, gradually narrowing inferiorly, so that the breadth of the bone near the alveolar margin is only one-half or one-third of its breadth at the upper extremity (fig. 76, p. 791). The next stage is shown by genera in which the ascending branch is considerably reduced in breadth above, being quite or nearly as narrow above as near the alveolar margin (ex. *Pteropus* and allied genera; *Epomophorus*; *Eonycteris*; *Megaloglossus*; *MacroGLOSSUS*; &c.); a still higher degree of reduction by genera in which the bone is tapering to a point above, its upper extremity often slightly curved forward (ex. nearly all genera of the *Cynopterus* section); and finally, the whole of the ascending branch may become so thin as to be almost linear throughout (*Dobsonia*). The whole of the premaxillary region is increased in breadth in *Hypsignathus* (owing to secondary modifications in the shape of the rostrum). In *Nyctimene* (fig. 61, p. 684) the alveolar branches are unusually deep (vertically), the ascending branches so short as not to reach the nasal bones (extremity of rostrum modified, for support of the peculiar nasal tubes in this genus).

*Direction.*—As a rule the ascending branches of the premaxillæ are

nearly vertical or only slightly proclivous. A somewhat, or even much, higher degree of proclivity is seen in *Plerotes*, *Epomops*, *Spherias*, all *Macroglossinæ* except *Eonycteris*, and in *Harpyionycteris*.

*Interconnection of branches.*—In the large majority of Fruit-bats the right and left alveolar branch of the premaxillæ are in simple contact anteriorly, the suture between them being permanent. In certain genera, however, they become, at an early age of the individuals, united by synostosis, *i. e.* firmly and solidly ankylosed together, without any trace in the adult (and, as a rule, not even in the semiadult) of an inter-premaxillary suture; this is the case in *Lissonycteris* (subgenus of *Rousettus*), *Pteralopex*, and *Harpyionycteris*, all of the *Rousettus* section, in *Hypsignathus* among the *Epomophorine* Fruit-bats, in *Dyacopterus*, *Chironax*, and *Nyctimene*, of the *Cynopterus* section, and in *Megaloglossus*, *Macroglossus*, *Syconycteris*, and *Notopteris*, among the *Macroglossinæ*. The opposite extreme is represented by a few genera in which the premaxillæ are not even in contact anteriorly, but distinctly spaced, connected by fibrous tissue only (constantly in *Eidolon* and *Boneia*; occasionally in *Eonycteris* and *Melonycteris*).

### 3. *Infraorbital canal.*

In Insectivora, as well as in primitive Mammalia generally, the infraorbital canal is long, its anterior aperture, the infraorbital foramen, situated a considerable distance in front of the orbital cavity. The only forms of Megachiroptera which in the length of the infraorbital canal approach to this primitive condition are the three genera *Melonycteris* (fig. 75, p. 786), *Nesonycteris* (fig. 76, p. 791), and *Notopteris* (fig. 77, p. 795), all closely interrelated and belonging to the subfamily *Macroglossinæ*. In all other Fruit-bats the canal is considerably shortened, its outer wall, as a rule, a narrow, often sublinear, bridge of bone, and the foramen situated nearly vertically below or only slightly in front of the orbital cavity.

### 4. *Postorbital processes and postorbital foramina.*

*Processes.*—The postorbital processes are generally small or moderately strong, and if so there is scarcely any trace of corresponding lower processes from the zygoma. In a small number of forms, all with heavy dentition (chiefly species of *Pteropus* and allied genera), they are stronger than usual, reaching about halfway between frontal and zygoma, and the lower processes are more or less conspicuously developed. Rarely (a few large species of *Pteropus* and *Acerodon*; *Pteralopex*) they are, at least in aged individuals, so long as to join the lower processes and form a complete ring round the orbit.

*Foramina.*—The base of the postorbital process is nearly always pierced by a relatively large foramen (no doubt homologous with the supraorbital notch or foramen of the human skull, for

*Nervus* and *Vasa supraorbitalia*). The only section of genera in which exceptions to this rule occur is the *Cynopterus* section; the postorbital foramina are, within that group of Fruit-bats, normally developed only in *Myonycteris*, *Cynopterus*, *Ptenochirus*, and *Megacerops*, minute (tending to disappear) in *Dyacopterus*, generally absent (or, if present, minute or traceable only on one side of the skull) in *Nyctimene*, always absent in *Balionycteris*, *Chironax*, *Thoopterus*, *Penthetor*, and *Spherias*.

### 5. Palate.

*Pteropus* (fig. 6, p. 62) is probably one of the genera that shows the Megachiropteran palate in its least modified form. The interdental palate is only moderately broad, gradually narrowing in front (the tooth-rows distinctly converging anteriorly); the postdental palate about one-fourth of the total length of the palate, its lateral margins forming almost straight lines converging posteriorly. In *Rousettus* and *Boneia* the interdental palate is relatively broader; an even greater increase of breadth is seen in *Epomops*, and in *Plerotes* this portion of the palate reaches its maximum of breadth (bearing a curious resemblance, in general outline, to that of the Carnivorous genus *Proteles*!). An opposite course of development is taken by *Epomophorus*, in which the palate is unusually narrow. If the lower canines are slanted outward, this necessitates a greater breadth of the palate anteriorly, between the upper canines, and therefore more nearly parallel tooth-rows (ex. *Boneia*, *Hypsognathus*, *Macrogllossus*).

The postdental palate is in the majority of genera essentially similar to that of *Pteropus* described above; it may be broader or narrower, shorter or longer, more rapidly narrowing posteriorly or more nearly parallel-margined; in *Nyctimene* it is somewhat pandurate in outline, i. e. distinctly constricted at middle (owing to the unusually broad mesopterygoid fossa; compare the presence of nasal tubes in this genus). But these variations are comparatively trivial as compared with the modifications exhibited by some genera of the *Epomophorus* section:—In *Plerotes*, *Epomops*, *Hypsognathus*, and *Scotoonycteris* it is relatively simple in shape, though in the two former genera rather broader than usual; but in *Epomophorus* (fig. 36, p. 515) it is deeply depressed posteriorly, and its posterior free margin high and prominent; in *Micropteropus* (fig. 38, p. 555) it is abruptly narrowed behind the roots of the zygomatic processes, the posterior depression is shallower, the free margin prominent; in *Nanonycteris* (fig. 40, p. 560) it is short, but unusually broad, longitudinally depressed on either side, slightly convex between, and flattened at the extreme posterior extremity, the free edge not prominent; and, finally, in *Casinycteris* (fig. 43, p. 569), a genus in other respects closely similar to *Scotoonycteris*, the postdental palate has practically disappeared, the mesopterygoid fossa extending forward very nearly to the level of the posterior molar, a modification unique in Megachiroptera and more closely recalling the type of palate found in Microchiroptera.

6. *Tympanic bones.*

Always annular, but the ring varying a little in breadth (rather broader than usual in *Rousettus*, *Dobsonia*, *Eonycteris*). The only peculiar modification is the development of a short bony auditory meatus in *Idolon* (fig. 1, p. 3; cf. Miller, 'Families and Genera of Bats,' p. 55, fig. 7 B), a genus closely related to *Rousettus*.

7. *Facial axis.*

Normally the facial axis if projected backward is nearly parallel with the basicranial axis, *i. e.* the former forms an angle with the latter of not much less than 180 degrees, and the line of the alveolar margin of the upper tooth-row if continued backward passes through the lower edge of the occipital condyle or even somewhat below the condyle; such is the case, with rare exceptions, in all genera of the *Epomophorus* and *Cynopterus* sections (ex. fig. 36, p. 515, and fig. 48, p. 588). In the *Rousetto-Pteropine* section generally the face is more distinctly, sometimes even very conspicuously deflected on the basicranial axis, so that when the rostrum is kept horizontal the axis of the brain-case points obliquely backward-and-downward, and the posterior projection of the alveolar line passes through the middle or upper margin of the occipital condyle (ex. fig. 1, p. 3; fig. 6, p. 62) or even through the middle of the supraoccipital (fig. 3, p. 49; fig. 18, p. 404). The maximum of facial deflection is seen in the majority of *Macroglossinæ*, in which the face is bent downward to such degree that the alveolar line if continued posteriorly would pass through the brain-case considerably above the lambdoid crest (fig. 70, p. 748).

As a general rule the deflection of the face is greatest in genera or species with weak dentition; thus it is considerably greater in the narrow-toothed *Stenonycteris* (fig. 3, p. 49) than in typical *Rousettus* (fig. 2, p. 17); in *Pteropus* the deflection is always noticeable, but least so in the heavy-toothed species (ex. fig. 15, p. 302, *Pt. pselaphon*), and unusually great in the small- and narrow-toothed *Pt. scapulatus* (fig. 18, p. 404) and *Pt. woodfordi* (fig. 19, p. 408); the only *Epomophorine* genus with conspicuously deflected facial axis is the very weak-toothed *Plerotes* (fig. 28, p. 484), and the only *Cynopterine* genus with similarly deflected face is the weak-toothed *Sphærias* (fig. 60, p. 672); within the subfamily *Macroglossinæ* the deflection is smallest in the relatively strong-toothed *Eonycteris* (fig. 66, p. 730), greater in *Megaloglossus* (fig. 68, p. 739), which in the degeneration of the dentition is transitional between *Eonycteris* and *Macroglossus*, very great in all other genera, all of which are characterized by unusually narrow or small cheek-teeth.

8. *Mandible.*

The heavier the dentition, the broader and deeper and more vertically ascending is the coronoid process of the mandible, the stronger its angular process, and the higher above the alveolar line its condyle; the weaker the dentition, the narrower and lower and more backwardly sloping is the coronoid process, the feebler the

angular process, and the lower down the position of the condyle. There is within the suborder every gradation from the unusually heavy mandible with nearly vertical coronoid process, deep and broadly rounded angular process, and the condyle situated high above the alveolar line, of *Pteralopex* (fig. 21, p. 433), *Acerodon* (fig. 20, p. 413), the heavy-toothed species of *Pteropus* (fig. 14, p. 289; fig. 15, p. 302), *Dobsonia* (fig. 24, p. 449), and most genera of the Cynopterine section (fig. 48, p. 588; fig. 61, p. 684), through the intermediate conditions as exhibited in the Epomophorine section (fig. 30, p. 488; fig. 40, p. 560), to the mandible as shaped in the narrowest-toothed *Macroglossinae* (fig. 70, p. 748), with its short, thin, and posteriorly directed coronoid process, weak angular process, and condyle situated considerably below the level of the alveolar line.

The symphysis of the mandible is in the *Pteropodinae* usually obliquely ascending, more rarely (ex. *Dobsonia*, *Nyctimene*) subvertical; in the *Macroglossinae* as a rule more nearly horizontal. In some genera of *Macroglossinae* (*Eonycteris*, *Megaloglossus*, *Macroglossus*, *Melonycteris*, *Nesonycteris*) there is a more or less clearly pronounced tendency to a development of a longitudinal keel along the antero-inferior surface of the symphysis.

#### 9. Incisors.

*Incisor formulae*.— $i^3$  is lost in all Chiroptera;  $i_3$  is present in many Microchiroptera, but lost in all Megachiroptera (the incisors of *Archaeopterus* are unknown); no Fruit-bat, therefore, has more than  $\frac{2}{2}$ — $\frac{2}{2}$  incisors, but some have less. The following five incisor formulae occur:—

$\frac{i^2 \ i^1 \ i^1 \ i}{i_2 \ i_1 \ i_1 \ i_2} = \frac{2}{2}$ — $\frac{2}{2}$ , the normal formula, found in all genera except those enumerated below.

$\frac{i^2 \ - \ - \ i^2}{i_2 \ i_1 \ i_1 \ i_2} = \frac{1}{2}$ — $\frac{1}{2}$ , in one genus, *Boneia* (allied to *Rousettus*).

$\frac{i^2 \ i^1 \ i^1 \ i^2}{i_2 \ - \ - \ i_2} = \frac{2}{1}$ — $\frac{2}{1}$ , in one genus of the *Pteropus* subsection, viz. *Styloctenium*; in four genera of the *Cynopterus* section, *Ptenochirus*, *Megarops*, *Balionycteris*, and *Penthetor*; and in two *Macroglossinae* genera, *Nesonycteris* and *Notopterus* (in the latter  $i^1$  is deciduous).

$\frac{i^2 \ - \ - \ i^2}{i_2 \ - \ - \ i_2} = \frac{1}{1}$ — $\frac{1}{1}$ , in *Dobsonia* and *Harpyionycteris*, both aberrant genera of the *Rousettus* section (on the homologies of the missing incisors in these two genera, see footnotes p. 452 and p. 801).

$\frac{- \ i^1 \ i^1 \ -}{- \ - \ - \ -} = \frac{1}{0}$ — $\frac{1}{0}$ , in *Nyctimene* only, a peculiarly modified genus of the *Cynopterus* section.

In *Pteropus*  $i_1$  is always conspicuously smaller than  $i_2$ , and in some species (*Pt. lombocensis* group) so much reduced as to be almost rudimentary; this foreshadows *Styloctenium*, in which  $i_1$  is completely lost, and *Dobsonia* and *Harpyionycteris*, in which both  $i_1$  and  $i^1$  are lost. In those genera of the *Cynopterus* section which have the normal number of incisors  $i_1$  is weaker than  $i_2$ , and  $i^2$  faintly shorter than  $i^1$ ; this leads to those genera of the same section, viz. *Ptenochirus*, *Megacerops*, *Balionycteris*, and *Penthetor*, in which  $i_1$  has disappeared and  $i^2$  is shortened to about half the length of  $i^1$ ; and to *Nyctimene* (lower canines moved forward to extremity of jaw), in which all lower incisors as well as  $i^2$  have disappeared. In the MacroGLOSSINE genus *Melonycteris*  $i_1$  is smaller than  $i_2$ , in the closely related *Nesonycteris* and *Notonycteris* it has disappeared.

*Differentiation.*—In the majority of Fruit-bats the incisors are small, thin, terete (styloform) or subterete, the crown only slightly or even indistinctly differentiated from the shaft, the cutting-edge of the lower incisors often faintly bilobed. Normally the incisors above and below are placed approximately vertically, those in the upper jaw in contact with each other or narrowly spaced, but with a relatively wide diastema on either side between the incisors and canines, those in the lower jaw crowded and in contact with the canines. The principal variations, to be described below, from this predominant type of incisors are, briefly summed up, these: (1) the crown of some or all of the incisors may become peculiarly differentiated in shape, (2) conspicuous posterior ledges may be developed, or (3) some of the incisors may be enlarged or reduced; further, (4) the direction of the incisors may be altered, and (5) the spacing of the incisors may be conspicuously unequal.

In *Pteropus* (and the closely allied *Acerodon*) the upper incisors are larger than usual, the crown distinctly differentiated, posterior basal ledges conspicuously developed, sometimes so much so as to form a noticeable shelf (*Pt. pselaphon* group),  $i_2$  always larger than  $i_1$ , either owing chiefly to a reduction of  $i_1$ , which may become nearly rudimentary (*Pt. lombocensis* group), or chiefly to an increase of  $i_2$  (*Pt. samoënsis* and *pselaphon* groups). Some of these tendencies are further developed in the related genus *Pteralopex*: the posterior ledge of the upper incisors is very large, shelf-like, rendering the antero-posterior equal to or greater than the transverse diameter of the teeth, and  $i_2$  is from twelve to fifteen times the bulk of  $i_1$ , its cutting-edge unequally trifid (middle cusp much the broadest).

In *Spharicus* (*Cynopterus* section) both the upper and lower incisors are triangularly pointed. In *Syconycteris* (*MacroGLOSSINA*) the upper incisors are larger than usual, the crown well-differentiated, narrowly chisel-shaped,  $i_2$  considerably higher and broader than  $i_1$ , with obliquely triangular crown.

In those genera (*Dobsonia*, *Harpyionycteris*, *Nyctimene*) which have only  $\frac{1}{1}-\frac{1}{1}$  or  $\frac{1}{2}-\frac{1}{0}$  incisors, and in which the lower canines are situated close together or in actual contact at the anterior extremity of the mandible, the single pair of upper incisors is acted upon by

the tips of the lower canines and somewhat altered in shape, the crown being more or less obliquely bilobed.

The normal vertical direction of the incisors is changed into a strong proclivity in *Sphærias*, *Syconycteris*, and *Harpyionycteris*.

Aberrations from the normal crowded or equidistant arrangement of the incisors are seen in several genera of *Macroglossinae*: in *Melonycteris*  $i_1-i_1$ , in *Nesonycteris* and *Notopteris*  $i^1-i^1$ , and in *Macroglossus* both  $i^1-i^1$  and  $i_1-i_1$  are unusually widely spaced.

In *Hypsignathus* (*Epomophorus* section) the lower incisors do not bite against but close some distance in front of the upper.

*Deciduous incisors.*— $i^1$  (rudimentary, barely piercing gum) is deciduous in *Notopteris*;  $i^2$  (relatively well developed) often deciduous in *Epomops* (for details see p. 489, footnote);  $i_2$  (the single lower incisor, almost functionless) sometimes deciduous in *Dobsonia* (*D. viridis* and *crenulata*), perhaps so in *Harpyionycteris*.

## 10. Canines.

Apart from minor variations in length and bulk, the canines may be modified: (1) by an enlargement of the cingulum, (2) by the development of secondary cusps, or (3) by the development of longitudinal grooves on the crown of the upper canines; further, (4) the direction of the canines may be changed (proclivity; outward or outward-and-backward slant of lower canines), and (5) the position of the lower canines may be changed.

*Cingulum.*—As a general rule, in Fruit-bats with weak dentition the cingulum of the canines is thin or obsolescent; on the other hand, the heavier the dentition, the thicker and more prominent the cingulum. In *Pteropus* (dentition, as a rule, unusually heavy) there is a pronounced tendency to an enlargement of the cingulum, particularly in the upper canines, and in certain species (*Pt. samoënsis* and *pselaphon* groups) the prominent edge of the cingulum tends to break up into a number of small, rounded, more or less incompletely separated tubercles. The extreme of this tendency is seen in the related, very heavy-toothed *Pteralopex*, in which the edge of the broad cingulum of the upper canines is distinctly cuspidate.

*Secondary cusps.*—May be developed from the inner edge only (in both upper and lower canines), or from the outer edge only (in the upper canines), or from both edges (very rarely, and only in the lower canines):—

From inner edge only:—In *Cynopterus* (fig. 48, p. 588) and the closely allied *Ptenochirus* (fig. 51, p. 643) a distinct secondary cusp is developed near the middle of the inner edge of the upper and lower canines, produced by a prolongation of the cingulum.

From outer edge only:—A small, well-marked secondary cusp from the outer edge of the upper canine, above the middle of the tooth, in *Pteropus tuberculatus*; a similar, but much larger cusp



halfway up the outer edge of the upper canine, in *Pteralopex* (fig. 21, p. 433); a similar, strong cusp in *Harpyionycteris* (fig. 78, p. 800); often a more or less well-defined outer cusp in the upper canine of *Nyctimene* (fig. 61, p. 684).

From both edges:—A strong secondary (cingulum) cusp at lower half of outer edge and a smaller one at middle of inner edge, in the lower canine of *Harpyionycteris* (fig. 78, p. 800). In this genus, it will be noticed, the upper canines are bicuspid, the lower tricuspid.

*Grooves*.—The anterior (or antero-medial) surface of the upper canine is not infrequently marked with a deep and well-defined longitudinal groove, reaching nearly from the base to the tip of the crown (and corresponding to the line followed by the tip of the lower canine, along the crown of the upper canine, when the lower jaw is moved up and down); this groove is particularly conspicuous in *Boneia* (as a rule obsolescent or shallow in the related *Roussettus*), *Pteropus* (rarely obsolete; in the related *Pteralopex* shallower or rather indistinct), *Styloctenium*, in all genera of the *Cynopterus* section except *Myonycteris*, *Cynopterus*, *Megarops*, and *Nyctimene*, and in all *MacroGLOSSINÆ*. More rarely, and only in some genera of *MacroGLOSSINÆ*, there are one or two additional longitudinal grooves on the outer surface of the upper canine (barely traceable in *MacroGLOSSUS*, shallow in *Syconycteris*, as a rule better developed in *Melonycteris*, *Nesonycteris*, and *Notonycteris*).

*Direction*.—The lower canines are slanted conspicuously outward or both outward and backward in *Boneia*, *Pterotes*, *Epomops*, *Hypsignathus* (lower canines, like lower incisors, closing some distance in front of upper), *Spherias*, and all *MacroGLOSSINÆ*. In *Dobsonia* the upper canines are a little proclivous; in the related *Harpyionycteris* both upper and lower canines (as well as the incisors) are unusually proclivous, the lower canines crossing the upper almost at right angles.

*Position of lower canines*.—In genera with a single pair of lower incisors the lower canines have, as a rule, moved a little closer together, toward the extremity of the jaw (*Styloctenium*, *Ptenochirus*, *Megarops*, *Balionycteris*, *Penthetor*; not in the two *MacroGLOSSINÆ* genera *Nesonycteris* and *Notonycteris*). The extreme phase of this tendency is seen in three genera, *Dobsonia*, *Harpyionycteris*, and *Nyctimene*, in which the lower canines have moved forward to the very extremity of the jaw, so as to be quite or nearly in contact with each other (in *Dobsonia* and *Harpyionycteris* the single pair of lower incisors is rudimentary, wedged in between the canines, and at least in *Dobsonia* sometimes deciduous; in *Nyctimene* all lower incisors are lost).

## 11. Premolars and molars.

*Formule*.— $p^2$  and  $p_2$  are lost in all Chiroptera,  $m^3$  in all Megachiroptera; no Fruit-bat, therefore, has more than  $\frac{5}{6}$  postcanine

teeth on either side. The following seven formulæ occur in the suborder :—

$\frac{p^1 p^3 p^4 m^1 m^2}{p_1 p_3 p_1 m_1 m_2 m_3} = \frac{5}{6}$ , the normal formula, found in all genera not enumerated below.

$\frac{p^1 p^3 p^1 m^1 m^2}{p_1 p_3 p_1 m_1 m_2} = \frac{5}{5}$ , in *Styloctenium* (related to *Pteropus*); *Balionycteris* (*Cynopterus* section); and one species of *Macroglossinae*, *Eonycteris rosenbergi* (the other species of *Eonycteris* have the normal formula).

$\frac{p^3 p^4 m^1 m^2}{p_1 p_3 p_1 m_1 m_2 m_3} = \frac{4}{6}$ , in *Dobsonia*, an aberrant genus of the *Rousettus* section.

$\frac{p^1 p^3 p^4 m^1}{p_1 p_3 p_1 m_1 m_2 m_3} = \frac{4}{6}$ , in *Plerotes* (*Epomophorus* section).

$\frac{p^1 p^3 p^1 m^1}{p_1 p_3 p_1 m_1 m_2} = \frac{4}{5}$ , the usual formula in the *Cynopterus* section, found in eight genera, viz. *Cynopterus*, *Ptenochirus*, *Megacerops*, *Chironax*, *Thoopterus*, *Penthetor*, *Spharrias*, and *Nyctimene*; further, in one species of *Macroglossinae*, *Syconycteris naias* (the other species of *Syconycteris* have the normal formula).

$\frac{p^3 p^1 m^1 m^2}{p_3 p_1 m_1 m_2 m_3} = \frac{4}{5}$ , in *Notonycteris* (subfamily *Macroglossinae*).

$\frac{p^3 p^1 m^1}{p_1 p_3 p_1 m_1 m_2} = \frac{3}{5}$ , the usual formula in the *Epomophorus* section, found in seven genera, viz. *Epomops*, *Hypsignathus*, *Epomophorus*, *Micropteropus*, *Nanonycteris*, *Scotonycteris*, and *Casinycteris*; and in one genus of the *Cynopterus* section, *Dyacopterus*.

*Formulae in the four primary sections of Megachiroptera.*—All genera of the *Rousettus* section have the normal number of pre-molars and molars ( $\frac{5}{6}$ ), except *Styloctenium*, which has lost the small  $m_3$ , and *Dobsonia*, which has lost the small  $p^1$ . All genera of the *Epomophorus* section have lost  $p^1$ ,  $m^2$ , and  $m_3$  ( $\frac{3}{5}$  cheek-teeth), except *Plerotes*, which has lost only  $m^2$ , and retained  $p^1$  and  $m_3$  in a rudimentary state. All genera of the *Cynopterus* section have lost  $m^2$  and  $m_3$  ( $\frac{4}{5}$  cheek-teeth), except *Myonycteris*, which has the full number of cheek-teeth (but  $m^2$  and  $m_3$  are quite small), *Balionycteris*, which has lost only  $m_3$  (but  $m^2$  is minute), and *Dyacopterus*, which has lost not only  $m^2$  and  $m_3$ , but also the small  $p^1$ . All *Macroglossinae* have the normal cheek-tooth formula ( $\frac{5}{6}$ ), except *Eonycteris rosenbergi*, which has lost  $m_3$  (in the other species of *Eonycteris*  $m_3$  is usually very small, and adult individuals occasionally occur in which it is absent at least on one side),

*Syconycteris naia*s, which has lost  $m_3$  and  $m^2$  (both small in the other species of the genus), and *Notopterus*, which has lost  $p^1$  and  $p_1$  (in the related *Melonycteris* and *Nesonycteris*  $p^1$  is rudimentary).

*Modifications of molar structure.*—Normally the structure of the molariform teeth in Megachiroptera is this: a median longitudinal groove flanked by a higher outer and lower inner ridge, each ridge rising (or tending to rise) into a cusp anteriorly. This typical structure is most clearly pronounced in  $p^1$  and  $m^1$ ,  $p_4$ ,  $m_1$ , and  $m_2$ . In  $p^3$  and  $p_3$  the outer and inner ridge raises anteriorly into a higher, more narrowly pointed cusp, and both cusps are either connected at base by a conspicuous commissure or (very often) completely fused from base to tip, making these teeth in profile almost caniniform. If present,  $p^1$ ,  $p_1$  and  $m_3$  are nearly always reduced in size, and their surface structure more or less degenerated.

The principal modifications of the typical molar structure are due to: (1) the development of a well-marked posterior basal ledge, (2) the development of an antero-internal basal ledge or cusp, (3) a more or less complete splitting of the outer or inner ridge, or both, into two or more cusps, or (4) the development of surface cusps. If only one of these modifications becomes operative, the general appearance of the tooth is comparatively little altered; if several (*Pteropus*) or all (*Harpyionycteris*) take effect in the same tooth, its appearance is naturally profoundly modified.

In *Pteropus* there is a pronounced tendency to the development of a posterior basal ledge in  $p^1$ ,  $p^4$ ,  $p_3$ , and  $p_4$ , often also in  $m^1$  and  $m_1$ , not infrequently in  $m_2$ , *i. e.* the posterior portion of the tooth is more or less distinctly marked off, by a notch in the outer ridge, from the rest of the tooth (fig. 9 B, p. 68; fig. 10 B, p. 69); these posterior ledges are unusually strong in the *Pteropus samoënsis* and *psclaphon* groups, and in one species of the former group (*Pt. auctianus*) the ledge is continued forward, as a well-defined shelf, along the inner side of  $p_1$ ,  $m_1$ , and  $m_2$  (fig. 10 C, p. 69; fig. 14, p. 289). In some species of the *Pteropus lombocensis*, *samoënsis*, and *psclaphon* groups there are traces of antero-internal basal tubercles in  $p^3$ ,  $p^4$ ,  $p_3$ , and  $p_4$  or in some of these teeth, *i. e.* the antero-internal cingulum is somewhat more differentiated than usual and tending to rise as a small ledge or tubercle.

These modifications are further developed and more definitely fixed in *Acrodon* (closely related to *Pteropus*): the posterior ledges are always strong, in  $p_1$ ,  $m_1$ , and  $m_2$  the ledge always extends along the inner base of the teeth as a broad, sharply-defined shelf, and a well-marked antero-internal tubercle is always developed in  $p^4$  and  $m^1$ , in some species also in  $p^3$  and  $p_3$ , making these teeth distinctly trienspid (fig. 20, p. 413).

The peculiar molar structure of *Paraotops* (also related to *Pteropus*) represents only an extreme phase of the modifications developed in the species of the *Pteropus psclaphon* group. The teeth are short and broad, the anterior and posterior ledges of  $p$ .

$p^4$ , and  $m^1$  prominently developed, shelf-like, with raised margin, the posterior ledges of the lower teeth heavy, and the cutting-edge of the outer ridge of  $p_4$  and  $m_1$  distinctly (though never deeply) bifid (fig. 22, p. 438).

Again, in *Dobsonia* (an offshoot from the Rousetto-Pteropine section) some of the modifications seen in *Pteropus* are taken up and further developed. In a single species (*Dobsonia minor*) the molar structure is practically unmodified Rousettine, but in the more highly differentiated forms of the genus there is a well-marked posterior basal ledge in  $p^3$ ,  $p^4$ ,  $p_3$ , and  $p_4$ , and a distinct antero-internal basal ledge or cusp in  $p^3$  and  $p^4$ , often also in  $p_3$ ,  $p_4$ ,  $m_1$ , and  $m^1$ ; to these modifications are added, in the majority of species, a median surface ridge (or cusp) in  $m^1$  and  $m_2$ , sometimes also in  $p^1$  and  $m_1$ , and a tendency to a splitting of both ridges of  $p^4$ ,  $m^1$ ,  $p_1$ , and  $m_1$  (rarely  $p^3$  and  $p_3$ ) into two or more cusps (fig. 25, p. 451).

A distinct (but never very deep) splitting of the ridges of some of the cheek-teeth was noted above in *Pteralopex* and *Dobsonia*. The same tendency crops up in several other Fruit-bats: in *Pteropus pselaphon* the inner ridge of  $m_1$ , and in *Pteropus leucopterus* both ridges of  $m_1$  and  $m_2$  tend to become bilobed; in *Hypsignathus* the outer ridge of  $p_4$  is more or less obscurely, that of  $m_1$  always distinctly trilobed or bilobed, that of  $m_2$  bilobed (rarely, and only as an individual anomaly, an initial stage of a splitting of the outer ridge of  $m_1$ , or both  $m_1$  and  $m^1$ , into two cusps is seen in the related *Epomophorus*); in *Nyctimene* (*Cynopterus* section) the outer ridge of  $p_3$ ,  $p_4$ , and  $m_1$  is sometimes more or less conspicuously bilobed; and, finally, in *Harpyionycteris* (related to *Dobsonia*) the splitting of the ridges is more complete than in any other genus of the suborder.

The occurrence of surface cusps (or ridges) in  $p^4$ ,  $m^1$ ,  $m_1$ , and  $m_2$  of *Dobsonia* was mentioned above. Similar cusps are developed in the related *Harpyionycteris*, and in  $p_1$  and  $m_1$  of four genera of the *Cynopterus* section, viz. *Cynopterus* (character not quite fixed), *Ptenochirus*, *Dyacopterus*, and *Thoopterus*.

The "multicuspidate" molar structure of *Harpyionycteris* is unquestionably the most peculiar in the suborder. In reality, however, it is effected simply by a combination of all the four types of modification discussed above, viz. by the development of postero-external and antero-internal cusps or ledges and of surface cusps, and by a splitting of the ridges (see analytical description of the teeth of this genus, pp. 801-803, and fig. 79, p. 802).

*Deciduousness of  $p^1$ .*—Even when reduced to a quite rudimentary (and therefore presumably almost functionless) condition  $p^1$  is in most genera permanent. It is known to be deciduous in a few species of *Rousettus* (*seminudus*, *brachyotis*), in many species of *Pteropus*, and in *Acerodon* and *Styloctenium* (perhaps occasionally in *Chironax*). [It is permanently lost in *Dobsonia*, all *Epomophorine*

genera except *Plerotes*, in *Dyacocterus* (probably; only one specimen is known), and in *Notopterus*. The latter genus is the only Fruit-bat that has lost both  $p^1$  and  $p_1$ .]

*Degeneration of cheek-teeth*.—Probably owing to adaptation to a kind of food that requires little mastication, the cheek-teeth are unusually narrow (sublinear) in *Stenonycteris* (subgenus of *Rousettus*), a few species of *Pteropus* (particularly *Pt. scapulatus* and *woodfordi*), *Plerotes* (*Epomophorus* section), *Sphærias* (*Cynopterus* section), and nearly all *Macroglossinae* (less so in *Eonycteris* and some species of *Syconycteris* than in the other genera). The narrowing of the teeth is not infrequently (*Plerotes*, many *Macroglossinae*) accompanied by a degeneration of their surface structure (flattening of crown).

## 12. Anomalies in the dental formula.

Notes have been taken, during the preparation of this Catalogue, of any anomaly in the dental formula of the specimens examined. Altogether forty-four cases have come under observation, *i. e.* 2·2 per cent. of the skulls examined exhibit individual aberrations from the normal number of teeth. There can be no doubt, however, that for the large majority of Megachiroptera this estimate is too liberal; the fact is that of the forty-four cases no less than twenty-three fall on forms distinguished by a more or less high degree of degeneration of the cheek-teeth, a condition which appears to be particularly favourable for the development of individual dental anomalies (see the paragraph "*Odontonycteris*," p. 754; the "genus" *Odontonycteris* was based on a *Macroglossus* with a supernumerary molar on each side above); it would probably be approximately correct to say that in any large series of skulls of *Macroglossus*, *Eonycteris spelæa*, and *Pteropus scapulatus* at least twelve per cent. will present anomalies in the dental formula, whereas in all other Fruit-bats taken together the percentage has been found to be only 0·9.

The anomalies observed may conveniently be classed under the following four headings:—(1) Absence of teeth which are normally present in the species (it is hardly necessary to say that senile conditions have been left entirely out of consideration, and that a tooth has been considered "absent" only if there is no trace whatever that it has ever been present in the individual), this anomaly in some cases "foreshadowing" the permanent disappearance of the same tooth in related forms: (2) Appearance of teeth which are normally absent in the species, but present in related forms of Megachiroptera: (3) Appearance of teeth which are normally absent in all Megachiroptera, but (since present in some Microchiroptera) have probably been present in some ancestral form: (4) Accidental outgrowths. Whether a case ought to be classed under the fourth or third category is, as noted below, sometimes doubtful.

*Absence of teeth that are normally present in the species.*—The most frequent anomaly is the absence of the last lower molar ( $m_3$  or  $m_2$ ) or the last upper molar ( $m^2$ ); more rarely  $p^1$ ,  $p_1$ , or  $i_1$  are undeveloped:—

$m_3$ .—Absent on one side of the jaw, in four cases, viz. one *Pteropus vampyrus vampyrus* (British Museum, no. 9.1.5.867), two *Eonycteris spelæa* (B.M. 0.8.2.1, 8.2.25.4), one *Macroglossus minimus minimus* (10.4.6.15).

Absent on both sides, in five cases, viz. one *Pteropus giganteus* (79.3.31.3), four *Pteropus scapulatus* (57.10.24.1, 62.5.2.3, 8.8.8.4, 8.8.8.6).

$m_3$  is always greatly reduced in size in *Pteropus* and *Eonycteris spelæa*; in a genus closely related to *Pteropus*, viz. *Styloctenium*, the tooth has permanently disappeared, and the same seems to be the case in one species of *Eonycteris* (*E. rosenbergi*). In *Pteropus scapulatus* and *Eonycteris* the cheek-teeth are tending to degenerate in size (breadth), and in *Macroglossus* the degeneration is even more pronounced.

$m^2$ .—Absent on one side, in one *Pteropus scapulatus* (8.8.8.4).

Absent on both sides, in one *Macroglossus minimus minimus* (10.4.6.15).

As noted above (under  $m_3$ ) both are forms with degenerated dentition.

$m_2$ .—Absent on one side, in two cases, viz. one *Cynopterus brachyotis angulatus* (8.2.5.13), and one *Cynopterus brachyotis minutus* (U.S. National Museum, 141243). In *Cynopterus* and related genera the number of cheek-teeth is reduced to  $\frac{4}{5}$ , that is,  $m_3$  and  $m^2$  are lost;  $m_2$  is therefore the last lower molar, and it is always considerably reduced in size.

$p^1$ .—Absent on both sides, in one *Eonycteris spelæa* (0.8.2.1). In *Eonycteris*, as in many other Megachiroptera,  $p^1$  is rudimentary; in certain genera it is deciduous or lost.

$p_1$ .—Absent on one side, in one *Acerodon celebensis* (94.7.4.2).  $p_1$  is always small, but in no Fruit-bat deciduous, and only in one genus (*Notopterus*, entirely unrelated to *Acerodon*) lost.

$i_1$ .—Absent on one side, in three cases, viz. one *Cynopterus brachyotis angulatus* (60.3.19.1400), one *Cynopterus b. brachyotis* (97.1.2.9), and one *Cynopterus b. javanicus* (79.11.21.68). This anomaly, it will be noticed, has only been observed in *Cynopterus*, and in several genera related to *Cynopterus*  $i_1$  is permanently lost.

*Occurrence of teeth that are normally absent in the species, but present in related forms:*—

$m_3$ .—Present on one side, in one *Cynopterus brachyotis javanicus* (9.1.5.73). The tooth is normally lost in *Cynopterus*, but present in all Fruit-bats with unmodified dental formula.

*Occurrence of teeth that are normally lost in all living Megachiroptera, but no doubt have been present in some extinct form:*—

$m^3$ .—Present on one side, in five cases, viz. one *Eidolon helvum* (B. M., unregistered, specimen  $c^3$ , p. 15), one *Rousettus leachi* (37.4.28.67), one *Rousettus seminudus* (unregistered, specimen  $a$ , p. 39), and two *Macroglossus lagochilus lagochilus* (10.3.3.23, 10.3.3.24).

Present on both sides, viz. one *Rousettus ægyptiacus* (4.4.9.2), one *Pteropus giganteus* (45.5.15.4), one *Macroglossus minimus minimus* (10.4.7.2), and one *Macroglossus lagochilus lagochilus* (U.S. National Museum, 125316).

$m^3$  is normally lost in all Megachiroptera, but present in some Microchiroptera. Of the nine cases recorded above of the occurrence of what seems to be an " $m^3$ " it is perhaps safest to eliminate the four observed in *Macroglossus*, owing to the high degree of degeneration of the dentition of that genus and the unusually frequent occurrence of supernumerary molars (compare the Marsupial genus *Myrmecobius*!). There remain five cases in *Eidolon*, *Rousettus*, and *Pteropus*, and in view of the fact that all three genera occupy a low position in the suborder it is at least not unlikely that the anomaly is a reversion to a more primitive condition.

*Supernumerary teeth that are certainly, or at least probably, merely accidental outgrowths:—*

" $i_3$ ."—In one *Pteropus vampyrus* skull (55.12.26.90) a tooth is present, on both sides, behind  $i_2$  and leaning against the inner side of the canine. The possibility of this tooth being really an  $i_3$  (lost in all Megachiroptera, but preserved in some Microchiroptera) cannot of course be denied, but from the position and general shape of the tooth it appears more likely that it is an accidental outgrowth.

$i^1$  reduplicated on both sides.—In one *Macroglossus minimus solrinus* (3.2.6.17).

$i^2$  reduplicated on one side.—In one *Cynopterus brachyotis angulatus* (6.11.6.42).

" $p_2$ ," i. e. a tooth occupying the position of a  $p_2$ .—Present on one side, in three cases, viz. one *Pteropus scapulatus* (86.11.1.1), one *Epomophorus gambianus* (Berlin Museum, 10171), and one *Eonycteris spelæa* (1.3.9.1). Present on both sides, in one *Epomophorus gambianus* (99.6.15.3).

It would be interesting if this supernumerary premolar really represented  $p_2$ , a tooth lost in all Chiroptera, and, as in the case of " $i_3$ " (above), the possibility cannot be altogether denied. But it should be remembered that *Pteropus scapulatus* and *Eonycteris* are forms with somewhat degenerated teeth, therefore liable to accidental anomalies in the dentition, and the teeth of *Epomophorus gambianus*, though not exactly degenerated, are remarkably small for the size of the bat; further, that the diastema between  $p_1$  and  $p_3$  is in all three forms considerably wider than elsewhere in the lower jaw, so that, if there is any latent tendency in the jaw to a development of a supernumerary tooth, this wide diastema so to speak "invites" it to crop up there; and finally, that in two of the species, viz. *Pt. scapulatus* and *E. gambianus*, cases are known (see below) of the appearance of a supernumerary premolar between  $p^3$  and  $p^4$  (compare a *Rousettus angolensis* with an abnormal tooth squeezed in between  $m^1$  and  $m^2$ ). This, to say the least, is a warning against too rash homologizations.

Supernumerary tooth between  $p^3$  and  $p^4$ .—On one side (tooth small) in one *Epomophorus gambianus* (99.6.15.2).

On both sides (tooth well-developed), in one *Pteropus scapulatus* (8.8.8.3). Supernumerary tooth between  $m^1$  and  $m^2$ .—On one side (tooth extremely narrow, abnormal in shape), in one *Rousettus angolensis* (6.12.4.5).

" $m_4$ ."—On one side, in four cases, viz. one *Pteropus giganteus* (106.d), one *Macroglossus lagochilus nanus* (10.3.3.3), two *Macroglossus l. lagochilus* (10.3.3.23; U.S. National Museum, 125316).

On both sides, in two cases, viz. one *Macroglossus minimus minimus* (10.4.7.4), one *Macroglossus lagochilus nanus* (10.3.2.2).

In no other genus are anomalies in the cheek-tooth series so frequent as in *Macroglossus* (see p. 754).

### 13. Palate-ridges.

Eight ridges forming regular curves from side to side, the interdental ridges almost equidistant, the postdental a little more narrowly spaced, and some of the latter slightly notched at the middle, as if tending to split into a right and left half, such is the simplest, and therefore presumably the most primitive, type of palate-ridges known in Megachiroptera (see fig. 28, p. 484, the Epomophorine genus *Plerotes*). A similar, more or less slightly, but never profoundly, modified arrangement of the ridges is seen in the large majority of genera of the Rousettine, Cynopterine, and Macroglossine sections; the number of the ridges may be a little increased, and, if so, the increase generally takes place chiefly on the postdental portion of the palate, the spacing of the ridges may

be a little less regular, and some of the posterior ridges may be more distinctly divided at middle (for these details see the descriptions and figures under each genus). But the Epomophorine is the only section of Fruit-bats in which more essential modifications of the system of ridges occur; in that section, and in that only, nearly every genus has its own peculiar form and arrangement of the palate-ridges, and in some cases (*Epomops*, *Epomophorus*) even the species may be identified from the characters of their soft palate (or, if this is removed, from the impressions left by some of the heavier ridges on the bony palate). Omitting all details, the modifications of the soft palate in the Epomophorine section of genera are briefly these:—

The simple palate-ridges of *Plerotes* have already been referred to above. In two of the three known species of the related *Epomops*, viz. *E. franqueti* and *buettikoferi* (figs. 31 A, B, p. 489), the general arrangement is still comparatively little modified, but the three anterior (interdental) ridges are become thick and prominent; in the third species, *E. dobsoni* (fig. 31 C, same page) a similar thickening of the three anterior ridges has taken place and, in addition to this, also the fourth and fifth ridges are modified, being heavy and triangularly prominent. The palate of the closely allied *Hypsignathus* (fig. 34 C, p. 504) differs only in less important details from that of *Epomops franqueti*. In *Epomophorus* (fig. 37, p. 516) all ridges (six in number, apart from a few thin and inconspicuous ridges at the extreme hinder edge of the palate) are thick and prominent. *Micropteropus* and *Nanonycteris* exhibit the most peculiar modifications of the ridges in the whole suborder. *Micropteropus* (fig. 39, p. 556) in so far resembles *Epomophorus* (to which it is most probably closely related) as all the ridges (five) are thick and prominent, but the first ridge is typically hastate in form, with the point directed backward, the second to fifth divided by a deep groove extending along the median line of the palate, very broad in front and gradually narrowing posteriorly; a glance at the palate of this animal is sufficient to distinguish it from any other Fruit-bat. The latter remark would apply also to *Nanonycteris* (fig. 41, p. 561); the interdental ridges of this genus are rather similar to those of *Epomops* (probably one of its closest relatives), but the postdental ridges are increased in number, narrowly and very regularly spaced, thickened and elevated at middle (forming a prominent keel along the median line of the postdental palate), depressed and very thin laterally; this is almost exactly the reverse of the type of palate-ridges found in *Micropteropus*, in which the soft palate is marked not with a prominent keel but with a deep and broad groove along the middle. *Scotonycteris* and *Casinonycteris* (fig. 45, p. 571) in so far recall *Nanonycteris* as the interdental ridges are thickened and the postdental ridges somewhat (*Scotonycteris*) or much (*Casinonycteris*) increased in number, but the latter are simple, thin, and serrate.



14. *Tongue.*

The principal modifications of the surface structure of the tongue have been described and figured on pp. 723-728, fig. 65.

15. *Wing-structure.*

Detailed descriptions of the characters of the wing, in each genus of Megachiroptera, are given in the systematic part of this Catalogue. The present paragraph intends to give only a general survey of the variability of some of these characters. [In all Fruit-bats there are three phalanges in the second finger, the terminal phalanx nearly always clawed, two phalanges in the third, fourth, and fifth.]

*Third, fourth, and fifth metacarpals.*—There is never any very great contrast in the lengths of the metacarpals of the three long fingers. As a rule, however, the third is distinctly the longest, in some genera the fifth, while in others again all three metacarpals are practically subequal. The variations in this respect, within the four primary groups of Fruit-bats, are briefly these:—

In *Rousettus* and its closest relatives (*Eidolon*, *Boneia*) the third metacarpal is as a rule slightly longer than the fourth, which is a little longer than or subequal to the fifth; the “indices” of the metacarpals (*i. e.* their lengths for a supposed length of forearm of 1000) are in typical *Rousettus*, respectively, 612, 595, and 586, in *Eidolon* 690, 668, and 641, in *Boneia* 671, 659, and 648. In *Dobsonia* (indices 621, 568, 586) and the related *Harpyionycteris* (697, 661, 673) the third has remained the longest, but the fourth tends to be a little shorter than the fifth. Finally, in *Pteropus* and its relatives, *Acerodon*, *Pteralopex*, and *Styloctenium*, the fifth is slightly the longest, the third a little longer than or equal to the fourth (*ex.*, *Pteropus hypomelanus* with the indices 689, 670, 718, *Pteralopex* with 690, 659, 708, *Styloctenium* with 723, 723, 739).

In the *Epomophorus* section the third is nearly always slightly the longest, the fourth and fifth subequal (or the fifth tending to be the longer of the two); *Epomophorus* with the indices 680, 647, and 641, and *Epomops* with 728, 699, and 715, may serve as examples. In *Scotonycteris* (682, 678, 688) and the related *Casiomycteris* (692, 683, 692) all three metacarpals are subequal: and in *Pterotes* (679, 698, 689) the fourth tends to be slightly the longest.

Again in the *Cynopterus* section the third is nearly always the longest, the fourth and fifth more or less subequal, though very often with a distinct tendency of the fourth to be the shortest, or the third and fifth may be subequal, the fourth slightly the shortest; indices in *Cynopterus* 640, 599, 625, in *Balionycteris* 719, 697, 714, in *Nyctimene* 708, 646, 678.

Two genera of *Macroglossinae* (and those two which also in skull and dentition are the least specialized in the subfamily), *viz.* *Eonycteris* and *Megaloglossus*, are nearly Rousettine in the

proportionate length of the metacarpals: third longest, fourth intermediate, fifth shortest; indices in *Eonycteris* 675, 656, 608, in *Macrologlossus* 760, 716, 670. In all other *Macrologlossinae* these three metacarpals are either practically subequal in length (*Macrologlossus* and *Syconycteris*, both closely interrelated), or the fifth is distinctly the longest (*Melonycteris*, *Nesonycteris*, *Notopteris*, all closely interrelated); examples, *Macrologlossus* 726, 733, 740, *Nesonycteris* 760, 755, 798.

*Phalanges of third, fourth, and fifth fingers.*—The second (terminal) phalanx of the third finger is always much longer than the first phalanx, but nearly always (for exceptions see below) decidedly shorter than the metacarpal of the same finger; the two phalanges of the fourth finger are subequal, but with a very distinct tendency of the terminal phalanx to be the longer; the two phalanges of the fifth are subequal, the terminal phalanx being sometimes rather longer, but more often a little shorter than the proximal. In some forms, however, a conspicuous lengthening has taken place of the terminal phalanx of the third finger, making it subequal to or longer than its metacarpal; this is the case in *Eidolou*, *Stenonycteris* (subgenus of *Rousettus*), *Boneia*, *Pteropus*, *Acerodon*, *Dobsonia*, and *Plerotes*, and the three closely interrelated *Macrologlossinae* genera, *Melonycteris*, *Nesonycteris*, and *Notopteris*.

Subjoined is given in tabular form the absolute minima and maxima of the indices of the metacarpals and phalanges of the three long fingers, and for comparison the actual indices of one of the shortest-winged (*Rousettus*) and one of the longest-winged (*Nesonycteris*) Fruit-bats.

	3rd finger.			4th finger.			5th finger.		
	Mtc.	1 ph.	2 ph.	Mtc.	1 ph.	2 ph.	Mtc.	1 ph.	2 ph.
Absolute minima .....	612	408	521	568	313	335	586	272	262
Typical <i>Rousettus</i> .....	612	408	521	595	313	353	586	291	323
<i>Nesonycteris</i> .....	760	566	745	755	458	453	798	340	358
Absolute maxima .....	760	566	773	755	478	497	798	368	382

*Total length of fingers.*—The third finger is always by far the longest of all; next in length comes the fourth, averaging about four-fifths of the third; then the fifth, averaging about eleven-twelfths of the fourth, in rare cases (*Epomops*, and a few *Cynopterine* genera) very nearly equal to, but never longer than, the fourth; the second finger is as a rule somewhat more than one-third of the third; the first one-half of the second, or a little more. The length of the hand is of course determined by the length of its longest finger, and to give a rough idea of the variations in the length of the hand as compared with the forearm the genera of Fruit-bats are arranged below according to the "index "

(relative length, for a forearm of 1000) of the whole of the third finger (metacarpals and phalanges combined). This index is between :—

- 1500–1600 :—In typical *Rousettus* (i. e. *R. amplexicaudatus* and allied forms), the shortest-winged Fruit-bats.  
 1600–1700 :—In the following genera of the *Cynopterus* section, viz. *Cynopterus*, *Penochirus*, and *Penthetor*.  
 1700–1800 :—(In the following genera of the *Rousettus* section :) *Eidolon* (as a rule), *Stenonycteris*, *Boneia*, and *Dobsonia*; (*Epomophorus* section :) *Epomophorus*, *Micropteropus*, *Scotonycteris*, and *Casinonycteris*; (*Cynopterus* section :) *Myonycteris*, *Megaterops*, *Dyacopterus*, *Chironax*, *Thoopterus*, and *Sphaerius*; (*Macroglossinae* :) *Eonycteris*.  
 1800–1900 :—(*Rousettus* section :) *Lissononycteris*, *Pteralopex*, and *Harpionycteris*; (*Epomophorus* section :) *Pterotes*, *Epomops*, *Hypsignathus*, and *Nanonycteris*; (*Cynopterus* section :) *Balionycteris*; (*Macroglossinae* :) *Megaloglossus* and *Macroglossus*.  
 1900–2000 :—(*Rousettus* section :) *Pteropus* (as a rule), *Acrodon* (as a rule), and *Styloctenium*; (*Cynopterus* section :) *Nyctimene*; (*Macroglossinae* :) *Sycononycteris*.  
 2000–2100 :—In the three *Macroglossinae* genera, *Melonycteris*, *Nesonycteris*, and *Notonycteris*.

The table below shows the absolute minima and maxima of the indices of all five fingers, and for comparison the actual indices of one of the shortest-winged and one of the longest-winged Fruit-bats.

	1st finger c. u.	2nd finger c. u. (if present).	3rd finger.	4th finger.	5th finger.
Absolute minima .....	303	608	1511	1261	1161
Typical <i>Rousettus</i> .....	335	608	1541	1261	1200
<i>Nesonycteris</i> .....	419	783	2071	1666	1496
Absolute maxima .....	474	786	2071	1666	1496

*Archæopteropus*.—*Archæopteropus transiens*, Meschinelli, from the Upper Oligocene of Italy, a bat which, judging from the length of its forearm, was equal in size to an *Eidolon* or a female *Hypsignathus*, is the only Fruit-bat known only from a fossil state (on "*Rousettus*" *gaillardii*, from the Middle Miocene of France, see footnote, p. 22), and as a tolerably complete impression of the skeleton of its fore-limb has been preserved, it may be of some interest to compare its wing-structure with that of living Megachiroptera. It must be pointed out in advance, however, that Meschinelli has made a mistake in the identification of two of its

fingers. If his identifications were correct, the indices of the third, fourth, and fifth fingers would be, respectively, 1486, 1450, and 1946, *i. e.* the third and fourth fingers would be very short and practically subequal, the fifth enormously lengthened, a condition unthinkable except on the supposition that the form of the wing of *Archaeopteropus* was fundamentally different from that of any other bat, living or extinct. It is obvious that what Meschinelli takes to be the fifth finger is the third, and what he considers the third is the fifth. With this correction the indices of the metacarpals and phalanges of the three long fingers (calculated from Meschinelli's measurements) are as indicated in the bottom line of the following table:—

	3rd finger.			4th finger.			5th finger.		
	Mtc.	1 ph.	2 ph.	Mtc.	1 ph.	2 ph.	Mtc.	1 ph.	2 ph.
<i>Pteropodidæ</i> , minima...	612	408	521	568	313	335	586	272	262
"      maxima ..	760	566	773	755	478	497	798	368	382
<i>Archaeopteropus</i> .....	676	450	820	793	297	360	856	324	162+144=306

And the indices of the total lengths of all fingers are these:—

	1st finger c. u.	2nd finger c. u. (if present).	3rd finger.	4th finger.	5th finger.
<i>Pteropodidæ</i> , minima ...	303	608	1541	1261	1161
"      maxima ..	474	786	2071	1666	1496
<i>Archaeopteropus</i> .....	242	843	1946	1450	1486

A comparative analysis of the hand gives the following results:—

The first finger differed in no respect from that of living Megachiroptera.

The second finger was somewhat less reduced in length (843, as compared with 608-786); as its first phalanx (index 126) was very nearly similar to the average of recent forms (in which the index varies from 89 to 149), and the metacarpal (541), though unusually long, is equalled by that of the longest-winged living Fruit-bats (total variation 406-543), the greater length of the whole finger was due chiefly to the rather less reduced second and third phalanges (together 176, as against 64-162 in recent Fruit-bats, but the latter maximum index includes the claw, whereas in the fossil form only the claw *phalanx* is included).

The third metacarpal was conspicuously shorter than the fourth, this again somewhat shorter than the fifth. Although in some living Fruit-bats the fifth distinctly tends to be the longest, so great a disproportion in the lengths of the three long metacarpals

is not found in any recent Fruit-bat (but there are more or less close parallels in Microchiroptera). A glance at the first table above shows that the third metacarpal was quite ordinary in length, and the discrepancy due to the greater length of the fourth and fifth.

The first phalanx of the third finger was normal; the second, as usual, by far the longest of all phalanges, and relatively even somewhat longer than usual in Fruit-bats. The two phalanges of the fourth finger were nearly normal, though the first rather shorter than usual. The first phalanx of the fifth finger was normal in length; but there seems to have been two phalanges distally to this (hence Meschinelli's statement that the "third" finger, which in reality is the fifth, had three phalanges), and, curiously enough, these two distal phalanges together are equal in length to the single distal phalanx of living Megachiroptera (one might almost be tempted to think whether these "two" distal phalanges are not one broken into two pieces, but it must be admitted that this suggestion is not borne out by the published plate).

As a rule in Megachiroptera the fifth finger is distinctly shorter than the fourth, though in a few genera (e. g. *Epomops*) practically equal to the fourth; in *Archæopteropus* it was a trifle longer than the fourth (as in a few Microchiroptera).

The general conclusions are:—In so far as the second finger had three phalanges, and its terminal phalanx was undoubtedly clawed, the hand of *Archæopteropus* was a genuine Megachiropteran hand; and in so far as the second finger was less reduced in length, the hand of the fossil form may be said to be a little more primitive than that of any living bat; and in the features in which it differed, more or less slightly, from that of living Megachiroptera, it rather approached the hand of some Microchiroptera (except, of course, if it really had a third complete phalanx in the fifth finger). [The teeth of *Archæopteropus* are very little known, but the molar structure is said to have been cuspidate as in normal Microchiroptera, a statement that cannot be controlled with certainty from the published plate; the tail was long as normally in Microchiroptera and in one genus of Megachiroptera, *Notopterus*.]

*Claw of second finger.*—The claw of the second finger is lost in one (aberrant) genus of the *Rousettus* section, viz. *Do'ssonia*, and in three genera of MacroGLOSSINÆ, *Eonycteris*, *Nesonycteris*, and *Notopterus*. Even if the claw is absent, the ungual phalanx is always present (rudimentary in *Notopterus*).

*Membranes.*—The lateral membranes arise as a rule from the flanks or, rather higher up, from the sides of the dorsum. In *Pteropus*, *Acerodon*, and *Styloctenium* the line of origin lies generally somewhat nearer toward the spine, and in a few species of *Pteropus* (*melanopogon*, *papuanus*, *neohibernicus*) the membranes arise very close together, almost from the sides of the spinal tract.

In *Pteralopex* (related to *Pteropus*) they arise almost from the spinal line, or at any rate so close together that the interspace is scarcely appreciable. Finally, in two mutually entirely unrelated genera, *Dobsonia* (*Rousettus* section) and *Notopterus* (*Macroglossinae*) the naked membranes are perfectly continuous across the back and connected with the integument of the dorsum only along the spinal line.

Posteriorly the membranes may be inserted on any toe, from the first to the fifth. The variations, within the primary sections, are these:—

- On first toe.—*Rousettus* section: *Eidolon*, *Rousettus* (pt.), *Boneia*, and *Dobsonia* (pt.), that is, in all genera except *Pteropus* and its closest relatives, and *Harpyionycteris*; but in *Rousettus* and *Dobsonia* the insertion varies between the first and second toe, and in *Boneia* the insertion is sometimes rather between the first and second toe than on the first. *Epomophorus* section: only in two genera, *Scotonycteris* and *Casinonycteris* (in all other genera on second toe). *Cynopterus* section: in *Cynopterus*, *Ptenochirus*, *Megacerops*, *Balionycteris*, *Penthetor*, and *Sphuerias* (in the other genera on second toe). *Macroglossinae*: in *Eonycteris* either on first or second toe, or between.
- On second toe.—*Rousettus* section: in *Pteropus*, *Acerodon*, *Pteralopex* (sometimes on first), *Styloctenium*, and *Harpyionycteris* (perhaps rather between first and second); on *Rousettus* and *Dobsonia* compare remarks under first toe. *Epomophorus* section: all genera, except *Scotonycteris* and *Casinonycteris*. *Cynopterus* section: *Myonycteris*, *Dyacopterus*, *Chironax* (?), *Thoopterus*, and *Nyctimene*; in the latter the insertion varies between the second and third toe. *Macroglossinae*: *Eonycteris* (often on first), *Megaloglossus* (sometimes on third), *Notopterus* (sometimes between first and second).
- On third toe.—*Rousettus* section: none. *Epomophorus* section: none. *Cynopterus* section: sometimes *Nyctimene* (see under second toe). *Macroglossinae*: *Megaloglossus* (on second or third), *Macroglossus* (on third or fourth), *Melonycteris* (third or fourth), and *Nesonycteris* (third or fourth).
- On fourth toe.—Only in some *Macroglossinae*: *Macroglossus* (third or fourth), *Syconycteris* (fourth or fifth, rarely between third and fourth), *Melonycteris* (third or fourth), and *Nesonycteris* (third or fourth).
- On fifth toe.—In the *Macroglossinae* genus *Syconycteris* (fourth or fifth).

The membranes are marked with well-defined yellow spots in *Balionycteris* and *Nyctimene* (both of the *Cynopterus* section); more or less obscure spots are detectable in a few other genera, e.g. *Eonycteris*. The wings are said to be "bright orange" in life in *Casinonycteris* (*Epomophorus* section).

## 16. Tail.

Varies as follows:—

(1) Tail equal in length to forearm:—the oligocene *Archaeopteropus* (8 free caudal vertebræ); one genus of living Megachiroptera, of the subfamily *Macroglossinæ*, viz. *Notopteris* ("10 vertebræ," statement taken from literature, not verified by the writer).

(2) Tail considerably reduced, subequal to or somewhat shorter than tibia, but longer than hind foot with claws:—one genus of the *Cynopterus* section, *Nyctimene* (7 free caudal vertebræ). Though the tail of *Nyctimene* is distinctly longer than in *Rousettus*, the number of vertebræ is the same as in *Rousettus amplexicaudatus*.

(3) Tail further reduced in length, from about one-half to the full length of the foot with claws:—(*Rousettus* section:) *Eidolon* (4 free vertebræ), *Rousettus* (5–7), *Bonasia*, *Dobsonia*;—(*Cynopterus* section:) *Myonycteris*, *Cynopterus* (4), *Ptenochirus*, *Dyacopterus*, *Penthetor*;—(*Macroglossinæ*:) *Eonycteris* (7).

(4) Tail rudimentary, as a rule reduced to a small knob externally, more easily traceable by touch than by eye:—(*Epomophorus* section:) *Plerotes* (tail absent?), *Epomops* (2 free vertebræ), *Epomophorus* (2–3), *Micropteropus* (3), *Nanonycteris*, *Scotonycteris*, *Casinnycteris*;—(*Cynopterus* section:) *Thoopterus*;—(*Macroglossinæ*:) *Megaloglossus* (5 vertebræ, terminal two or three rudimentary), *Macroglossus* (3 or 2), *Syconycteris*.

(5) External tail absent:—(*Rousettus* section:) *Pteropus* (no free vertebræ), *Acerodon*, *Pteralopex*, *Styloctenium*, *Harpyionycteris*;—(*Epomophorus* section:) *Hypsignathus* (no free vertebræ); (*Cynopterus* section:) *Megarops*, *Balionycteris* (no vertebræ), *Chironax* (no vertebræ), *Sphaerias*;—(*Macroglossinæ*:) *Melonycteris*, *Nesonycteris*.

In the first, second, and third of the stages recorded above the basal portion of the tail is included in (connected by its dorsal integument with) the interfemoral, the tip freely projecting (whether or not this was the case also in *Archaeopteropus* is unknown); in the fourth stage the tail rudiment is usually unconnected with the interfemoral.

Two facts are evident from the above, first, that the tail is considerably reduced in length in all living Megachiroptera, with the single exception of *Notopteris*, second, that the degree to which it is reduced varies, as a rule even very conspicuously, within each of the primary sections of the suborder. The *Rousettus* section falls into three natural subsections, the *Rousettus*, *Pteropus*, and *Dobsonia* subsections; in the first (*Eidolon*, *Rousettus*, *Bonasia*) the tail is on the third stage of reduction, in the second (*Pteropus*, *Acerodon*, *Pteralopex*, *Styloctenium*) entirely absent, while in the third it is either on the third stage (*Dobsonia*) or absent (*Harpyionycteris*). In the whole of the *Epomophorus* section the tail is rudimentary (fourth stage), except in *Hypsignathus* (and *Plerotes*?), which has no tail. Within the *Cynopterus* section, it is on the second stage in *Nyctimene* only, on the third in *Myonycteris*, *Cynopterus*, *Ptenochirus*, *Dyacopterus*, and *Penthetor*, on the fourth in *Thoopterus*.

and absent in *Megetops*, *Balionycteris*, *Chironax*, and *Sphaerias*. Finally, in the *Macroglossinae*, it is on the first stage in *Notopterus* only, on the third in *Eonycteris*, on the fourth in *Megaloglossus*, *Macroglossus*, and *Syconycteris*, and absent in *Melonycteris* and *Nesonycteris*, these two genera being the closest relatives of the long-tailed *Notopterus*.

#### 17. *Calcar*.

The calcar is rudimentary in *Plerotes* (*Epomophorus* section) and *Syconycteris* (subfamily *Macroglossinae*), absent in *Sphaerias* (*Cynopterus* section), the modification being in all three cases due to a reduction of the lateral interfemoral; in the two former genera the interfemoral is reduced to a narrow (*Plerotes*) or even sublinear (*Syconycteris*) rim along the tibia, in *Sphaerias* it terminates at about the middle of the tibia.

#### 18. *Colour of fur*.

In the majority of Fruit-bats the prevailing tinges of the coloration of the fur are a dark brown, sometimes inclining toward dark hair-brown\*, sometimes closely approaching to bistre, or (not infrequently) washed with dull olive, the underparts being usually distinctly paler than the back. To have a basis for comparison this colour type may be considered the "typical" Megachiropteran coloration, and the principal modifications, exhibited by genera and species differing from this "typical" colour, may then be referred to one or several of the following categories:—

(1) The dark brown tinge may brighten to fawn-brown, café-au-lait, fawn-drab or related tinges; or to wood-brown, yellowish, buffy or even cream: or by increasing admixture of (sprinkling with) greyish hairs to pale hair-brown, ashy drab, or even light silvery grey (for examples see the brief summary of the colour changes in the primary sections of Megachiroptera, below):

(2) The dark brown tinge may darken into seal-brown or blackish, either on the dorsal surface only (many species of *Pteropus*, some *Acerodon*), or both on the dorsal and ventral surfaces (some species of *Pteropus*), this latter modification leading in its extreme to complete melanism (*Pteropus moligianii*, *Pt. natalis*, some races of *Pt. vampyrus*; *Pteralopex*; occasionally in *Pteropus alecto* and *Pt. tyleri*); or a darkening of the underparts may be combined with a lightening of the colour of the dorsal surface (some races of *Pteropus hypomelanus*; *Melonycteris*):

(3) The fur of the neck (the "mantle") may become brighter-coloured, forming a more or less strikingly-coloured (chestnut, russet, tawny, buff, yellowish buff, cream-buff, whitish) "tippet" contrasting with the unmodified or nearly unmodified dark back (many *Pteropus*, *Acerodon*); or the development of a

\* Throughout the whole of this Catalogue the colours are named, as far as possible, in accordance with Ridgway's 'Nomenclature of Colors' (1886).



peculiarly coloured mantle may be combined with any of the colour changes indicated under (1), (2), and (4):

(4) The head may be marked with sharply defined stripes or patches (*Pteropus capistratus* and *personatus*, *Styloctenium*, *Scotonycteris*, *Casinonycteris*):

(5) A small tuft of hair at the anterior and posterior bases of the ear-conch may become pale-coloured, whitish or buffy (seemingly a trivial modification, but in fact eminently characteristic of all genera of the *Epomophorus* section, except one):

(6) A dark spinal stripe may develop (only in *Nyctimene*, and not equally distinct in all species):

(7) Peculiar light or bright-coloured neck-tufts may develop, the brightening of the colour sometimes spreading across the fore-neck and chest and backward along the flanks (in males of many species, rarely in females; see the paragraph "Secondary sexual characters," below).

In each of the natural sections of Megachiroptera the more noteworthy modifications of the colour of the fur are, briefly summarized, these:—

*Rousettus* section.—*Rousettus*, *Bonasia*, and *Harpionycteris* are essentially "typical" in colour. In *Eidolon* (*helvum* and *sabæum*) the colours are more or less conspicuously tinged with yellowish (and more so in females than in males). In *Dobsonia* the dark brown (*Rousettine*) general colour is often more or less brightened by admixture of olive, raw-umber, or tawny-olive, these tinges often with an indefinable greenish hue. *Pteropus* (together with the closely related *Acerodon*) shows greater colour variations than any other genus of Fruit-bats; any of the modifications mentioned above under (1) to (4) occur, single or combined; a summary has been given in the systematic part of this Catalogue (pp. 74-75). The two known species of *Pteralopex* are nearly (*anceps*) or quite melanistic (*atrata*). The single species of *Styloctenium* is unusually light-coloured (silvery greyish or silvery buffy, with sharply contrasting dark brown bases to the hairs), and with peculiar head markings, closely similar to those of *Pteropus personatus*, to which the genus is undoubtedly related.

*Epomophorus* section.—Small whitish hair-tufts at the base of the ears anteriorly and posteriorly are present in all genera of this section, except *Scotonycteris*, but in no other Fruit-bats. The general colour of the fur is in *Hypsipmathus* dull, dark plumbeous or slate, in all other genera as a rule more or less tending toward the paler tinges of brown, fawn-brown, café-au-lait, brownish russet, brownish isabella, or allied tinges. White markings on the head, curiously analogous to those of *Pteropus personatus* and *Styloctenium*, are present in *Scotonycteris* and *Casinonycteris* (the appearance of essentially analogous head markings in so widely separated forms as *Pteropus personatus* and *Styloctenium* on the one hand, *Scotonycteris* and *Casinonycteris* on the other is difficult indeed to account for, except on the supposition that these are cases of

reversion to a colour pattern of the head of some common ancestral form).

*Cynoptyerus* section.—Brownish tinges with paler underparts are the rule, except in *Nyctimene*. *Myonycteris* is practically Rousettine in general colour. In *Cynoptyerus* the colour of the back is often suffused with warmer (russet) tinges, sometimes with cinnamon, or a tinge between cinnamon and wood-brown, the foreneck, sides of chest, and flanks with chestnut, cinnamon-rufous, or deep hazel (but generally much more so in males than in females). *Megarops* is somewhat paler above, approaching café-au-lait, like many *Epomophori*; *Sphærias* nearly greyish hair-brown. *Balionycteris* and *Chironax* are rather darker above than usual, with the head and nape of neck nearly blackish. A well-marked dark brown spinal stripe renders most species of *Nyctimene* easily distinguishable in colour from all other Fruit-bats; the stripe is generally narrow (one-fifteenth to one-eighth of the breadth of the back), sometimes obsolescent, sometimes again (*N. aillo*) very broad (one-third of back); the general colour of the upperside is sometimes irregularly mottled all over with darker tips to the hairs, as a rule, however, paler than usual in Fruit-bats, fawn-brown, fawn-drab, ashy-drab, wood-brown, buffy, or even cream (the palest tinges seen in females of some species).

*MacroGLOSSINE*.—*Eonycteris* is typically Rousettine in colour; *Megaloglossus* and *Notopteris* dark. In *MacroGLOSSUS* and *Syconycteris* the colour of the upperside is lighter, varying from warm russet Prout's brown to almost pure wood-brown. *Melonycteris* is approximately cinnamon above, with small white "epaulettes," nearly seal-brown beneath (an unusual contrast); the related *Nesonycteris* differing only by the pale underparts and the absence of "epaulettes."

### 19. Size.

To show their differences in size the whole series of genera of Megachiroptera are arranged below according to the lengths of the forearm (that this list can be only approximately correct is a matter of course, some of the genera being as yet known only from one or a few specimens). The smallest Fruit-bats are but little larger than the very smallest Microchiroptera, the largest greatly surpass in size any form of Microchiroptera. The "expanse" of a Fruit-bat is roughly about six times the length of the forearm (rather more than less). The extent of *individual* variation is in any Bat usually at least about ten, often twelve per cent., very rarely as much as fifteen to seventeen; *i. e.* if in a sufficiently representative series of individuals, all belonging to one species or subspecies, the forearm of the smallest adult individual measures 50 mm., that of the largest will be about 55–56 or a little more, or if the minimum is 150, the maximum will as a rule not be more than 165, rarely as much as 170.

- 37- 42 mm.:—*Balionycteris*; ? *Chironax*; *Megaloglossus*; *Macroglossus*; *Syconycteris*.
- 43- 49 mm.:—*Nanonycteris*; *ScotoNycteris*; *Chironax*; ? *Sphaerarias*; *Megaloglossus*; *Macroglossus*; *Syconycteris*.
- 50- 59 mm.:—*Plerotes*; *Micropteropus*; *Nanonycteris*; *ScotoNycteris*; ? *CasinNycteris*; *Myonycteris*; *Cynopterus*; *Megarops*; *Penthetor*; *Sphaerarias*; *Nyctimene*; *Melonycteris*; *Nesonycteris*; *Notopteris*.
- 60- 69 mm.:—*Rousettus*; *Epomophorus*; *CasinNycteris*; *Myonycteris*; *Cynopterus*; *Penthetor*; *Nyctimene*; *Eonycteris*; *Melonycteris*; *Notopteris*.
- 70- 79 mm.:—*Rousettus*; *Dobsonia*; *Epomophorus*; *Cynopterus*; *Dyacopterus*; *Thoopterus*; *Nyctimene*; *Eonycteris*.
- 80- 89 mm.:—*Rousettus*; *Pteropus*; *Dobsonia*; *Harpyionycteris*; *Epomops*; *Epomophorus*; *Cynopterus*; *Ptenochirus*; *Nyctimene*; ? *Eonycteris*.
- 90- 99 mm.:—*Rousettus*; *Boneia*; *Pteropus*; *Styloctenium*; *Epomops*; *Epomophorus*; *Cynopterus*.
- 100-109 mm.:—*Pteropus*; *Dobsonia*; *Epomops*.
- 110-119 mm.:—*Eidolon*; *Pteropus*; *Dobsonia*; *Hypsignathus*.  
[*Archæopteropus* would belong here.]
- 120-129 mm.:—*Eidolon*; *Pteropus*; *Dobsonia*; *Hypsignathus*.
- 130-139 mm.:—*Eidolon*; *Pteropus*; *Acerodon*; *Pteralopex*; *Dobsonia*; *Hypsignathus*.
- 140-149 mm.:—*Pteropus*; *Acerodon*; *Pteralopex*; *Dobsonia*.
- 150-159 mm.:—*Pteropus*; *Acerodon*; *Dobsonia*.
- 160-205 mm.:—*Pteropus*; *Acerodon*.
- 206-220 mm.:—*Pteropus*.

## 20. Secondary sexual characters.

In all or nearly all genera (in so far as both sexes are known) the cauvines average at least a little heavier and the zygomatic breadth of the skull at least a little greater in males than in females. In several *Pteropodina* (some species of *Pteropus*; *Pteralopex*; *Penthetor*) and the majority of *Macroglossina* (*Macroglossus*, *Syconycteris*, *Melonycteris*, *Nesonycteris*, *Notopteris*) this seems to be the only tangible secondary sexual differentiation, and even this difference is in some cases so small as to be only appreciable in large series of individuals. As a rule, however, the differentiation of the sexes is somewhat more conspicuous, the secondary sexual characters being referable to the following four categories:—

(1) Males of a few genera average noticeably larger than females (*Epomops*, *Hypsignathus*, and *Epomophorus*; *Eonycteris*).

(2) The general colour of the fur is in a few species conspicuously lighter in females than in males (some species of *Eidolon* and *Nyctimene*); or males average somewhat richer in general colour than females (*Dobsonia viridis*).

(3) A tuft of hair on either side of the neck is in a large number of genera distinctly differentiated in the males, being more rigid, unctuous, and brighter (or deeper or more saturated) in colour than the surrounding fur (development of "neck-tufts"); or the whole of the fur across the foreneck and anterior portion of the chest may be more rigid and more saturated in colour in males than in females (development of a "ruff"), or the hair of the same region of males may differ, if not in rigidity, at least in its richer colour from that of females; or (as is the case in some species of *Pteropus*) there may hardly be any sexual difference in the fur of the foreneck, but that of the nape of the neck (the "mantle") may be distinctly more rigid in males, and in some of these species pale-coloured from tip to base, whereas in females of the same species it is pale-coloured only at the exposed tip, dark-coloured at the concealed base (*Pteropus mariannus* and *conspicillatus* groups). In some genera of the *Epomophorus* section the "neck-tufts" of the males have, so to speak, moved higher up on the sides of the neck, being situated one on each "shoulder," i. e. the region of the sides of the neck immediately in front of the origin of the antebrachial membrane ("shoulder brushes" or "epaulettes," hence the name "*Epomophorus*," epaulette-bearer), at the bottom of a deep, pouch-like depression in the skin ("shoulder pouches), each shoulder brush being usually erectile and retractile at the will of the animal ("when erected the tuft had a vibratory movement," collector's note on the label of a *Micropteropus pusillus*, British Museum).

(4) Relatively rarely (*Epomops*, *Hypsignathus*, *Epomophorus*) males differ from females by the possession of one or several pharyngeal air-sacs, a peculiarity very often, perhaps always, combined with an enlargement of the larynx of the males (the voice of *Epomops* and *Hypsignathus* (both sexes? or males only?) is described as a loud croaking, that of the latter recalling the croaking of the Ethiopian Giant Frog, *Rana occipitalis*). In one of the same genera (*Hypsignathus*) the muzzle and cranial rostrum are much heavier in males, owing to the development in that sex of a subcutaneous air-sac on either side of the muzzle and large cutaneous folds on the extremity of the muzzle (the latter present, but much smaller, also in females).

Reviewed in each of the four natural sections of Megachiroptera the secondary sexual characters are, briefly, these (differences in size of canines and in zygomatic breadth omitted):—

*Rousettus* section.—*Eidolon*: males with richer-coloured neck-tufts (traceable, but smaller and less rich in colour, in females); females, at least in two species (*helvum* and *sabaeum*), conspicuously paler than males. *Rousettus*: males as a rule with neck-tufts, the unctuous hair sometimes forming a "ruff" across the foreneck. *Boneia*: sexual characters unknown (females not on record). *Pteropus*: fur of mantle often (not always) more rigid and unctuous in males, softer and more spreading in females, in a few species

darker at concealed base in females than in males; neck-tufts (not conspicuous, except on spreading the fur) in males of some species. *Acerodon*: essentially as *Pteropus*. *Pteralopex*: no appreciable differentiation. *Styloctenium*: sexual characters imperfectly known. *Dobsonia*: as a rule scarcely any appreciable differentiation, in at least one species (*D. viridis*) males distinctly richer in general colour. *Harpyionycteris*: known from one adult specimen (unsexed).

*Epomophorus* section.—Generally characterized by the unusually high development of secondary sexual differences. *Plerotes*: differentiation unknown (one female). *Epomops*: males with large shoulder pouches and erectile shoulder brushes; males with two pairs of pharyngeal sacs (p. 492); larynx enlarged in males; males averaging considerably larger than females. *Hypsignathus*: no shoulder pouches or shoulder brushes; males with pharyngeal sacs and enlarged larynx, as in *Epomops*, and with a pair of subcutaneous rostral air-sacs; cutaneous folds on extremity of muzzle much larger in males; muzzle and cranial rostrum of males much enlarged and differing in shape from those of females; males averaging much larger. *Epomophorus*: males with large shoulder pouches and erectile shoulder brushes, and with one small central pharyngeal sac; males averaging larger (character much less pronounced in the smaller than in the larger species). *Micropteropus* and *Nanonycteris*: deep shoulder pouches and erectile brushes in males (females often with small pouches, but no brushes); scarcely any appreciable sexual difference in size. *Scotonycteris* and *Casinonycteris*: sexual characters uncertain (adult males unknown).

*Cynopterus* section.—Sexual differentiation, if developed, usually Rousettine in character (though often more pronounced). *Myonycteris*: males with neck-tufts and "ruff" across foreneck (adult females unknown). *Cynopterus* and *Ptenochirus*: males with neck-tufts (small tufts sometimes traceable in females) and often with "ruff." *Megarops* and *Dyacopterus*: males unknown. *Balionycteris*: hair of foreneck brighter in males. *Chironax* and *Thoopterus*: adult males unknown. *Penthetor*: no sexual differentiation. *Spherias*: males not seen. *Nyctimene*: in some species, males with fur of sides of neck, foreneck, chest, and flanks much brighter in colour; in other species, scarcely any sexual differentiation in the colour of the underparts, but females much paler above (cream-buff, cream-white) than males (fawn-brown, ashy-brown, ashy-drab).

*Macroglossinae*.—Secondary sexual differences in most genera undeveloped; if present, essentially Rousettine, though in the case of one genus combined with a conspicuous average difference in size. *Eonycteris*: males with a well-defined "ruff" across the foreneck of generally deeper (more saturated) colour, and averaging noticeably larger. *Megaleglossus*: males with large (whitish) neck-tufts. *Macroglossus*, *Syconycteris*, *Melonycteris*, *Nesonycteris*, and *Notopterus*: no conspicuous sexual differentiation.

## III. INTERRELATIONS OF THE GENERA OF MEGACHIROPTERA.

It has been considered desirable to give here a summary of the mutual affinities and probable phylogeny of the genera, "sections," and subfamilies of living Fruit-bats, omitting as far as possible all discussion of details. For these latter the reader is referred to the paragraph "Affinities" under each genus, in the systematic part of this Catalogue.

*Rousettus* (in its typical form, as represented by the species of the subgenus *Rousettus*) is one of the least specialized genera of living Megachiroptera. The rostrum is moderate in length and in no respect peculiarly modified, the premaxillæ in simple contact with each other in front (not ankylosed together, nor spaced), the lateral margins of the postdental palate forming straight lines converging backward, the postorbital processes are short, the post-orbital foramina present, and the brain-case perfectly unmodified in general shape. On the other hand, that all the most primitive cranial characters found in any living Fruit-bat should be united in the skull of this or any other living genus, is hardly to be expected; it is not difficult, therefore, to point out a few single skull characters in which *Rousettus* stands a little higher than one or another genus of Megachiroptera: as in the large majority of Fruit-bats the infraorbital canal is quite short (considerably longer in *Melonycteris*, *Nesonycteris*, and *Notopterus*), and the ascending branches of the premaxillæ as narrow at their upper extremities as near the alveolar margin (much less narrowed above in the three genera just mentioned); the palate is perhaps rather too broad to be considered quite unmodified in form, the tympanic bones, though typically annular, are rather broader than in most other genera, and the facial portion of the skull is distinctly, though not very strongly, deflected against the basicranial axis (more so than in the majority of Epomophorine and Cynopterine genera; but it should be noticed that the deflection of the facial axis often varies to some extent in undoubtedly closely interrelated genera, and sometimes even in species of one genus: see *antea*, p. xxiii). The dental formula is unmodified Megachiropteran ( $\frac{2}{2} - \frac{2}{2}$  incisors,  $\frac{5}{6}$  cheek-teeth), the teeth in no way peculiar, except in so far as the inner cusp of  $p^3$  and  $p_3$  is completely fused with the outer, and that of  $p_1$  nearly so, characters shared with a large number of other genera. The palate-ridges are arranged in regular and almost equidistant curves over the whole of the palate, some of the posterior ridges always distinctly interrupted in the middle; the tongue papillæ essentially unmodified (there is a faint tendency to a lengthening of the conical papillæ at the extremity of the tongue: compare *Macroglossina*). A short tail is present, the second finger clawed, the wing-membranes inserted on the preaxial side of the foot, the prevailing colours of the fur a dark tinge of hair-brown or brown, the secondary sexual differentiation inconspicuous (males as

a rule with small, often more or less concealed, neck-tufts), and the general size moderate.

The genus has divided into three branches (subgenera), *Rousettus*, *Stenonycteris*, and *Lissonycteris*. The subgenus *Rousettus* (ten species) ranges over the Ethiopian and Oriental regions (extending from the former northward to Egypt, Palestine, and Cyprus) and the whole of the Austro-Malayan subregion, while *Stenonycteris* and *Lissonycteris* are confined to tropical Africa. In *Stenonycteris* (two species) the cheek-teeth are become narrow,  $m_2$  is reduced in size, and the facial axis more strongly deflected than in *Rousettus* s. str. *Lissonycteris* is somewhat more aberrant: the brain-case is peculiarly flattened posteriorly and the facial axis even less deflected than in *Rousettus*, both characters giving the skull, viewed in profile, a rather striking resemblance to that of *Epomops*; the premaxillæ are ankylosed together anteriorly, the postdental palate relatively longer, the cheek-teeth shorter and broader (subsquarish) with the ridges more cusp-like (shorter antero-posteriorly and higher vertically), those of  $p_1$  separated,  $m^1$  and  $p_1$  reduced in size.

*Eidolon* (three species, Ethiopian and Malagasy regions) has originated from a *Rousettus*-like bat.  $p^1$  is not quite so much reduced as in *Rousettus*, but in other respects *Eidolon* is a little more peculiar: the premaxillæ are spaced in front, the postdental palate more expanded laterally, the tympanic bone elongated to form a short bony auditory meatus (a character unique among Bats),  $m_1$  longer (antero-posteriorly) than usual, the sexual differentiation rather more pronounced (males always with neck-tufts, females often conspicuously paler than males), and the general size of the animals larger.

*Boneia* (one species, Celebes) is closely related to *Rousettus*, but more specialized. The lower canines are slanted strongly outward, this necessitating a greater breadth of the palate between the upper canines, this again making the rostrum conspicuously broader in front; perhaps as a further consequence the premaxillæ are spaced anteriorly; but in all other respects the skull is essentially Rousettine in shape.  $i^1$  has disappeared,  $i_2$  is somewhat increased in size, the molariform teeth flatter, the outer and inner cusps of  $p_1$  separated and those of  $p^3$  and  $p_3$  less completely fused than in *Rousettus*. The external characters are practically unmodified.

*Pteropus*, the largest genus of Megachiroptera (eighty-five species, a hundred and three forms) and one of the most widely distributed, has originated from a bat essentially similar to *Rousettus*, but slightly more primitive than the living species of that genus, in so far as it must have had a narrower palate, the tympanic ring thinner, and the cusps of  $p^1$  and  $p_3$  distinctly separated. The dentition is in all typical species of the genus considerably heavier than in *Rousettus*, hence the skull much more heavily built, the crests stronger, the postorbital processes longer,

the coronoid process of the mandible broader and more steeply ascending.  $i_1$  is always distinctly smaller than  $i_2$  (and in some species, chiefly of the *Pteropus lombocensis* group, nearly rudimentary),  $p^1$  usually deciduous,  $m^2$  and  $m_3$  somewhat reduced; the occipital (sublamdoid) portion of the skull is more elongate, sub-tubular. The tail has entirely disappeared, the colours of the fur are much more varied (that of the nape of the neck, the "mantle," generally conspicuously brighter than the back), and the size of the animals often greatly increased, the species varying in size from that of a Fieldfare (or a medium-sized *Rousettus*) to that of a Raven. *Pteropus* is distributed over nearly the whole area inhabited by Megachiroptera, with the important exception of the African continent, a fact all the more remarkable inasmuch as the genus is relatively richly represented in the whole of the Malagasy region and occurring also in the island of Pemba, south of Zanzibar.

The only claim of *Acerodon* (six species, nine forms: western Austro-Malaya and Philippine Islands) to stand as a genus distinct from *Pteropus* is the rather higher specialization of its dentition:  $p^1$  and  $m^1$  (sometimes also  $p^3$  and  $p_3$ ) have developed a well-defined antero-internal tubercle, and the lower molariform teeth ( $p_1$ ,  $m_1$ , and  $m_2$ ) a sharply defined inner basal ledge; more or less distinct approximations to similar modifications are, however, seen in some specialized forms of *Pteropus* (see p. 415).

The principal characters of *Pteralopex* (two species: Solomon Islands) are the excessively heavy dentition, the shortened, sub-squarish form of the upper molariform teeth, the prominent anterior and posterior basal ledges of the same teeth, the bicuspidato outer ridge of the lower molariform teeth, the thick upper canines with a heavy external secondary cusp and small inner basal cusps, and the very large outer and small inner lower incisor. As pointed out in detail elsewhere (p. 436) all these peculiarities represent, in fact, only the last phase of modifications exhibited, more or less in an initial stage, by certain species of the *Pteropus pselaphon* group (*pselaphon*, *pilosus*, *tuberculatus*, and *leucopterus*). That *Pteralopex* has developed from a bat closely related to the living species of that group, or is, in other words, the peculiarly modified Solomon Islands representative of that group, is scarcely open to doubt.

From another branch of *Pteropus* has developed the genus *Styloctenium* (one species: Celebes):  $i_1$  and  $m_3$  have disappeared, and the colour of the fur is pale with dark bases to the hairs and sharply defined head markings,—all characters so distinctly foreshadowed in, or closely approached by, the living species of the *Pteropus temmincki* and *lombocensis* groups as to indicate, almost with certainty, the origin of *Styloctenium* from a form closely allied to the living species of those groups of *Pteropus* (for a discussion of details, see p. 444).

At some, probably not very remote, period of the growth of the Rousetto-Pteropine main branch of Megachiroptera a bat must



have existed which, though essentially similar to a *Pteropus* in the general appearance of the skull (palate narrower than in *Rousettus*, occiput rather more "subtubular" than in *Rousettus* but less so than in *Pteropus*, tympanic ring thin) and with the whole series of cheek-teeth unmodified Rousettine or Pteropine in number ( $\frac{5}{6}-\frac{5}{6}$ ) and structure, differed in the following important dental characters: the upper canines were slightly proclivous, the lower canines situated close together at the extremity of the mandible, the inner pair of incisors above and below ( $i^1$  and  $i_1$ ) had disappeared, the single pair of lower incisors ( $i_2$ ) was quite small, the single pair of upper incisors ( $i^2$ ) somewhat modified in shape (crown obliquely triangular or obliquely bilobed, owing to it being acted upon not by  $i_2$ , which was wedged in between the closely approximated lower canines and much too small to reach  $i^2$ , but by the tip of the lower canines), and, as consequences of these modifications of the front teeth, the premaxillæ were considerably reduced in breadth (sublinear); externally this bat must have been very like a *Rousettus*: tail present (at least about the length of the foot), second finger clawed, wings from sides of back and inserted posteriorly on first or second toe, colour of fur some dark tinge of brown or hair-brown, size probably as a small *Rousettus*, if not smaller still. From this bat have developed in one direction *Dobsonia* (Austro-Malaya), in another *Harpyionycteris* (Philippine Islands).

In *Dobsonia* (twelve species, thirteen forms) the following further modifications have taken place: the small  $p^1$  (which is sometimes deciduous in *Rousettus*, and usually so in *Pteropus*) has entirely disappeared (cheek-teeth  $\frac{4}{6}$ ), the wings arise from the spinal line of the back, which is therefore completely covered by the naked membranes, and the claw of the second finger has been lost. In the most primitive species of the genus (*D. minor*, New Guinea) the molar structure is typically Rousettine, but in all other species it is more or less complicated, by the development of posterior basal ledges, antero-internal basal ledges, median surface ridges, or by a tendency of the outer and inner ridges to break up into two or more cusps (for details see pp. 450-452 and fig. 25).

In its development from the above-described supposed prototype *Harpyionycteris* (one species) has been modified as follows: the upper and lower canines and upper incisor are strongly proclivous (upper and lower canines crossing each other at nearly right angles), the premaxillæ solidly fused anteriorly with each other and laterally with the maxillæ, an outer secondary cusp has developed in the upper and lower canines, and a small inner cusp in the lower canines (which therefore are tricuspidate), the number of cheek-teeth is unchanged ( $\frac{5}{6}$ :  $p^1$  present), but the tendency in this branch of Fruit-bats (see *Dobsonia*, above) toward a development of posterior and anterior basal ledges and of surface cusps and to a splitting of the outer and inner ridges into two or more

cusps has been carried to an extreme, so as to render the molari-form teeth multicuspidate (for a discussion of the homologies of the cusps see pp. 801-803 and fig. 79). Externally, the only noteworthy modification is the loss of the tail (wing-membranes normal, claw of second finger present).

The nine genera reviewed above constitute what may be termed the **Rousettine section** of Megachiroptera, in contradistinction to the Epomophorine, Cynopterine, and Macroglossine sections.

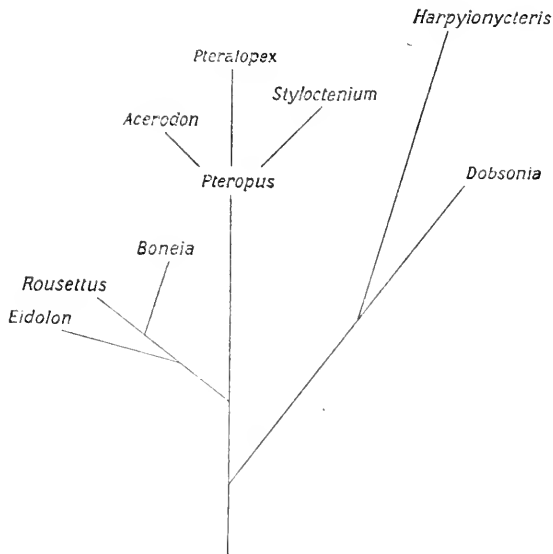


FIG. II.—Interrelations of the genera of the *Rousettus* section.

It has divided into three branches (subsections); the **Rousettine branch** (*Rousettus*, *Eidolon*, *Boneia*), characterized by the simple, unmodified cranial characters (rostrum never shortened, premaxillæ not sublinear, occiput not elongated, &c.), by the full Megachiropteran dental formula (except for the loss of  $i^1$  in *Boneia*, and the occasional deciduousness of  $p^1$ ), the simple form of the premolars and molars, and externally by the presence of a tail and by having nearly always the third metacarpal slightly but distinctly longer than the fourth and fifth; the **Pteropine branch** (*Pteropus*, *Acerodon*, *Pteralopex*, *Styloctenium*): cranial characters Rousettine, except for the more "subtubular" occiput and relatively narrower

palate, dental formula unmodified (except for the loss of  $i_1$  and  $m_3$  in *Styloctenium*), molar structure sometimes simple, but more often showing some, though rarely (*Pteralopex*) a high, degree of specialization, tail absent, and fifth metacarpal nearly always slightly but distinctly longer than third and fourth; and the **Dobsonian branch** (*Dobsonia*, *Harpyionycteris*): rostrum at least somewhat shortened, premaxillæ reduced in breadth, lower canines situated close together at the extremity of the mandible,  $i^1$  and  $i_1$  lost, molariform teeth with a pronounced tendency to a high degree of specialization, tail present or absent, of the three long metacarpals the third nearly always distinctly the longest, the fourth the shortest, the fifth intermediate. The Rousettine branch (eighteen species) has spread over the whole area inhabited by Megachiroptera, except Polynesia; the Pteropine branch (ninety-four species, a hundred and fifteen forms) covers the whole of the same area, including Polynesia, but excluding the continent of Africa and the Eastern Mediterranean countries; while the Dobsonian branch (thirteen species, fourteen forms) is confined to Austro-Malaya and the Philippines.

The probable mutual affinities of the genera of the Rousettine section are expressed in the diagram (fig. II.) on the foregoing page.

The Epomophorine genus **Plerotes** (one species: Ethiopian) probably originated from a primitive *Rousettus*-like type. Except for the loss of  $m^2$  its dental formula is typically Megachiropteran (in all other Epomophorine bats not only  $m^2$ , but also  $p^1$  and  $m_3$  are lost, and, as shown in fig. 28, p. 484, even in *Plerotes* these two teeth are so small as to be nearly functionless), and its remarkably simple palate-ridges are easily derived from those of *Rousettus* or rather from a form in this respect somewhat more primitive than the living representatives of that genus (see fig. 29, p. 485). But in other respects *Plerotes* is highly specialized: the palate is unusually broad, the cheek-teeth greatly reduced in breadth (almost Macroglossine), the molars and last premolar flattened, with scarcely a trace of the usual cusp-like elevations, the lower canines slanted outward, and the tail and calcar absent or rudimentary.

Somewhat similar lines of development have been followed by the related genus **Epomops** (three species, four forms: Ethiopian). Like many, if not all, other Epomophori it subsists chiefly on soft juicy fruits, the contents of which it draws out rather by suction than by mastication, and its lips, pharynx, larynx, cranial rostrum, dentition, and palate-ridges have been modified accordingly. The lips are full, pendulous, and highly expansible; the pharynx long, wide, and greatly extensible, communicating with the oral cavity by a very restricted aperture, the larynx spacious, with ossified walls, and supported behind by the expanded hyoids, acting as an "exhauster" during the suction; the bony palate is broad (though not broadened to the same extent as in *Plerotes*), the interdental palate-ridges thick and prominent (fig. 31, p. 489), the canines and

$p^3$  and  $p_3$  thin and sharply pointed, adapted to piercing the rind of the fruit and keeping it in position, while it is squeezed between the jaws and pressed upward against the interdental palate-ridges; the other cheek-teeth are relatively feeble,  $p^1$ ,  $m^2$ , and  $m_3$  have disappeared;  $i^2$  is often deciduous.

**Hypsignathus** (one species: Ethiopian) is undoubtedly derived from a form very similar to *Epomops*, but probably with the postdental palate narrower. The rostrum is greatly enlarged, particularly in depth (and much more so in males than in females), the lower canines slanted more outward,  $p_1$  more reduced, the ridges of the molariform teeth higher and their cusps more narrowly pointed, the outer ridges of some of the lower teeth more or less distinctly bi- or tricuspidate, the premaxillæ ankylosed together in front, the muzzle thick and truncate ("Hammerheaded Bats"), the upper lip with prominent integumentary folds, the palate-ridges (fig. 34, p. 504) with relatively slight modifications similar to those of *Epomops*.

The origin of *Nanonycteris*, *Scotonycteris*, and *Casinonycteris* (all monotypic and Ethiopian) is perhaps not quite clear; that they are rather closely allied to each other there cannot be much doubt, and the probability is that this small branch is an offshoot from a type related to, but less specialized than, *Pterotes* and *Epomops*. In all three genera the rostrum is considerably shortened, in *Scotonycteris* and *Casinonycteris* almost to the same degree as in *Cynopterus*, and the dental formula is in all the same as in *Epomops* (cheek-teeth  $\frac{3}{5}$ :  $p^1$ ,  $m^2$ , and  $m_3$  lost). They differ from each other chiefly in the form of the bony palate. In *Nanonycteris* the postzygomatic palate is unusually short and broad (fig. 40, p. 566), in *Scotonycteris* of normal length, with the lateral margins converging backward in straight lines (fig. 42, p. 564), while *Casinonycteris* exhibits the unique peculiarity of having no postdental palate, the mesopterygoid fossa extending forward very nearly to the level of the last molar (fig. 43, p. 569). The palate-ridges, though specially modified in each genus (see pp. 561, 565, 571), are without difficulty derived from an *Epomops*-like pattern.

Like *Epomops*, **Epomophorus** (eight species, nine forms: Ethiopian) feeds chiefly on soft fruits, but in having adapted themselves to this diet the two genera have followed to a certain extent different lines of development. In *Epomops* the rostrum and palate are broadened, in *Epomophorus* long and narrow; in *Epomops* the postdental palate is broad and flat, *i. e.* essentially Rousettine in shape, in *Epomophorus* it is more or less deeply depressed posteriorly, with prominent palation rim; in typical *Epomops* the anterior interdental palate-ridges are thick and prominent, the postdental ridges simple (figs. 31 A, B, p. 489), in *Epomophorus* the postdental are practically similar to the interdental ridges, all being thick and prominent (fig. 37, p. 516). The dental formula and the characters of the teeth are the same in both genera.

**Micropteropus** (one species: Ethiopian) has probably originated from a type related to, but more primitive than, the living species of *Epomophorus* (without the lengthening and narrowing of the rostrum characteristic of these). As in *Epomophorus* the post-dental palate is distinctly depressed posteriorly, with raised palation rim; the palate-ridges are thick and prominent, but separated by a deep and broad groove along the median line of the palate (fig. 39, p. 556); the dental formula as in the majority of *Epomophori* ( $p^1$ ,  $m^2$ , and  $m_3$  lost); but the rostrum is as short and heavy as in *Cynopterus*, the interdental palate broad posteriorly, and the post-dental palate abruptly narrowed behind the anterior root of the zygomatic arches (fig. 38, p. 555).

The eight genera reviewed above (*Plerotes*, *Epomops*, *Hypsignathus*, *Nanonycteris*, *Scotonycteris*, *Casinonycteris*, *Epomophorus*, and *Micropteropus*) constitute the **Epomophorine section** of Fruit-bats. The principal differential characters, as compared with the Rousettine section, may be briefly summed up as follows:—Dentition on the whole weak,  $p^1$ ,  $m^2$ , and  $m_3$  lost in all genera except *Plerotes*, which has retained  $p^1$  and  $m_3$  in a rudimentary condition; molar structure perfectly simple, except for the nearly total degeneration of all surface structure in *Plerotes* and the splitting of some of the ridges in *Hypsignathus*; number of incisors unmodified in all genera ( $\frac{2}{2}-\frac{2}{2}$ ), except for the deciduousness of  $i^2$  in *Epomops*; facial axis only very little deflected against the basiscranial axis (except in *Plerotes*); brain-case distinctly flattened posteriorly (the same peculiarity is, however, seen in one type of the Rousettine section, *Lissonycteris*); form of postdental palate highly variable (in the whole series of Megachiroptera this is the only section that shows any great variation in this portion of the skull); palate-ridges simple only in *Plerotes*, in all other genera more or less highly specialized (the only section of Megachiroptera showing any great modification of the surface structure of the soft palate, in fact the only one in which every genus may be identified with certainty only by an examination of the palate-ridges); tail either reduced to an inconspicuous rudiment, more easily detectable by the touch than by the eye, and not connected with the intertemoral, or absent; small tufts of white hair present at anterior and posterior bases of the ear-conch in all genera, except *Scotonycteris*; secondary sexual characters often unusually highly developed: males with shoulder pouches and erectile light-coloured shoulder tufts ("epaulettes"; exception: *Hypsignathus*), sometimes with pharyngeal sacs (*Epomops*, *Hypsignathus*, *Epomophorus*), and not infrequently averaging considerably larger than females (*Epomops*, *Hypsignathus*, several species of *Epomophorus*). The range of the section is strictly confined to the Ethiopian region. Only *Epomophorus* is distributed over nearly the whole of this region; the other seven genera are inhabitants of the "West African Province" (approximately synonymous with the Great West African Forest Tract), from the Guinea Coast east

to, or in the case of one or a few species a little beyond, Victoria Nyanza, south to Angola, Benguela, and Damaraland.

The genera of this section fall into three natural groups (branches, subsections):—(1) The **Epomops branch**, the genera *Plerotes*, *Epomops*, and *Hypsignathus* (five species, six forms): rostrum long, palate broad, postdental palate simple, at least some of the postdental palate-ridges unmodified (except in *Epomops dobsoni*); (2) the **Nanonycteris branch**, including *Nanonycteris*, *Scotonycteris*, and *Casinonycteris* (three species): rostrum much shortened, postdental palate highly variable, though never as in the third branch, at least some of the postdental palate-ridges unmodified; (3) the **Epomophorus branch**, the genera *Epomophorus* and *Micropteropus* (nine species, ten forms): postdental palate depressed posteriorly, rostrum varying in length, all palate-ridges modified.

The probable mutual affinities of the genera of the Epomophorine section are expressed in the subjoined diagram (fig. III.).

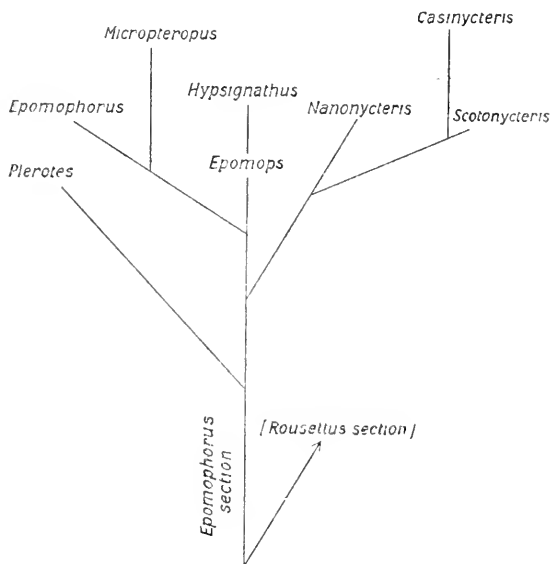


FIG. III.—Interrelations of the genera of the *Epomophorus* section.

**Myonycteris** (four species: West African Province) has in many respects remained on the Rousettine level of development, while in others it exhibits modifications approaching to those of *Cynopterus*. The general external appearance, the dental formula, and the palate-

ridges are quite or nearly as in *Roussettus*, but the rostrum is conspicuously shortened, the facial axis less deflected,  $m_3$  and  $m^2$  (last lower and upper molar) reduced almost to rudiments, the orbits larger, the nostrils more prominent, and the calcar weaker. One species, inhabiting the island of San Thomé, Gulf of Guinea, is a little peculiar in some details of its dentition and ought to stand as a distinct subgenus (*Phyggetis*, p. 579, fig. 47).

**Cynopterus** (six species, sixteen forms: Oriental region, east to Celebes and Timor) is further modified: the rostrum is still more shortened, the facial axis more nearly horizontal,  $m_3$  and  $m^2$  have disappeared, more or less distinct surface cusps are often developed in  $p_4$  and  $m_1$  (see p. 589 and fig. 49), the upper and lower canines have developed a small supplementary cusp on the inner edge, the papillæ on the inner side of the lips are increased both in number and size, the palate-ridges more crowded, thicker, and more sharply projecting, the nostrils more prominent, the tail a little more reduced, the colours of the fur more inclining toward the brighter tinges of brown, and the neck-tufts of the males more conspicuously differentiated.

**Ptenochirus** (one species: Philippine Islands) is an only slightly modified offshoot from the *Cynopterus* type (showing particularly close affinities to the "*Niadius*" group of that genus, a small group of species inhabiting the Malay Peninsula, Sumatra, Nias, and Java, and characterized by the rather broader, more sub-squarish cheek-teeth and rather more sharply developed surface cusps in  $p_1$  and  $m_1$ ):  $i_1$  has disappeared (the tooth is in *Cynopterus* smaller in bulk than  $i_2$ ),  $i^2$  is considerably shortened (in *Cynopterus* already slightly so), and there is a distinct vertical groove on the antero-medial surface of the upper canines (scarcely traceable in *Cynopterus*).

**Megærops** (one species: Malay Peninsula, Sumatra, Borneo) is derived from a bat very similar to *Cynopterus* but without secondary cusps in the canines and without surface cusps in the lower cheek-teeth;  $i_1$  is lost,  $i^2$  shortened, some of the lower cheek-teeth ( $p_4$ ,  $m_1$ ) are become broader, more subsquarish in outline, the rostrum is much deeper in front, the nostrils rather more prominent (subtubular), and the external tail has disappeared.

Also **Dyacopterus** (one species: Borneo) has originated from a primitive "*Cynopterus*," without secondary cusps to the canines; the cheek-teeth above and, particularly, below are shorter and broader,  $m^1$  and  $m_1$  somewhat reduced,  $p_4$  and  $m_1$  have developed a conspicuous rounded surface tubercle,  $p^1$  is absent (or deciduous), the premaxillæ solidly ankylosed together in front, the postdental palate shorter, the postorbital foramina (piercing bases of post-orbital processes) quite small, the membranes inserted on second (instead of first) toe, and the fur of the body unusually short and closely adpressed.

In *Myonycteris*  $m_3$  and  $m^2$  are present, though reduced; **Balionycteris** (one species: Borneo) has lost  $m_3$ , but retained  $m^2$  in a

rudimentary state; in all other Cynopterine genera both  $m_3$  and  $m^2$  are lost. In the mere dental formula, therefore, *Balionycteris* has remained on a slightly more primitive stage than all other Cynopterine bats, except *Myonycteris*, but in other respects it is peculiarly specialized:  $i_1$  is lost,  $i^2$  shortened,  $m^1$  and  $m_1$  somewhat reduced, some of the lower teeth ( $p_1$  and  $m_1$ ) subsquarish,  $p^3$  has developed an antero-external basal lobe, the postorbital foramina have disappeared, the tail is absent, the wings longer than usual and marked with sharply defined yellowish spots, and the general size of the animal is unusually small.

**Chironax** (one species) is the Javan representative of the Bornean *Balionycteris*. The two genera are strikingly alike in nearly all characters of the skull, in the general aspect of the dentition, as well as in external appearance, while at the same time some of the peculiar characters of *Chironax* are too important to allow it to be included in *Balionycteris*:—*Balionycteris* has retained a small  $m^2$ , in *Chironax* this tooth is lost; in *Balionycteris*  $i_1$  is lost and  $i^2$  shortened, in *Chironax*  $i_1$  is present and  $i^2$  normal in length; *Balionycteris* has developed an antero-external lobe in  $p^3$ , in *Chironax* the lobe is represented by a well-defined cusp; in *Balionycteris* the premaxillæ are in simple contact anteriorly, in *Chironax* ankylosed together; and the wing-membranes of *Chironax* are probably unspotted. From this it is not difficult to suggest the characters of the common ancestor of these two genera; it must have been a bat very similar to *Chironax*, but with a small  $m^2$  and the premaxillæ in simple contact; in Java it developed into *Chironax* ( $m^2$  lost, premaxillæ solidly fused), in Borneo into *Balionycteris* ( $m^2$  retained,  $i_1$  lost,  $i^2$  shortened, the antero-external cusp of  $p^3$  enlarged into a lobe, wings spotted).

The two closely interrelated monotypic genera *Thoopterus* and *Penthetor* may be presumed to have originated from a bat similar to *Cynopterus*, with the same number ( $\frac{2}{2}-\frac{2}{2}$ ) of incisors, the same number of cheek-teeth ( $\frac{4}{5}$ :  $m_3$  and  $m^2$  lost), the same length of the tail, and the wing-membranes inserted on the first toe; but the molariform teeth, particularly  $p_4$  and  $m_1$ , have been unusually broad, quadrate in outline, and their inner ridge very low, the upper canines grooved, both upper and lower canines without secondary cusps, there was no trace of surface cusps in any cheek-tooth, and the postorbital foramina had disappeared. This form developed in Western Austro-Malaya into **Thoopterus**: incisors unmodified,  $p_4$  and  $m_1$  with large surface cusps, tail rudimentary, wings from second toe; and in Indo-Malaya into **Penthetor**:  $i_1$  suppressed,  $i^2$  shortened, no surface cusps in any cheek-tooth, tail of normal length, wings from first toe.

**Sphærias** (one species: Burma) is probably derived from a primitive "*Cynopterus*," i. e. a bat with the dental formula and other characters essentially as in *Cynopterus*, but without secondary cusps in the canines and without surface cusps in the lower cheek-teeth: but it is in certain respects more aberrant than any of the



foregoing Cynopterine genera. The premaxillæ are proclivous, the incisors likewise and their crowns peculiarly differentiated (triangularly pointed), the rostrum is rather less shortened than usual in Cynopterine bats and very thin and low anteriorly, the facial axis more distinctly deflected than usual in Cynopteri, the canines (particularly those in the lower jaw) slanted outward, and the cheek-teeth considerably reduced in breadth; the odontoid papillæ on the inner side of the lips are few and small (as in the *Rousettine* section), the tail is suppressed, the interfemoral extends only to the middle of the tibia, and the calcar, therefore, has disappeared.

The prototype of the highly peculiar genus *Nyctimene* (thirteen species: Austro-Malaya and Australia) was probably similar to *Cynopterus* in all the essential characters of the skull, dentition, palate-ridges, and lip papillæ, but without the secondarily acquired dental characters of the living species of *Cynopterus* (no inner cingulum cusp in the canines, no surface cusps in the cheek-teeth), and with the tail less reduced in length, even a little longer (though very likely not with a greater number of vertebræ) than in *Rousettus*. Developing into *Nyctimene* this ancestral form was modified as follows:—The lower canines moved forward close together to the extremity of the mandible, and probably as a consequence of this all lower incisors disappeared (compare *Dobsonia* and *Harpyionycteris*, both with the lower canines in a similar position, with  $i_2$  lost and  $i_1$  present only in a quite rudimentary state and occasionally deciduous); also  $i^2$  disappeared (compare the very conspicuous shortening of this tooth in several Cynopterine genera), so that  $i^1$  became the only remaining pair of incisors above and below; the nostrils were elongated into cylindrical tubes and the extremity of the rostrum modified to act as a support of these tubes: the rostrum became unusually high (truncate) anteriorly, the premaxillæ deep, but short (not reaching nasals), and firmly ankylosed together in front, and the extremity of the nasals was produced forward and downward in the middle; probably as a further consequence of the extraordinary development of the anterior nares, the posterior narial passage and mesopterygoid fossa became broader and deeper than usual (hence the slightly “pandurate” outline of the postdental palate). The wings are spotted with yellow (as in *Balionycteris*). The posterior circumvallate papilla is divided into two (fig. 65 A, p. 725), and the cardiac portion of the stomach indistinctly differentiated (compare the alleged insectivorous habits of the genus). (For a more detailed discussion of the characters and affinities of this genus see pp. 691–694.)

The eleven foregoing genera constitute what may be called the **Cynopterine section** of Fruit-bats (thirty-one species, forty-one forms). The principal characters that link these genera together as a natural group are these:—(1) the rostrum is always conspicuously shortened, in all genera (except *Myonycteris* and *Spharicus*) so much so that the distance from the orbit to the extremity of the nasals is

considerably less than the breadth of the rostrum across the lachrymal foramina; parallels or close approximations are found only in certain genera of the Epomophorine section (*Nanonycteris* branch and *Micropteropus*) and in some species of *Dobsonia*: (2) the facial axis of the skull is in all genera (except *Myonycteris* and *Sphaerias*) only very slightly deflected; a similar inconspicuous deflection of the face is seen in the majority of Epomophori, whereas in the Rousettine and Macroglossine sections the face is always somewhat, and often much, more deflected: (3) in *Myonycteris* the last molar below and above ( $m_3$  and  $m^2$ ) are reduced almost to rudiments, in *Balionycteris*  $m_3$  is lost, in all other genera both  $m_3$  and  $m^2$ , reducing the cheek-tooth formula from the typical Megachiropteran  $\frac{5}{6}$  to  $\frac{4}{5}$ , a formula very rarely found outside this section of Fruit-bats (it occurs in one species of *Syconycteris*, and in *Notopteris*, but in the latter case owing not to the loss of  $m_3$  and  $m^2$  but of  $p^1$  and  $p_1$ ): (4) only *Myonycteris* has preserved the Rousettine aspect of the soft palate, in all other genera (in so far as the palate-ridges are known) the surface structure of the soft palate is remarkably uniform, the ridges being prominent and crowded; an exactly similar aspect of the palate is not found outside this section: (5) in all genera (except *Myonycteris* and *Sphaerias*) the odontoid papillæ on the inner side of the lips are more numerous, larger, and more crowded than in any other section.

There is a marked tendency in this section to—(1) a suppression of the inner pair of lower incisors ( $i_1$ , which if present is always distinctly smaller than  $i_2$ ) combined with a reduction of the outer pair of upper incisors ( $i^2$ ); the incisor formula  $\frac{i^2 \ i^1 \ i^1 \ i^2}{i_2 \ - \ - \ i_2}$  occurs in

a few other genera (*Styloctenium*, *Nesonycteris*, *Notopteris*), but generally without a conspicuous reduction of  $i^2$ : (2) a development of surface cusps in  $p_1$  and  $m_1$  (*Cynopterus*, *Ptenochirus*, and *Dyacopterus*, but not in the related *Megerops*; in *Thoopterus*, but not in the related *Penthetor*); a similar tendency is shown only by *Dobsonia* and *Harpyionycteris*: (3) to a disappearance of the post-orbital foramen (present and well developed in *Myonycteris*, *Cynopterus*, *Ptenochirus*, and *Megerops*; rudimentary in *Dyacopterus*; absent in *Balionycteris*, *Chironax*, *Thoopterus*, *Penthetor*, *Sphaerias*, and usually in *Nyctimene*); the foramina are present and well-developed in all other Megachiroptera without exception: (4) to a shortening or complete suppression of the tail.

Except for *Myonycteris*, which is Ethiopian (West African), the section is confined to the Oriental region and Austro-Malaya, one genus (*Nyctimene*) extending from the latter subregion to Australia.

The question whether this section, so far as our present knowledge of the genera goes, is perfectly homogeneous, *i. e.* includes only genera which are more closely related to each other than to any genus outside the group, must, in the opinion of the writer, be answered in the affirmative, but it is quite possible that some systematists would be inclined to consider the status of *Myonycteris*

a little doubtful. The fact is that this genus has retained many characters of *Roussettus*, while in practically all the features in which it differs from *Roussettus* it more or less closely approaches to *Cynopterus*. Whether a genus exhibiting characters of this description ought, in a linear arrangement, to be classed at or near the end of the Roussettine section or as the "opening" genus of the Cynopterine section, must necessarily remain a matter of opinion.

With regard to the principles for the arrangement of the genera, only a few remarks are required. Putting for a moment *Myonycteris* and *Nyctimene* at one side, it would be easy to divide all the remaining nine genera of this section into two groups according to the number of incisors ( $\frac{2}{2}-\frac{2}{2}$  or  $\frac{2}{1}-\frac{2}{1}$ ); but, as pointed out elsewhere (p. 649, footnote), an arrangement based primarily on

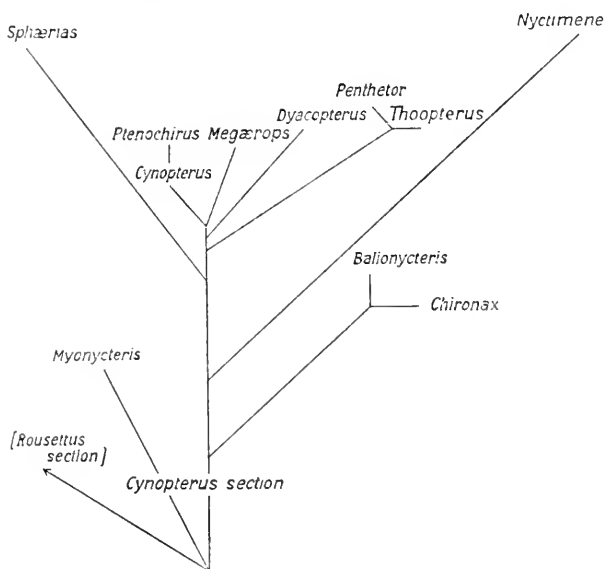


FIG. IV.—Interrelations of the genera of the *Cynopterus* section.

this character would be thoroughly artificial; it would separate *Ptenochirus* and *Megærops* from their closest relative, *Cynopterus*; *Balionycteris* from its Javan representative, *Chironax*; and *Penthetor* from its eastern representative, *Thoopterus*; there is no doubt that the loss of  $i_1$  is a character developed independently in different branches of the section. The diagram above (fig. IV.) is based, therefore, on the following considerations:—*Myonycteris*

may at once be separated, owing to its less shortened rostrum and the presence of  $m_1$  and  $m^2$ ; next the two closely interrelated genera *Balionycteris* and *Chironax*, the former of which has preserved  $m^2$ ; as a third branch *Nyctimene*, and as a fourth *Spherias*, on account of their peculiar specializations in different directions: the remaining six genera may be divided into two groups, those with (*Cynopterus*, *Ptenochirus*, *Megarops*, *Dyacopterus*) and those without postorbital foramina (*Thoopterus*, *Penthetor*), *Dyacopterus* being in this respect intermediate (foramina present but minute).

All the genera reviewed above, the Rousettine, Epomophorine, and Cynopterine sections, form together a Subfamily of Megachiroptera, the **Pteropodinae**. The characters of this subfamily, in contradistinction to the second primary subdivision of Megachiroptera, the subfamily **Macroglossinae**, have been fully discussed in the systematic part of this Catalogue (pp. 723-728, fig. 65), and it is sufficient here to emphasize the fact that the only real difference between the two subfamilies lies in the greater specialization of the tongue and the tongue papillae in the *Macroglossinae* (adaptation to a diet consisting, at least partly, of pollen).

**Eonycteris** (three species: Indo-China, Indo-Malaya, Celebes) is on the whole the least specialized genus of *Macroglossinae*. In the general characters of the skull, dentition, and palate-ridges, as well as in external appearance (except for the loss of the claw of the index), it is remarkably like *Rousettus*, but the cheek-teeth are narrower than in typical *Rousettus*,  $m_3$  and  $m^2$  somewhat reduced ( $m_3$  absent in one species), the tongue is, of course, typically Macroglossine, there is scarcely any trace of odontoid papillae on the inner side of the lips, and the difference in length between the third (longest) and fifth metacarpals is greater than in *Rousettus*.

**Megaloglossus** (one species: Ethiopian) is undoubtedly derived from an *Eonycteris*-like type, but is considerably more advanced in specialization. The molars are become low and linear, but  $p^3$ ,  $p^4$ , and  $p_3$  are practically unreduced in height (fig. 71 B, p. 749), the rostrum longer and slenderer, the premaxillae proclivous and ankylosed together in front, the extremity of the mandible elongated, the tongue somewhat lengthened, and the tail rudimentary (in some individuals hardly traceable externally).

**Macroglossus** (two species, six forms: Indo-China, Indo-Malaya, Austro-Malaya) is the eastern representative of the Ethiopian *Megaloglossus*. It has evidently originated from a type essentially similar to *Megaloglossus*, but with  $p^1$ ,  $m_3$ , and  $m^2$  less reduced in size; and it has carried the specialization considerably farther than *Megaloglossus*. All cheek-teeth ( $p^3$ ,  $p^4$ , and  $p_3$  not excepted) are become low and linear (fig. 71 C, p. 749), the premaxillae are even more proclivous, the mandible even more lengthened anteriorly, the mandibular symphysis longer, the facial axis much more strongly deflected, the third metacarpal shortened and

the fifth lengthened (so as to make the third, fourth, and fifth metacarpals equal in length), and the caudal vertebræ further reduced in number.

**Syconycteris** (three species, seven forms: Austro-Malaya and Australia) is closely related to *Macroglossus*, but all upper and the outer lower incisors are conspicuously enlarged and proclivous, the posterior molar above and below reduced (absent in one species), the interfemoral unusually narrow, and the calcar rudimentary.

In the foregoing four genera of *Macroglossinae*, which may be called the **Eonycterine section**, as well as in all *Pteropodinae*, the infraorbital canal is short (the outer wall a narrow bridge of bone and its anterior aperture, the infraorbital foramen, situated vertically below or closely in front of the orbit), and the premaxillæ are not or only very little broader above (at nasals) than below (near alveolar border). In the remaining three genera of *Macroglossinae*, the **Notopterine section** (*Melonycteris*, *Nesonycteris*, and *Notopteris*), the infraorbital canal is much less reduced, the infraorbital foramen therefore situated a considerable distance in front of the orbit, and the premaxillæ are less narrowed in their upper halves, being about thrice or twice as broad above as below; and the species of one of these genera (*Notopteris*) are the only living Fruit-bats in which the tail has remained long. Externally these two primary sections of *Macroglossinae* may easily be distinguished by an examination of the wings: in the Eonycterine section either the third metacarpal is distinctly longer than the fourth and fifth or these three metacarpals are subequal in length, and the terminal phalanx of the third finger is always conspicuously shorter than the third metacarpal; in the Notopterine section the fifth metacarpal is the longest, and the terminal phalanx of the third finger subequal to or even longer than the third metacarpal.

In point of dentition **Melonycteris** (one species: New Guinea and Bismarck Archipelago) is the least modified genus of the Notopterine section. The dental formula is typically Megachiropteran (incisors  $\frac{2}{2}-\frac{2}{2}$ , cheek-teeth  $\frac{5}{6}$ ), all the cheek-teeth are much reduced in size and sublinear in form. The external characters are not peculiar, except in so far as the tail has disappeared (and the ventral surface of the body is much darker in colour than the dorsal).

**Nesonycteris** (one species: Solomon Islands) is the slightly modified eastern representative of *Melonycteris*:  $i_1$  is suppressed and the claw of the second finger is lost (the ventral surface of the body, as usual in Megachiroptera, paler than the dorsal).

In having retained a long tail, much longer than in any other Fruit-bat, **Notopteris** (two species: Western Polynesia) is more primitive than *Melonycteris* and *Nesonycteris*, in other respects it has to a certain point followed similar lines of development, but is considerably more highly specialized.  $p^1$  and  $p_1$  are lost (the latter

tooth is in the two related genera quite small, the former rudimentary and almost functionless),  $p_3$  is enlarged and moved forward closely behind the canines,  $i_1$  is lost (as in *Nesonycteris*), and  $i^1$  is deciduous; the extremity (premaxillary portion) of the rostrum is elongated, the corresponding portion of the lower jaw peculiarly broadened, and the premaxillæ solidly united in front; the claw of the second finger has disappeared (as in *Nesonycteris*) and even the claw phalanx is reduced in size, and the wings arise from the spinal line of the back, which is therefore covered by the naked membranes.

The *Macroglossinæ* (seven genera, with twelve species or twenty forms) are essentially Austro- and Indo-Malayan in distribution: one genus (*Macroglossus*) extends westward into the Indo-Chinese subregion, another (*Notopterus*) is peculiar to Western Polynesia, a third (*Syconycteris*) extends southward to Australia; and one genus (*Megaloglossus*) is confined to West Africa. The subjoined diagram (fig. V.) illustrates the probable interrelations of the genera.

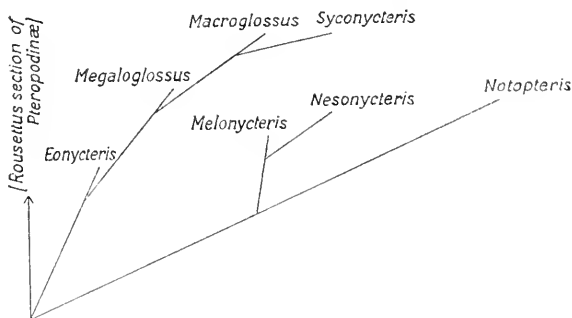


FIG. V.—Interrelations of the genera of the subfamily *Macroglossinæ*.

As pointed out above, this subfamily falls into two natural sections, the Eonycterine and Notopterine. The less shortened infra-orbital canal and broad upper extremities of the premaxillæ in all Notopterine genera, and the presence of a long tail in one genus of the same section, all primitive characters lost in all other Fruit-bats, are evidence that the *Macroglossinæ* as a whole, in spite of the often very high specialization in other directions of the living genera, are of slightly lower origin than the *Pteropodinae* (see fig. VI., next page).

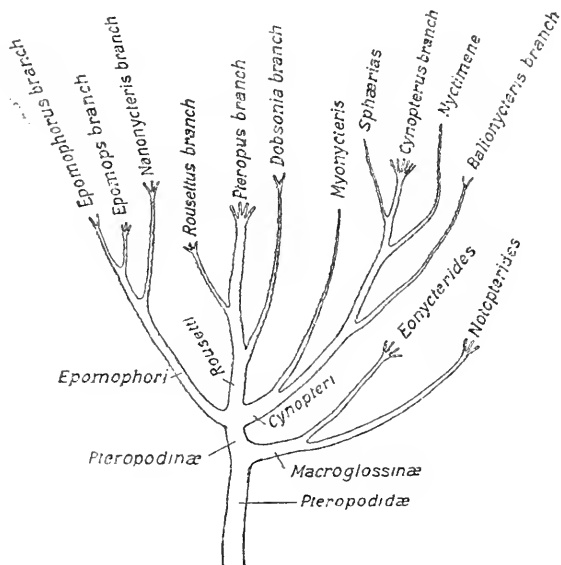


FIG. VI.—General view of the interrelations of the subfamilies, sections, and subsections of living Megachiroptera.

#### IV. GEOGRAPHICAL DISTRIBUTION OF MEGACHIROPTERA.

##### 1. *Distribution of genera.*

In the table below the ciphers in the left-hand column, after each genus, if single indicate the total number of species in the genus, if double the first is the number of species, the second the number of recognizable forms. In the other columns is given the number of species of each genus known to occur in each zoogeographical region or subregion (as defined by Wallace), and if the number of "forms" is different from that of species it is added between parentheses. (If the ciphers in one horizontal row are added together, the total sum will not infrequently be found to be greater than the number of species or forms given for the genus; the reason is, of course, that in such cases one or several forms of the genus extend through more than one region or subregion.) In the column headed "Ethiopian region" is included the single species (*Roussettus aegyptiacus*) which extends into the Eastern Mediterranean subregion (Egypt, Syria, Palestine, Cyprus). For comments on the table, see the paragraph "Remarks on the geographical distribution," pp. lxxv–xcii.

[illegible]



The number of genera, species, and forms represented in each region and subregion is as follows:—

	Genera.	Species.	Forms.
E. Mediterranean subregion .....	1	1	1
Ethiopian region .....	13	32	34
Malagasy region .....	2	9	10
Indian & Ceylonese subregions .....	3	7	8
Indo-Chinese subregion .....	6	14	15
Indo-Malaya .....	13	36	55
Austro-Malaya .....	15	89	93
Australian continent .....	3	8	8
Polynesia .....	2	20	20

## 2. Distribution of species and subspecies.

The subjoined geographical list of the species and subspecies is based almost entirely on the material examined by the writer during the preparation of this Catalogue. An asterisk after a generic, specific, or subspecific name indicates that the genus, species, or subspecies is not known to occur outside the area dealt with.

### EASTERN MEDITERRANEAN SUBREGION.

Egypt, Syria, Palestine, Cyprus:—*Roussettus ægyptiacus* (also in Ethiopian region).

### ETHIOPIAN REGION.

West African Province (Great West African Forest Tract, south to Damara-land, east to Victoria Nyanza; one of the forms marked as autochthonous extends a little beyond the eastern limits of the province):—

*Eidolon helvum* (Ethiopian region generally).

*Roussettus ægyptiacus* (N.E. to Egypt, Syria, &c.); *lanosus* \* (Ruwenzori) *angolensis* \*; *smithi* \* (Guinea coast).

*Pterotes* \* *anchietæ* (Benguela).

*Epomops* \* *franqueti strepitans* (Gold Coast, Lagos, Nigeria); *franqueti franqueti* (Old Calabar to Bukoba); *buettikoferi* (Sierra Leone, Liberia); *dohsoni* (Benguela, Katanga).

*Hypsignathus* \* *monstrosus* (Gambia to Monbattu).

*Epomophorus wahlbergi haldemani* \* (Cameroons to G. & B. East Africa); *gambianus* (Senegal to Sennar and Abyssinia); *angolensis* \* (Benguela, Damara-land); *pousarguesi* \* (Upper Shari).

*Micropteropus* \* *pusillus* (Gambia to Victoria Nyanza).

*Nanonycteris* \* *veldekampi* (Guinea coast).

*Scotonycteris* \* *zeukeri* (Cameroons, Fernando Po).

*Casinonycteris* \* *argymnis* (Cameroons).

*Myonycteris* \* *wroughtoni* (Welle district); *leptodon* (Sierra Leone, Liberia); *torquata* (Lower Congo, Angola); *brachycephala* (San Thomé).

*Megaloglossus* \* *voermanni* (Congo to Liberia).

Eastern side of Continent:—

*Eidolon helvum* (Ethiopian region generally).

*Roussettus leachi* \* (B. East Africa to Cape Colony); *ægyptiacus* (Erythraea, south-west to Gaboon and Loanda, north to Egypt, Syria, &c.); *kempi* \* (Shoa, B. East Africa).

*Epomophorus wahlbergi wahlbergi* \* (B. East Africa to Cape Colony);  
*labiatus* \* (Sennaar, Abyssinia, Shoa); *minor* \* (Shoa to G. East  
 Africa); *anurus* \* (Abyssinia and Erythrea to Tanganyika); *crypturus* \*  
 (Nyasa to Transvaal); *gambianus* (Sennaar and Abyssinia, west to  
 Guinea Coast).

South Arabia:—

*Eidolon sabæum* \*.

*Rousettus arabicus* (also Karachi).

Pemba Island:—*Pteropus voeltzkowi* \*.

#### MALAGASY REGION.

Madagascar:—

*Eidolon dupreanum* \*.

*Pteropus rufus* \* *rufus* (northern and central); *rufus princeps* (southern).

Comoro Islands:—*Pteropus comorensis* \*; *livingstonei* \*.

Aldabra:—*Pteropus aldabrensis* \*.

Seychelles:—*Pteropus seychellensis* \*.

Manritius, Reunion:—*Pteropus submiger* \*; *niger* \*; ? *rodricensis*.

Rodriguez:—*Pteropus rodricensis* \* (perhaps also Mauritius).

#### INDIAN AND CEYLONESE SUBREGIONS.

Maldives:—*Pteropus ariel* \*.

Ceylon:—

*Rousettus seminudus* \*.

*Pteropus giganteus giganteus* (also Indian Peninsula).

*Cynopterus sphinx sphinx* (also Indian Peninsula); *brachyotis ceylonensis* \*.

Indian Peninsula:—

*Rousettus arabicus* (Karachi; also S. Arabia); *leschenaulti* (also Indo-China).

*Pteropus giganteus giganteus* (also Ceylon).

*Cynopterus sphinx sphinx* (S. & E. provinces; also Ceylon, Assam, N. Burma, N. Siam); *sphinx gangeticus* (N.W. & C. Provinces).

#### INDO-CHINESE SUBREGION.

Himalayas (Kooloo, Nepal, Darjeeling, Assam, Cachar, Manipur):—

*Rousettus leschenaulti* (also Indian Peninsula, Burma, &c.).

*Pteropus giganteus leucocephalus* \*.

*Cynopterus sphinx sphinx* (Assam; also Indian Peninsula, N. Burma, N. Siam); *brachyotis angulatus* (also Burma, Siam, &c.).

? *Macroglossus minimus sobrinus* ("Darjeeling"; also Malay Peninsula, &c.; perhaps Siam, Burma, Tenasserim).

Burma:—

*Rousettus leschenaulti* (also Indian Peninsula, Siam, &c.).

*Cynopterus sphinx sphinx* (N. Burma; also Indian Peninsula, N. Siam); *brachyotis angulatus* (also Assam, Siam, &c.).

*Sphærias* \* *blanfordi*.

*Eonycteris spelæa* (also Tenasserim, Siam, Malay Peninsula, &c.).

? *Macroglossus minimus sobrinus* (also Malay Peninsula, &c.; perhaps Siam, Tenasserim).

Tenasserim:—

*Pteropus intermedius* (\*) (probably also Lower Siam).

*Eonycteris spelæa* (also Burma, Siam, Malay Peninsula, &c.).

? *Macroglossus minimus sobrinus* (also Malay Peninsula, Sumatra, &c. perhaps Burma, Siam).

Mergui Archipelago :—*Pteropus hypomelanus geminorum* \*.

South China (Amoy) :—*Rousettus leschenaulti* (also Siam, Burma, Nepal, Indian Peninsula).

South Liu-kiu Islands :—*Pteropus dasymallus* \*; *lochoënsis* \*.

Formosa :—*Pteropus formosus* \*.

Siam, Cambodia, Saigon, Pulo Condor :—

*Rousettus leschenaulti* (Siam; also S. China, Burma, Nepal, Indian Peninsula); *amplexicaudatus* (Cambodia; also Indo-Malaya).

*Pteropus hypomelanus condorensis* \* (Siam, P. Condor); *lylei* \*.

*Cynopterus sphinx sphinx* (also N. Burma, Indian Peninsula); *brachyotis angulatus* (also Burma, Assam, Malay Peninsula, &c.).

*Eonycteris spelæa* (also Burma, Tenasserim, Malay Peninsula, &c.).

? *Macroglossus minimus sobrinus* (also Malay Peninsula; perhaps Burma, Tenasserim, Darjeeling).

#### INDO-MALAYAN SUBREGION.

Andamans :—

*Pteropus satyrus* \* (Narcondam); *tytleri* \*.

*Cynopterus brachyotis brachysoma* \*.

Nicobars :—

*Pteropus faunulus* \*; *melanotus* \*.

*Cynopterus brachyotis seherzeri* \*.

Lower Siam :—

? *Rousettus amplexicaudatus* (Indo-Malaya generally, Cambodia).

? *Pteropus intermedius* (also Tenasserim).

*Cynopterus brachyotis angulatus* (also Siam, Burma, Malay Peninsula, &c.); *brachyotis brachyotis* (also Malay Peninsula, Borneo, Sumatra, &c.).

*Eonycteris spelæa* (also Siam, Burma, Malay Peninsula, &c.).

? *Macroglossus minimus sobrinus* (also Malay Peninsula, perhaps Siam).

Malay Peninsula :—

? *Rousettus amplexicaudatus* (Indo-Malaya generally, Cambodia).

*Pteropus vampyrus malaccensis* (also Sumatra).

*Cynopterus brachyotis angulatus* (also Lower Siam, Borneo, Sumatra, &c.); *brachyotis brachyotis* (also Lower Siam, Borneo, Sumatra, &c.); *karpax* \*.

*Megærops caudatus* (also Sumatra, Borneo).

*Penthetor lucasi* (also Rhio Archipelago, Borneo).

*Eonycteris spelæa* (also Siam, Burma, Sumatra, &c.).

*Macroglossus minimus minimus* (?) (also Java, perhaps Sumatra); *minimus sobrinus* (also Sumatra and Java; perhaps Lower Siam, &c.).

Sembilan Islands (off west coast of Malay Peninsula) :—*Pteropus hypomelanus robinsoni* \*.

Sumatra (incl. Rhio-Linga Archipelago, Banka) :—

*Rousettus amplexicaudatus* (Indo-Malaya generally).

*Pteropus vampyrus malaccensis* (also Malay Peninsula).

*Cynopterus sphinx titthæcheilus* (also Java, Lombok); *brachyotis angulatus* (also Malay Peninsula, Simalu, Mentawai); *brachyotis brachyotis* (also Malay Peninsula, Borneo, &c.); *horsfieldi lyoni* \*.

*Megærops caudatus* (also Malay Peninsula, Borneo).

*Penthetor lucasi* (Rhio Archipelago, so far not recorded from Sumatra; also in Malay Peninsula, Borneo).

*Eonycteris spelæa* (also Malay Peninsula, Siam, Java, &c.).

*Macroglossus minimus minimus* (?) (also Java, perhaps Malay Peninsula); *minimus sobrinus* (also Malay Peninsula, Java).

Simalu Islands :—*Cynopterus brachyotis angulatus* (also Mentawai, Sumatra, &c.).

Nias :—

*Pteropus niadieu* \*.

*Cynopterus brachyotis minutus* \*; *major* \*; *princeps* \*.

*Macroglossus minimus sobrinus* (also Sumatra, Java).

Mentawai Islands :—

? *Pteropus hypomelanus enganus* (also Engano).

*Cynopterus brachyotis angulatus* (also Simalu, Sumatra, &c.).

Engano :—

*Rousettus amplexicaudatus* (Indo-Malaya generally).

*Pteropus hypomelanus enganus* (\*) (perhaps also Mentawai); *modiglianii* \*.

Christmas Island (S. of Java) :—*Pteropus natalis* \*.

North Natunas :—

*Pteropus hypomelanus canus* \*; *vampyrus natunæ* (also Borneo).

? *Cynopterus brachyotis brachyotis* (also Malay Peninsula, Borneo, Sumatra, &c.).

South Natunas :—*Pteropus hypomelanus annectens* \*. [*Pteropus vampyrus natunæ*, not yet recorded.]

Tambelan Islands, Palo Aor, Tioman, Lantinga, Great Redang, Perhentian :—

*Pteropus hypomelanus lepidus* \*.

Borneo (incl. Labuan, Mengalun, Sibutu, Lamboyan Islands) :—

*Rousettus amplexicaudatus* (Cambodja, Indo-Malaya generally).

*Pteropus hypomelanus tomesi* \*; *speciosus* (Sibutu I.; also Malanipa I., off Zamboanga); *vampyrus natunæ* (also N. Natunas).

*Cynopterus brachyotis brachyotis* (also Malay Peninsula, Sumatra, Philippines, Celebes).

*Megascops ecadatus* (also Malay Peninsula, Sumatra).

*Dyacopterus* \* *spadiceus*.

*Balionycteris* \* *maculata*.

*Penthetor lucasi* (also Malay Peninsula, Rhio Archipelago).

*Eonycteris major* \*.

*Macroglossus lagochilus lagochilus* (also Philippines, Celebes, &c.).

Mata Siri Islands :—*Cynopterus brachyotis insularum* (also Kangean Islands).

Java (incl. Madura) :—

*Rousettus shortridgei* \*; *minor* \*.

*Pteropus vampyrus vampyrus* \*.

*Cynopterus sphinx titthæcheilus* (also Sumatra, Lombok); *brachyotis javanicus* \*; *horsfieldi horsfieldi* \*.

*Chironax* \* *melanocephalus*.

*Eonycteris spelea* (also Sumatra, Malay Peninsula, Siam, Burma).

*Macroglossus minimus minimus* (also Kangean Is.; perhaps Sumatra and Malay Peninsula); *minimus sobrinus* (also Sumatra, Malay Peninsula; perhaps Indo-China).

Bawean Islands :—*Pteropus aterritus* (also Kangean Is.).

Kangean Islands :—

*Pteropus aterritus* (also Bawean Is.).

*Cynopterus brachyotis insularum* (also Mata Siri Is.).

*Macroglossus minimus minimus* (also Java, &c.).

Bali :—*Pteropus vampyrus pluton* (also Lombok).

Philippines (incl. Cagayan Sulu and Palmas Is.) :—

*Rousettus amplexicaudatus* (Indo-Malaya generally).

*Pteropus hypomelanus cagayanus* \*; *speciosus* (Malanipa I., off Zamboanga; also Sibutu I., off N. Borneo); *minus* (also Celebes); *pumilus* \* (Palmas Is.); *leucopterus* \* (Luzon); *vampyrus luzensis* \*.

*Acerodon jubatus* \* *jubatus* (Luzon, Leyte, Negros, Dinagat, ? Panay); *jubatus mindanensis* (Mindanao); *Lucifer* \* (Panay).

*Harpyionycteris* \* *whiteheadi* (Mindanao)  
*Cynopterus brachyotis brachyotis* (also Borneo, Celebes, &c.).  
*Ptenochirus* \* *jagori*.  
*MacroGLOSSUS lagochilus lagochilus* (also Borneo, Celebes, &c.).

## AUSTRO-MALAYAN SUBREGION.

Celebes :—

*Rousettus celebensis* (also Sanghir).  
*Bonia* \* *hidens*.  
*Pteropus hypomelanus macassaricus* (also Sanghir, Talaut); *minus* (also Philippines); *dobsoni* \*; *personatus* (also Gilolo and Amboina groups); *alecto* (also Salayer, Lombok).  
*Acerodon celebensis* (also Salayer, Sula Is.).  
*Styloctenium* \* *willacii*.  
*Dobsonia exoleta* \*.  
*Cynopterus brachyotis brachyotis* (also Borneo, Philippines, &c.).  
*Thoopterus nigrescens* (also Gilolo group).  
*Nyctimene minutus* \*; *cephalotes* (also Amboina group, Timor Laut, Timor).  
*Eonycteris rosenbergi* \*.  
*MacroGLOSSUS lagochilus lagochilus* (also Borneo, Philippines, Sanghir, Amboina group).

Sanghir Islands :—

*Rousettus celebensis* (also Celebes).  
*Pteropus hypomelanus macassaricus* (also Celebes, Talaut); *caniceps* (also Gilolo group, Sula Is.); ? *melanopogon* (also Amboina group, Banda Is., Timor Laut); ? *chrysoproctus* (also Amboina group).  
*MacroGLOSSUS lagochilus lagochilus* (also Celebes, Philippines, Amboina group, &c.).

Talaut Islands (Lirong) :—

*Pteropus hypomelanus macassaricus* (also Sanghir, Celebes).  
*Acerodon humilis* \*.

Bonerato, Dyampea, Salayer :—

*Pteropus griseus* (also Timor); *alecto* (also Celebes, Lombok).  
*Acerodon celebensis* (also Celebes, Sula Is.).

Lombok :—

*Pteropus lombocensis* (also Flores); *vampyrus pluton* (also Bali); *alecto* (also Salayer, Celebes).  
*Cynopterus sphinx titthæcheilus* (also Java, Sumatra).

Flores :—

*Rousettus amplexicaudatus* (Indo-Malaya generally).  
*Pteropus lombocensis* (also Lombok).  
*Acerodon mackloti floresii* \*.  
*Dobsonia peroni* (also Timor, Alor, Wetter).

Sumba :—

*Pteropus morio* (also Savu).  
*Acerodon gilvus* \*.  
*Dobsonia sumbana* \*.

Savu :—

*Rousettus amplexicaudatus* (also Flores, Alor, Timor, Indo-Malaya).  
*Pteropus vampyrus edulis* (also Timor); *morio* (also Sumba).

Timor (incl. Wetter) :—

*Rousettus amplexicaudatus* (also Flores, Savu, Alor, Indo-Malaya).  
*Pteropus griseus* (also Bonerato, Dyampea); *tomlinsoni* (also Amboina group); *vampyrus edulis* (also Savu).  
*Acerodon mackloti mackloti* \*.  
*Dobsonia moluccensis* (?) (also Amboina group, Aru Is.); *peroni* (also Flores, Alor).

? *Cynopterus sphinx tithæcheilus* (also Lombok, Java, Sumatra).  
*Nyctimene cephalotes* (also Celebes, Amboina group, Timor Laut).

Alor (Ombay):—

*Rousettus amplexicaudatus* (also Flores, Savu, Timor, Indo-Malaya).  
*Pteropus solitarius* \*.  
*Acerodon mackloti aloreensis* \*.  
*Dobsonia peroni* (also Flores, Wetter, Timor).

Gilolo group (Morotai, Gilolo, Ternate, Batchian):—

*Pteropus hypomelanus hypomelanus* \*; *caniceps* (also Sula Is., Sanghir);  
*personatus* (also Celebes, Amboina group); *chrysauchen* (also Ghebi,  
 Salawati, Mysol, N.W. New Guinea).  
*Dobsonia crenulata* \*.  
*Thoopterus nigrescens* (also Celebes).  
*Nyctimene albiventer* \*.

Sula Islands:—

*Pteropus caniceps* (also Gilolo group, Sanghir).  
*Acerodon celebensis* (also Celebes, Salayer).

Amboina group (Buru, Amboina, Ceram, Goram, Manawolka, Watubella):—

*Rousettus brachyotis* (also New Guinea, &c.).  
*Pteropus liops* \*; ?*argentatus* \*; *melanopogon* (also Banda Is., Timor  
 Laut, probably Sanghir); *chrysoproctus* (\*) (perhaps also Sanghir);  
*temmincki* (also Timor); *personatus* (also Celebes, Gilolo group);  
*ocularis* \*.  
*Dobsonia moluccensis* (also Aru Is., perhaps Timor); *viridis umbrosa* (also  
 Banda Is.).  
*Nyctimene varius* \*; *cephalotes* (also Celebes, Timor Laut, Timor).  
*Macroglossus lagochilus lagochilus* (also Banda Is., Celebes, Philippines,  
 &c.).  
*Syconycteris crassa major* \*.

Banda Islands:—

*Pteropus pallidus* \*; *melanopogon* (also Amboina group, Timor Laut,  
 probably Sanghir).  
*Dobsonia viridis umbrosa* (also Amboina group).  
*Macroglossus lagochilus lagochilus* (also Amboina group, Sanghir, Celebes,  
 &c.).

Timor Laut:—

*Pteropus melanopogon* (also Amboina group, Banda Is., &c.).  
*Nyctimene cephalotes* (also Timor, Amboina group, Celebes).

Key Islands:—

*Pteropus keyensis* \*.  
*Dobsonia viridis viridis* \*. [*D. moluccensis* not recorded, but possibly  
 occurring; known from Amboina group and Aru Is.]  
*Nyctimene papuanus* (also New Guinea, &c.).  
 [ *Macroglossus lagochilus nanus* not recorded, but possibly occurring;  
 known from Aru Is., New Guinea, &c.]  
*Syconycteris crassa keyensis* \*.

Aru Islands:—

*Pteropus aruensis* \*; *macrotis* \*.  
*Dobsonia moluccensis* (also Amboina group).  
*Macroglossus lagochilus nanus* (also New Guinea, &c.).  
*Syconycteris crassa papuana* (also New Guinea).

Ghebi, Salawati, Mysol, Waigeou:—

*Pteropus chrysauchen* (also Gilolo group, N.W. New Guinea); ? *papuanus*  
 (also New Guinea).  
*Dobsonia magna* (also New Guinea).  
*Nyctimene aello* (also New Guinea).  
*Macroglossus lagochilus nanus* (also New Guinea, &c.).

## New Guinea:—

- Rousettus brachyotis* (also Amboina group, Bismarck Arch., Solomon Is.).  
*Pteropus hypomelanus luteus* (also islands off S.E. New Guinea); *chrysauchen* (N.W. New Guinea; also Mysol, Salawati, Ghebi, Gilolo group);  
*conspicillatus* (S.E. New Guinea with satellite islands, N. Australia);  
*papuanus* (\*) (perhaps also Ghebi, Mysol); *epularius* \*.  
*Dobsonia minor* \*; *magna* (also Mysol, Waigeou).  
*Nyctimene papuanus* (also Admiralty Is., Key Is., Cape York); *cyclotis* \*  
 (Arfak Mts.); *certain* \*; *geminus* (also Trobriand and D'Entrecasteaux Is.); *aëlle* (also Mysol).  
*Macroglossus lagochilus nanus* (also Mysol, Bismarck Arch., Aru Is.).  
*Syconycteris crassa papuana* (also Aru Is.).  
*Melonycteris melanops* (also Bismarck Arch.).

## Conflict, Trobriand, D'Entrecasteaux, Alcester Is., Louisiades:—

- Pteropus hypomelanus luteus* (also New Guinea); *conspicillatus* (also S.E. New Guinea, N. Australia); ? *poliocephalus* (also Australia).  
*Dobsonia paunietensis* \*.  
*Nyctimene geminus* (also New Guinea).  
*Syconycteris crassa crassa* \*.

## Woodlark Island:—

- Pteropus hypomelanus luteus* (also Trobriand and Conflict Is., New Guinea); *conspicillatus* (also Alcester and Trobriand Is., New Guinea, N. Australia).  
*Nyctimene lullulæ* \*.  
*Syconycteris naia* \*.

Murray Islands (Torres Straits):—*Macroglossus lagochilus pygmaeus* \*.

## Admiralty Islands:—

- Pteropus admiralitatum* \*.  
*Nyctimene papuanus* (also New Guinea, &c.).

## Bismarck Archipelago:—

- Rousettus brachyotis* (also New Guinea, &c.).  
*Pteropus capistratus* \*; *neohibernicus* \*.  
*Dobsonia prædatrix* \*.  
*Nyctimene major* \*.  
*Macroglossus lagochilus nanus* (also New Guinea, &c.).  
*Syconycteris crassa finschi* \*.  
*Melonycteris melanops* (also New Guinea).

## Solomon Islands (whole Megachiroptera fauna):—

- Rousettus brachyotis* (also Guadalcanar, Bismarck Arch., New Guinea).  
*Pteropus colonus* \*; *solomonis* \*; *cognatus* \*; *rayneri* \*; *rubianus* \*;  
*lavellanus* \*; *grandis* \*; *woodfordi* \*.  
*Pteralopex anceps*; *atrata*.  
*Dobsonia inermis* \*; *nesea* \*.  
*Nyctimene scitulus* \*.  
*Macroglossus lagochilus microtus* \*.  
*Nesonycteris woodfordi*.

## Known distribution in the separate groups of Solomon Islands:—

## Bougainville, Shortland, Fauro:—

- Rousettus brachyotis* (also Guadalcanar).  
*Pteropus colonus* \*; *grandis* \*.  
*Pteralopex anceps* \*.  
*Dobsonia nesea* (also Rubiana).  
*Nyctimene scitulus* (also New Georgia, Florida, Guadalcanar).  
*Nesonycteris woodfordi* (also Guadalcanar).

Vella Lavella:—*Pteropus lavellanus* \*.

Glizo, Rubiana, New Georgia:—

*Pteropus solomonis* \*; *rubianus* \*; *woodfordi* (also Guadalcanar).

*Dobsonia nesea* (also Shortland).

*Nyctimene scitulus* (also Shortland, Florida, Guadalcanar).

Florida, Guadalcanar:—

*Rousettus brachyotis* (also Fauro).

*Pteropus rayneri* \*; *woodfordi* (also New Georgia).

*Pteralopex atrata* \*.

*Nyctimene scitulus* (also Shortland, New Georgia).

*MacroGLOSSUS lagochilus microtus* \*.

*Nesonycteris woodfordi* (also Shortland, Fauro).

San Christoval, Ugi:—

*Pteropus cognatus* \*.

*Dobsonia inermis* \*.

#### AUSTRALIAN CONTINENT.

*Pteropus brunneus* \*; *gouldi* \*; *conspicillatus* (also S.E. New Guinea and adjacent islands); *poliocephalus* (\*) (perhaps also Trobriand Is.); *scapulatus* \*.

*Nyctimene papuanus* (also New Guinea, &c.); *robinsoni* \*.

*Syconycteris australis* \*.

#### POLYNESIAN SUBREGION.

Bonin and Volcano Islands:—*Pteropus psclaphon* \*.

Mariannes:—*Pteropus mariannus* \*.

Pelew Islands:—*Pteropus pelewensis* \*; *pilosus* \*.

Carolines (all islands together):—

*Pteropus yapensis* \*; *valanus* \*; *molossinus* \*; *insularis* \*; *phæcephalus* \*.

? *Notopterus macdonaldi* (also New Hebrides and Fijis).

Records from the separate islands:—

Yap, Mackenzie:—*Pteropus yapensis* \*.

Ruck Atoll:—*Pteropus insularis* \*.

Mortlock:—*Pteropus molossinus* (also Ponapé); *phæcephalus* \*.

Ponapé:—*Pteropus molossinus* (also Mortlock).

Ualan (Kushai):—*Pteropus ualanus* \*.

Sta. Cruz Islands (Vanikoro):—*Pteropus vanikorensis* \*; ? *tuberculatus* \* (there is some uncertainty about the habitat of this species).

New Caledonia:—

*Pteropus ornatus* \*; *geddici* (also New Hebrides).

*Notopterus neocaledonica* \*.

Loyalty Islands:—*Pteropus auratus* \*.

New Hebrides (Aneiteum):—

*Pteropus geddici* (also New Caledonia); *anctianus* \*.

*Notopterus macdonaldi* (also Fijis).

Fijis:—

*Pteropus tonganus* (also Tongas, Samoas); *nawairnsis* \*.

*Notopterus macdonaldi* (also New Hebrides).

Tongas:—*Pteropus tonganus* (also Fijis, Samoas).

Samoas:—*Pteropus tonganus* (also Fijis, Tongas); *samoensis* \*.



### 3. Remarks on the geographical distribution.

The northern limits of the area known to be inhabited by Megachiroptera are Senegambia, Egypt, Cyprus, Syria, South Arabia, Karachi (one unverified record of *Pteropus giganteus* from Kelat), Himalayas, Amoy, Formosa, South Liu-kiu Islands, Bonins, Pelew Islands, and Mariannes; in Polynesia they occur as far east as the Samoa Islands. No Fruit-bat is known from North Africa west of Egypt and north of Senegal, nor from Asia Minor, Persia, Japan proper (records in literature of *Pteropus desymallus* from Kiushiu and Hondo probably refer to captive specimens), Hawaii, New Zealand, and Tasmania (one probably erroneous record of *Pteropus poliocephalus*). The only fossil Fruit-bat thus far described is *Archaeopteropus transiens*, from the Upper Oligocene of Italy ("Rousettus" *gaillardi*, from the Middle Miocene of France, was, judging from the published figure of its humerus, a species of Microchiroptera).

Of the four primary sections of Megachiroptera, one, the *Epomophorus* section (8 genera, 17 species, 19 forms), is strictly confined to the Ethiopian region; a second, the *Cynopterus* section (11 genera, 31 species, 41 forms), extends from India and Ceylon in the west to the Solomon Islands and Australia in the east, and is represented by one genus (*Myonycteris*, 4 species) in West Africa; a third, the *Macroglossine* (7 genera, 13 species, 21 forms), ranges from Indo-China eastward to the Fiji Islands, and reoccurs, in a single genus and species (*Megaloglossus*), in West Africa; the fourth, the *Rousettus* section (9 genera, 125 species, 147 forms), in the number of species more than twice as large as the three other sections together, covers the whole of the area inhabited by Megachiroptera, from West Africa east to the Samoa Islands.

A few genera have a very wide distribution: *Rousettus* (14 species) from West Africa to the Solomon Islands (but not to Australia), *Pteropus* (85 species, 103 forms, the largest of all genera, in the number of species nearly equal to all the other genera together) from the island of Pemba (south of Zanzibar), through the Malagasy, Oriental, and Australian regions to the Samoa Islands; others have a moderately wide range, *e.g.* *Macroglossus* from Indo-China to the Solomon Islands (not to Australia), *Cynopterus* from India and Ceylon to Celebes. But for the majority of genera the geographical limits are much narrower, and not a few (chiefly monotypic genera) are so far known only from one place, island, or group of islands: *Spharicus* from Burma only, *Dyacopterus* and *Balionycteris* from Borneo, *Chironax* from Java, *Harpyionycteris* and *Ptenochirus* from the Philippines, *Boninia* and *Styloctenium* from Celebes, *Pteralopex* and *Nesonycteris* from the Solomon Islands: all Epomophorine genera, except *Epomophorus*, as well as *Myonycteris* and *Megaloglossus* are practically confined to the whole or part of the great West African Forest Tract.

The range of the species is, of course, as a rule restricted within much narrower limits, or if a species is widely distributed it has usually differentiated into a number of local forms: *Pteropus hypo-*

*melanus*, for instance, covers practically the whole area from Indo-China to New Guinea and Woodlark Island, but is broken up into no less than twelve subspecies; *Pteropus vampyrus* ranges over the whole of the Indo-Malayan subregion, but divided into six races; *Epomophorus wahlbergi* is distributed over the greater part of the Ethiopian region (except the Guinea coast west of Cameroons), but falls into two races—a western and eastern; *Cynopterus brachyotis* is known from the whole of Indo-Malaya, extending eastward beyond this subregion to Celebes, westward to Burma and Assam, and reappearing farther west in Ceylon, but is broken up into eight local forms; *Macroglossus lagochilus* extends from Borneo in an unbroken range eastward to the Solomon Islands, but has differentiated into four subspecies; *Syconycteris crassa* ranges from the Moluccas to the islands south-east of New Guinea, but has split into five races. There are, however, a few noticeable exceptions from the general rule of the relatively narrowly limited range of the species and subspecies; *Eidolon helvum* is generally distributed, without any appreciable change of characters, over nearly the whole of the Ethiopian region (South Arabia excepted); *Rousettus amplexicaudatus* occurs in Cambodja, through the Philippines, Borneo, Sumatra (not Java), east to Flores and Timor, apparently without splitting into local forms; *Rousettus brachyotis* ranges, seemingly unchanged, from the Amboina group to the Solomon Islands; *Cynopterus brachyotis brachyotis* from Lower Siam, through the Malay Peninsula to Sumatra, Borneo, the Philippines, and Celebes; *Macroglossus lagochilus lagochilus* over Borneo, the Philippines, Celebes, and the Amboina group. Whether these exceptions are really much more frequent and much more striking among Megachiroptera (and Chiroptera in general) than among non-flying Mammalia, is perhaps doubtful. In any case, against these few instances of an exceptionally wide distribution of one apparently unchanged form may be placed a large number of species known only from, and in many cases probably really restricted to, one island or group of islands.

The evidence afforded by the geographical distribution of Bats has generally been considered of doubtful value; hence they have either been entirely excluded from the material worked out by zoogeographers or at least treated with pronounced suspicion, as likely to be more or less unreliable documents of evidence. This unwillingness or hesitation to place Bats on an equal zoogeographical footing with non-flying Mammalia would seem to be due, partly to the preconceived idea that owing to their power of flight Bats must evidently have been able easily to spread across barriers which, in ordinary circumstances, are insuperable for wingless Mammalia; partly to the fact that hitherto very often whole series of distinct forms have been concealed under one technical name. So long as (to mention only three cases among many) "*Macroglossus minimus*" was believed to range unchanged from the Himalayas to New Guinea, Australia, and the Solomon Islands (now two distinct genera, thirteen recognizable forms), or "*Cynopterus marginatus*"

over India, Ceylon, Indo-China, and Indo-Malaya (now six species, fourteen forms), or "*Rhinolophus ferrum-equinum*" uniformly over Europe, Asia, and Africa (now numerous distinct forms), they were undoubtedly of questionable value as zoogeographical material. But these and similar anomalies invariably disappear as soon as modern methods of discrimination applied on vastly increased material render it possible to draw the lines of separation between the species (and their local modifications) somewhat more closely in accordance with the lines drawn by Nature. The second argument referred to above, that the spreading of Bats from one locality to another must obviously have been greatly facilitated by their possession of wings, may in theory appear plausible enough, but when tested on the actual distribution of the species and subspecies it proves to be of much less importance than commonly supposed; it rests, in reality, on a confusion of two different things: the power of flight no doubt would *enable* a Bat to spread over a much larger area than non-flying Mammalia, but, as a matter of fact, only in very few cases is there any reason to believe that it has *caused* it to do so. The following pages, in which the distribution of the Megachiroptera within each zoogeographical region or sub-region is discussed in some detail, will give ample evidence to this effect, but a few of the more striking examples may be mentioned here: a species of *Pteropus* inhabits the island of Pemba, south of Zanzibar, but although this island is separated from Africa by a channel only 35-40 miles wide, not this particular species only but the whole genus is unknown from any part of the adjacent continent; although absent from Africa the genus *Pteropus* is distributed all over the Malagasy region, and each group of islands (Madagascar, Comoros, Aldabra, Seychelles, Mascarenes) has its own peculiar species, intermigration between the groups of islands is unknown; the Epomophorine section of Fruit-bats is distributed over the whole of the Ethiopian region (eight genera, nineteen forms), but not a single form has spread to any island of the Malagasy region; the *Pteropus melanotus* group of species is distributed over the Andamans, Nicobars, Nias, Engano, and Christmas Island (south of Java), and the whole group is confined to this chain of islands, no form having spread to the neighbouring Malay Peninsula or Sumatra; *Pteropus hypomelanus* is represented by a local form in Engano, off Western Sumatra, but the species, though widely distributed elsewhere in Indo-Malaya, is unknown in Sumatra and Java; the Megachiropteran fauna of Ceylon shows, of course, very close affinities to that of the Indian Peninsula, but the Indian *Rousettus leschenaulti* is replaced by a distinct species (*seminudus*), and the Indo-Chinese and Indo-Malayan *Cynopterus brachyotis* is represented by a local form, though the species is unknown in the Peninsula; the Fruit-bat faunas of the Malay Peninsula, Sumatra, and Borneo are closely interrelated, like their Mammalian faunas in general, but each has some distinct autochthonous forms of Fruit-bats (Borneo even two autochthonous genera), as it has of other Mammalia; the Javan Mammalian fauna in

general is more peculiar, both by the absence of some of the forms found in Sumatra and the Malay Peninsula and by the greater percentage of autochthonous forms, and this is again borne out by the Megachiropteran fauna of the island (absence of two Sumatran genera, presence of one autochthonous genus, among ten forms six autochthonous); the *Pteropus rayneri* group is represented probably all over the Solomon Islands, but it has differentiated into five distinct species, one in the Bongainville group, a second on Vella Lavella, a third in the New Georgia group, a fourth on Guadalcanar, and the fifth on San Christoval. This (and a series of similar examples might easily be adduced) tends to show that the present distribution of the Megachiroptera has not been influenced to any great, and as a rule not even to any appreciable, extent by their power of flight; if it had, the Fruit-bat fauna of one group of islands could not, so commonly as is actually the case, differ from that of a neighbouring group or continent, and the tendency to differentiation of insular species or forms would have been neutralized by the free intercourse between neighbouring faunas.

### *Ethiopian Region.*

13 genera, 32 species (34 forms). Of the four primary sections of Megachiroptera, one, the *Epomophorus* section (8 genera, 17 species, 19 forms), is entirely Ethiopian; of the *Rousettus* section (9 genera, 125 species, 147 forms) three genera are represented in this region, *Eidolon* by two species, *Rousettus* by seven, and *Pteropus* by one; the *Cynopterus* section (11 genera, 31 species, 41 forms) by one peculiar genus, *Myonycteris* (four species); the *Macroglossinae* (7 genera, 13 species, 21 forms) by one peculiar genus, *Megaloglossus* (one species). Of the thirteen genera ten are peculiar, viz. all except *Eidolon* (outside the Ethiopian region occurring only in Madagascar), *Rousettus*, and *Pteropus*. Of the thirty-two species thirty are peculiar, viz. all except *Rousettus aegyptiacus*, which extends to the eastern Mediterranean subregion, and *Rousettus arabicus*, which extends to Karachi.

A subdivision of the Ethiopian region, on the basis of its Megachiropteran fauna, is very simple indeed. The region falls decidedly into two well-defined provinces, viz. (1) the *West African Province*, i. e. the whole of the Guinea coast and Congo basin, east to the western bank of Victoria Nyanza, south to Benguela and Damaraland, thus approximately synonymous with the Great West African Forest Region, though at least in the south-west extending beyond the limits of the forest belt, and (2) the *East African Province*, i. e. the eastern side of the continent from Erythrea and Abyssinia in the north to the Capo Colony in the south. So sharp is the contrast between the faunas of these two provinces that the large majority of genera and species occurring in the former are unknown in the latter, only a few species extending beyond its limits to part of East Africa. A single species, *Eidolon helvum*, seems to be thoroughly common to both, ranging from Senegambia,

Sennaar, and Somaliland in the north, to Namaqualand, Mashona, and Nyasaland in the south. Besides these two provinces, South Arabia and the island of Pemba require special remarks.—Matschie's attempt to subdivide the Ethiopian region into a large number of zoogeographical districts ("Gebiete"), each with its own distinct Mammalian fauna, breaks completely down when tested on the distribution of the Ethiopian Fruit-bats.

*West African province.*—12 genera, 23 species (24 forms). *Pteropus* is the only genus which, though represented in the Ethiopian region (the island of Pemba), is absent from W. Africa. Of the twelve genera no less than nine are peculiar, viz. *Plerotus*, *Epomops*, *Hypsignathus*, *Micropteropus*, *Nanonycteris*, *Scotonycteris*, and *Casinonycteris* (all of the *Epomophorus* section), *Myonycteris* (*Cynopterus* section), and *Megaloglossus* (*Macroglossinae*); expressed in other words: all genera of the Epomophorine section of Fruit-bats are confined to this province, except *Epomophorus* itself, which is common to W. and E. Africa, and this province ("Afro-Malaya," as it was, perhaps a little jokingly, called by the late Dr. R. Bowdler Sharpe) is the only part of Africa in which the otherwise essentially Oriental and Austro-Malayan Cynopterine and Macroglossine sections are represented. The three non-autochthonous genera are *Eidolon*, *Rousettus*, and *Epomophorus*. The genus *Rousettus* falls into three subgenera, *Rousettus*, *Stenonycteris*, and *Lissonycteris*; of these the first is widely distributed in the Ethiopian and Oriental regions and Austro-Malaya, while the two latter are confined to the Ethiopian region; *Stenonycteris* is common to the West and East African Provinces (one species in each), *Lissonycteris* (two species) is peculiar to West Africa. Of the twenty-four West African forms no less than twenty-one are peculiar, i. e. all forms except *Eidolon helvum* (generally distributed in the Ethiopian region), *Rousettus aegyptiacus* (Loanda and Congo to Egypt, Palestine, &c.), and *Epomophorus gambianus* (Guinea coast to Sennaar and Abyssinia); only one of the twenty-one peculiar forms, viz. *Epomophorus wahlbergi haldemani*, extends eastward a little beyond the borders of the province, into German and British East Africa.

Suggestions as to a possible subdivision of the province would be premature; in too many cases the range of the genera and species is only imperfectly known. Some species (*Hypsignathus monstrosus*, *Micropteropus pusillus*) have a continuous distribution from Gambia, along the Guinea coast, through the Congo Basin to Victoria Nyanza; in other cases the area is divided between several species of one genus: *Epomops буттikoferi* in Liberia and Sierra Leone, *E. franqueti* from the Gold Coast, east to Victoria Nyanza, south to Loanda, *E. dobsoni* in Benguela and Katanga; *Myonycteris leptodon* in Liberia and Sierra Leone, *M. wroughtoni* in the Welle district of the Congo Basin, *M. torquata* in the Lower Congo district and Angola.

*Islands in Gulf of Guinea.*—The following species have been recorded from the islands of Fernando Po, Principe, San Thomé,

and Annobon :—Fernando Po, *Eidolon helvum*, *Hypsignathus monstrosus*, *Scotonycteris zenkeri* : Principe, *Eidolon helvum* : San Thomé, *Eidolon helvum*, *Myonycteris brachycephala* : Annobon, *Eidolon helvum*. *Myonycteris brachycephala* is known only from San Thomé, and the sole representative of the subgenus *Phygetis* ; all the other three species are common to the islands and the adjacent coasts of the continent.

*East African province*.—3 genera (*Eidolon*, *Rousettus*, *Epomophorus*), 10 species. This province is incomparably poorer than W. Africa, both in genera and species and in the number of really peculiar forms. None of the genera is autochthonous. *Eidolon helvum*, *Rousettus ægyptiacus*, and *Epomophorus gambianus* are common to this and the foregoing province ; the other seven forms (two *Rousettus*, five *Epomophorus*) are entirely East African.

*Rousettus leachi* ranges from the Cape Colony north to British East Africa, and is in Egypt and part of West Africa replaced by *R. ægyptiacus* ; *Epomophorus wahlbergi wahlbergi* likewise from the Cape Colony to British East Africa, and is replaced in West Africa by *E. w. hildebrandi* ; *Epomophorus crypturus* extends from Transvaal to Nyasaland, and is replaced northward, from Tanganyika to Erythrea, by *E. anurus*. It will be noticed that the southern forms have as a rule an unbroken distribution from the Cape Colony or Transvaal north to British East Africa or at least to Nyasaland.

*South Arabia*.—2 genera, 2 species. Affinities decidedly African, *Eidolon sabæum* (autochthonous) being closely related to the widely-distributed African *E. helvum*, *Rousettus arabicus* to the East African *R. leachi*. *R. arabicus* extends as far east as Karachi, N.W. India.

*Pemba Island*.—Remarkable by being inhabited by a distinct species of *Pteropus*, although the genus is absent from the whole continent of Africa. The Pemba species (*Pt. voeltzkowi*) is closely related to a Malagasy form (*Pt. comorensis*).

### *Malagasy Region.*

2 genera, 9 species (10 forms : *Eidolon* one, *Pteropus* nine) ; neither of the genera is confined to this region, but all the species are peculiar. The single species of *Eidolon* (*E. dupreanum*, closely related to the Ethiopian *E. helvum*) is apparently restricted to the island of Madagascar, while *Pteropus* is distributed over the whole of the Malagasy region. The affinities of the Malagasy *Pteropus* fauna have been discussed elsewhere (pp. 79–80).

### *Indian and Ceylonese subregions.*

3 genera, 7 species (8 forms), viz. *Rousettus* (three species), *Pteropus* (two species), *Cynopterus* (two species, three forms). *Rousettus arabicus* is a South Arabian species which only enters the

north-west corner of the Indian Peninsula; *R. leschenaulti* occurs all over the Peninsula, as well as in Indo-China, but is in Ceylon replaced by a very closely related peculiar form, *R. seminudus*. *Pteropus giganteus* is the Indian and Himalayan representative of the Indo-Malayan *Pt. vampyrus* (from which it only differs in trivial details); Peninsular specimens (subspecies *giganteus*) are indistinguishable from Ceylonese, but slightly different from Himalayan (subspecies *leucocephalus*) and Maldivic specimens (*ariel*). *Cynopterus sphinx* has in continental South Asia differentiated into two subspecies, the one (*sphinx*) ranging over the southern and eastern provinces of the Indian Peninsula, south to Ceylon, north-east to northern Indo-China, the other (*gangeticus*) known only from the central and north-western provinces of India. In addition to *Rousettus seminudus* Ceylon possesses a second peculiar Fruit-bat, *Cynopterus brachyotis ceylonensis*, to which there is no equivalent in the Indian Peninsula, all the other forms of *C. brachyotis* being Indo-Malayan or Indo-Chinese.

*Indo-Chinese subregion.*

6 genera, 14 species (15 forms), viz. *Rousettus* (two species), *Pteropus* (seven species, eight forms), *Cynopterus* (two species), *Sphaerias* (one), *Eonycteris* (one), *Macroglossus* (one).

*Continental Indo-China.*—*Rousettus leschenaulti* and *Cynopterus sphinx sphinx* are invaders from west, the Indian Peninsula; the same may be said of the Himalayan *Pteropus giganteus leucocephalus*, but it is subspecifically distinct from the Indian form. Evidence of the affinities of the present area with Indo-Malaya are, first, the direct invaders from the latter; second, those forms which, though subspecifically or specifically distinct, are undoubtedly closely related to Indo-Malayan forms. To the first category belong *Rousettus amplexicaudatus*, *Eonycteris spekei*, and *Macroglossus minimus*. To the second, *Pteropus intermedius* (Tenasserim), a representative of the Indo-Malayan *Pt. vampyrus*; *Pt. lylei* (Siam and Saigon), a peculiar species of the same group; and *Pt. hypomelanus condorensis* (Siam, Cambodia, Pulo Condor), a local race of a widely-distributed Indo- and Austro-Malayan species. *Cynopterus brachyotis angulatus*, rather than being an invader from south, is perhaps an Indo-Chinese form which has spread southward through Lower Siam to Sumatra. Finally, *Sphaerias blanfordi* is a highly peculiar autochthonous genus and species of the *Cynopterus* group so far known only from Burma.

*Formosa.*—The single species recorded, *Pteropus formosus*, has its closest relatives to the south in the Amboina group (*Pt. liops*), to the north in the South Liu-kin islands (*Pt. dasymallus*).

*South Liu-kin islands.*—The two species of *Pteropus* known from these islands belong to different groups of the genus. *Pt. dasymallus* is, as mentioned above, the local representative of the Formosan *Pt. formosus*; *Pt. lochoënsis* a species of the otherwise entirely Polynesian *Pt. mariannus* group.

*Indo-Malayan subregion.*

13 genera, 36 species (55 forms). Of the genera seven (all monotypic) are peculiar, viz. one of the *Roussettus* section (*Dobsonia* branch), *Harpionycteris*, and six of the *Cynopterus* section, *Ptenochirus*, *Megerops*, *Dyacopterus*, *Balionycteris*, *Chironax*, and *Penthetor*. Twenty-seven species (forty-six forms) are peculiar. Only one or two forms have entered the present subregion from the west (Indo-China), viz. *Cynopterus splinx* (here differentiated as a distinct subspecies, *tittthecheilus*) and, perhaps, *Cynopterus brachyotis angulatus*; but four species have spread in the opposite direction, from Indo-Malaya into Indo-China, viz. *Roussettus amplexicaudatus*, *Pteropus hypomelanus*, *Eonycteris spelæa*, and *Macroglossus minimus*. *Macroglossus lagochilus* is the only species which is widely distributed both in Indo- and Austro-Malaya, but four other Indo-Malayan species extend into the extreme western or south-western Austro-Malaya, viz. *Pteropus minimus* and *Cynopterus brachyotis* to Celebes, *Roussettus amplexicaudatus* and *Pteropus vampyrus* to Timor.

*Malay Peninsula, Sumatra, and Borneo.*—Taken as a whole this “province” is characterized, as against any other part of Indo-Malaya, by the presence of four peculiar genera, *Megerops* (*ecaudatus*), *Dyacopterus* (*spadiceus*), *Balionycteris* (*maculata*), and *Penthetor* (*lucasi*). It must be mentioned, however, that *Balionycteris* has its “equivalent” in Java (*Chironax*), and *Penthetor* a close relative in western Austro-Malaya (*Thoopterus*). The status of the Malay Peninsula, Sumatra, and Borneo *inter se* is, judged by the Megachiroptera, practically the same as if judged by any other large group of Mammalia, i. e. they are undoubtedly closely connected zoogeographically, while at the same time each has certain distinctive features, these latter decidedly more pronounced in the Bornean than in the Peninsular and Sumatran faunas. Borneo has two peculiar genera (*Dyacopterus*, *Balionycteris*) and four peculiar forms, the Malay Peninsula and Sumatra have no peculiar genera, but each one peculiar form. The following forms are common to all three areas, viz. *Roussettus amplexicaudatus*, *Cynopterus brachyotis*, *Megerops ecaudatus*, and *Penthetor lucasi* (not actually recorded from Sumatra itself, but from the Rhio Archipelago); of these the two latter are the most important, since found nowhere outside this province; the two former have a wider distribution in Indo-Malaya. The following are common to the Malay Peninsula and Sumatra, but unknown from Borneo, viz. *Pteropus vampyrus malaccensis* (in Borneo replaced by *Pt. v. natuna*), *Cynopterus brachyotis angulatus*, *Eonycteris spelæa* (in Borneo replaced by *E. major*), and *Macroglossus minimus* (in Borneo replaced by a form of *M. lagochilus*). No form is common to Sumatra and Borneo but absent in the Malay Peninsula, and none is common to the Malay Peninsula and Borneo but absent in Sumatra.



*Andamans*.—Only *Pteropus* (two species) and *Cynopterus* (a local form of *C. brachyotis*) have found their way to these islands. All three forms are peculiar. Of the two species of *Pteropus*, one (*Pt. tytleri*) belongs to the *Pt. melanotus* group, a group entirely confined to the Andaman, Nicobar, Nias, Engano, and Christmas island chain; the other (*Pt. satyrus*) to the widely-distributed *Pt. hypomelanus* group. *Cynopterus brachyotis* is a common Indo-Chinese and Indo-Malayan type.

*Nicobars*.—As in the Andamans, one species of the *Pteropus melanotus* group (*Pt. melanotus*), one of the *Pt. hypomelanus* group (*faunulus*), and one local form of *Cynopterus brachyotis*, all three forms peculiar, though closely related to those of the Andamans.

*Nias*.—*Macroglossus minimus sobrinus* (also in Sumatra); a peculiar species of the *Pteropus melanotus* group (*Pt. niadicus*), most nearly allied to the Nicobar species of that group (the whole of the *Pt. melanotus* group is absent in Sumatra); no less than three peculiar forms of *Cynopterus*, viz. one local subspecies of *C. brachyotis* (a different subspecies in Sumatra), one species (*major*) allied to *C. brachyotis angulatus* (Indo-China, Malay Peninsula, Sumatra), and one unusually well-differentiated species (*princeps*) of the "*Niadus*" section of *Cynopterus* (represented in Sumatra by *C. horsfieldi*).

*Engano*.—A peculiar local form of *Pteropus hypomelanus*, a peculiar species of the *Pt. melanotus* group (*Pt. modigliani*), and the widely-distributed *Rousettus amplexicaudatus*. The differences from the fauna of the neighbouring Sumatra are striking; that many Sumatran types are absent in this outlying island, was only to be expected; but the *Pt. hypomelanus* and *melanotus* groups, though represented in Engano, are unknown in Sumatra.

*Christmas Island* (S. of Java).—One peculiar species of *Pteropus*, belonging to a group of the genus (*Pt. melanotus*) represented elsewhere only in Engano, Nias, the Nicobars, and Andamans.

*Java*.—The Fruit-bat fauna of Java, like its Mammalian fauna in general, is remarkable (1) by the absence of certain types found in Sumatra and Borneo, (2) by the relatively large number of autochthonous forms, and (3) by its complicated affinities, these pointing partly toward the neighbouring islands, partly with exclusion of these latter toward Indo-China. To take these three categories of faunistic characters separately:—(1) The following forms present both in Sumatra (and the Malay Peninsula) and Borneo are absent from Java, viz. *Rousettus amplexicaudatus*, *Cynopterus brachyotis brachyotis*, *Megascops (caudatus)*, and *Penthetor (lucasi)*: (2) Of ten forms known from Java six are peculiar, one of these (*Chironax melanocephalus*) being a peculiar genus: (3 a) Forms indicating affinities with Sumatra, or Borneo, or both,

viz. *Rousettus minor*, the Javan representative of *R. amplexicaudatus*; *Pteropus vampyrus vampyrus*, replaced in Sumatra by *Pt. v. malaccensis*, in Borneo by *Pt. v. natunæ*; *Cynopterus brachyotis javanicus*, a local form of the widely-distributed *C. b. brachyotis*; *Cynopterus horsfieldi horsfieldi*, replaced in Sumatra by *C. h. lyoni*, while the species is absent in Borneo; *Chironax melanocephalus*, represented in Borneo by *Balionycteris maculata*, both genera having no equivalent elsewhere; *Eonycteris spelæa*, also in Sumatra, but in Borneo a distinct species (*major*); *Macroglossus minimus*, also in Sumatra, but in Borneo a distinct species (*lagochilus*): (3*b*) Evidence of affinities with Indo-China, with exclusion of Sumatra and Borneo, *Rousettus shortridgei*, closely allied to the Indo-Chinese *R. leschenaulti*, a bat which has no representative elsewhere in Indo-Malaya; probably also *Cynopterus sphinx titthæcheilus* (though this form is common to Java and Sumatra), *Cynopterus sphinx* being decidedly not an Indo-Malayan but an Indian and Indo-Chinese type, which, probably, in Java has differentiated into a distinct race, *C. s. titthæcheilus*, which again has spread westward to Sumatra, eastward to Lombok, perhaps as far as Timor.

*Philippines*.—7 genera, 13 species (14 forms). The general characters of the Fruit-bat fauna (which is, of course, still imperfectly known) would seem to be these: the autochthonous element is strongly developed (two genera, one of which is so peculiarly modified that it has recently been proposed to separate it in a distinct subfamily, six species, nine forms), the affinities of the autochthonous forms are partly Indo-Malayan, partly Austro-Malayan, while one species has its closest known relatives in the Bonin and Pelew Islands; in addition, some direct invasion has taken place both from Indo-Malaya (Borneo) and Austro-Malaya (Celebes), perhaps also, though if so to a much less extent, movements in the opposite direction. The details are:—Indigenous genera: *Harpionycteris* (*whiteheadi*), a highly peculiar genus, with no nearer relative than the Austro-Malayan *Dobsonia*; *Ptenochirus* (*jayori*), closely allied to *Cynopterus*, and most closely to its "*Niadius*" section, which is known only from the Malay Peninsula, Sumatra, Nias, and Java. (2) Indigenous representatives of (essentially) Indo-Malayan species: *Pteropus hypomelanus cagayanus*; *Pt. vampyrus lanensis*. (3) Indigenous representatives of Austro-Malayan species: *Pteropus pumilus*, closely allied to *Pt. griseus* (Bonerato, Dyampea, Timor); *Acerodon jubatus* and *lucifer*, all other forms of *Acerodon* being Austro-Malayan. (4) Indigenous representative of an otherwise exclusively north-west Polynesian group: *Pteropus leucopterus*, allied to *Pt. pselaphon* (Bonin Islands) and *Pt. pelewensis* (Pelew Islands). (5) Probable invaders from Indo-Malaya (Borneo): *Rousettus amplexicaudatus*; *Pteropus speciosus* (?); *Cynopterus brachyotis brachyotis*; *Macroglossus lagochilus lagochilus*. (6) Invader from Celebes (or from the Philippines into Celebes): *Pteropus minimus*.

*Austro-Malayan Subregion.*

15 genera, 80 species (93 forms), thus much richer in species than any other subregion, the number of species being more than twice that of Indo-Malaya; 43 per cent. of all known genera and exactly the same percentage of all known species are represented in this subregion. Of the fifteen genera seven (with altogether nineteen species) are peculiar, viz. four of the *Rousettus* section, *Boneia* (one species), *Pteralopex* (two), *Styloctenium* (one), and *Dobsonia* (twelve); one of the *Cynopterus* section, *Thoopterus* (one); and two *Macroglossinae*, *Melonycteris* (one) and *Nesonycteris* (one). The affinities of these seven autochthonous genera are as follows:—*Boneia* is closely related to the widely-spread *Rousettus*; *Pteralopex* and *Styloctenium* are offshoots from the even more widely-distributed *Pteropus*; *Dobsonia* is an unusually peculiarly modified genus with only one near relative, the Philippine *Harpyionycteris*, and is both by its comparatively large number of species, all strictly confined to this subregion, by its many aberrant characters, and by its distribution over practically the whole area from Celebes to the Solomon Islands, zoogeographically perhaps the most important of the autochthonous genera; *Thoopterus* is the Austro-Malayan representative of the Indo-Malayan *Penthetor*; while *Melonycteris* and *Nesonycteris* have no closer relative than the Polynesian *Notopteris*. The non-autochthonous genera are, *Rousettus*, *Pteropus*, *Acerodon* (found elsewhere only in the Philippines), *Cynopterus* (only entering the extreme western part of Austro-Malaya), *Nyctimene* (entirely Austro-Malayan, except for one Australian species, and one common to New Guinea and Australia), *Eonycteris* (ranging from Indo-Malaya only to Celebes), *Macroglossus* (from Indo-China to the Solomon Islands), and *Syconycteris* (entirely Austro-Malayan, except for one Australian species). If *Nyctimene* and *Syconycteris* were added to the number of autochthonous genera, and they could evidently be so without much error, the number of such genera would be no less than nine (out of fifteen), with altogether thirty-three species, so that the number of peculiar species belonging to peculiar genera would be 41 per cent. of the total number of species known from the subregion.

Seventy-one of the eighty species (89 per cent.) are entirely confined to Austro-Malaya. The nine species that are not wholly restricted to this subregion are:—(1) such as extend from Indo-Malaya only to the Lesser Sunda Islands, viz. *Rousettus amplexicaudatus*, *Pteropus vampyrus*, and *Cynopterus sphinx* (subsp. *tithæcheilus*); (2) one extending from Indo-Malaya only to Celebes, *Cynopterus brachyotis* (subsp. *brachyotis*); (3) such as extend from Indo-Malaya over a greater part of Austro-Malaya, but here differentiated into a number of subspecies, viz. *Pteropus hypomelanus* and *Macroglossus lagochilus*; (4) one common only to the Philippines and Celebes, *Pteropus mimus*; (5) such as are common to New Guinea and Australia, viz. *Pteropus conspicillatus* and *Nyctimene papuanus*.

*Celebes and Sanghir Islands*.—11 genera, 17 species (excluding a few doubtful records from literature). Two genera, both monotypic, are peculiar, *Boneia*, closely allied to *Rousettus*, and *Styloctenium*, closely allied to *Pteropus* and more particularly to the entirely Austro-Malayan *Pt. temminckii* group, one species of which (*Pt. personatus*) occurs also in Celebes. So far as the records go (for there is no doubt still much to be added to our knowledge of the Fruit-bats of Celebes and Austro-Malaya in general) seven species seem to be confined to Celebes, with the Sanghir islands, viz. *Rousettus celebensis*, *Boneia bidens*, *Pteropus dobsoni*, *Styloctenium wallacei*, *Dobsonia exoleta*, *Nyctimene minutus*, and *Eonycteris rosenbergi*; and in connection with these may be mentioned *Pteropus hypomelanus macassaricus*, *Pteropus alecto*, and *Acerodon celebensis*, though the first is known to extend north to the Talaut islands, the second south through Salayer to Lombok, and the third south to Salayer and east to the Sula Islands. An analysis of the relationships of the fauna gives this result:—(1) Indigenous species pointing, geographically, in uncertain direction, *Rousettus celebensis*, a rather peculiar, narrow-toothed species of doubtful affinities, and *Boneia bidens*: (2) Indigenous species of an otherwise entirely Indo-Malayan genus, *Eonycteris rosenbergi*: (3) Forms common to Celebes and some part of Indo-Malaya (Borneo and Philippines), *Pteropus minus*, *Cynopterus brachyotis brachyotis*, and *Macroglossus lagochilus lagochilus*: (4) Distinct form with quite close relatives both in Indo- and Austro-Malaya, *Pteropus hypomelanus macassaricus*: (5) Distinct forms with clearly pronounced Austro-Malayan affinities, *Pteropus dobsoni*, *Pt. alecto*, *Acerodon celebensis*, *Styloctenium wallacei*, *Dobsonia exoleta*, and *Nyctimene minutus*: (6) Forms common to the Celebes and Moluccas (Gilolo group, or Amboina group, or both), *Pteropus caniceps*, *Pt. personatus*, *Thoopterus nigrescens*, and *Nyctimene cephalotes*. The general conclusion is that, while the Indo-Malayan element is by no means inconspicuous, the Austro-Malayan affinities of the Fruit-bat fauna are decidedly predominant.

*Amboina group* (Buru, Amboina, Ceram, and smaller islands) and *Banda Islands*.—6 genera, 14 species. Of the Celebean genera, *Boneia*, *Acerodon*, *Styloctenium*, *Cynopterus*, *Thoopterus*, and *Eonycteris* are absent, but *Syconycteris* has been added. No genus is autochthonous. Five species are (so far as known) restricted to this group of islands, viz. *Pteropus pallidus* (closely allied species in Celebes and Timor), *Pt. liops* (no very close relative until in Formosa), *Pt. chrysoproctus* (perhaps also in Sanghir islands; curiously enough no closely related species until in the Solomon islands, where the group is widely distributed), *Pt. ocularis* (closely allied species in the Gilolo group and New Guinea), and *Nyctimene varius* (a closely allied species in Celebes); to these may be added two peculiar subspecies, *Dobsonia viridis umbrosa* (another subspecies in the Key Islands) and *Syconycteris crassa major* (other subspecies in the Papuan section of Austro-Malaya). The non-

peculiar element points towards any of the surrounding islands, the Gilolo group, Celebes, South West Islands (Timor), South East Islands (Timor Laut, Key, Aru), and New Guinea, it being in most cases mere conjecture whether the movements have taken place from the Amboina group, into the neighbouring group or in the opposite direction.

*Gilolo group* (Morotai, Gilolo, Ternate, Batjan, &c.).—4 genera, 7 species; but the fauna is no doubt more imperfectly known than that of the Amboina group. The faunistic leanings are more decidedly toward Celebes than to the Amboina group and New Guinea, but a large number of Celebean genera are absent from the list, viz. *Rousettus*, *Bonasia*, *Acerodon*, *Styloctenium*, *Cynopterus*, *Eonycteris*, and *Macroglossus*; the absence of *Rousettus* and *Macroglossus*, both generally distributed elsewhere in Indo- and Austro-Malaya, may be due to incompleteness of the records. As in the case of the Amboina group, no genus is autochthonous. Two species seem to be confined to the Gilolo group, *Dobsonia crenulata* (a closely allied species in the Amboina group, viz. *D. viridis*) and *Nyctimene albiventer* (its closest relative in New Guinea); in addition to these, one autochthonous subspecies of *Pteropus hypomelanus* (other subspecies in Celebes and New Guinea, but not in the Amboina group). Specimens common with Celebes and Sanghir Islands are, *Pteropus caniceps*, *Pt. personatus*, and *Thoopterus nigrescens* (genus confined to Celebes and the present group). One species is common with N.W. New Guinea, *Pteropus chrys-auchen*.

*New Guinea* (including Ghebi, Salawati, Mysol, and Waigeou, but excluding the satellite islands to the north, east, and south).—7 genera, 16 species. The genera are the same as those occurring in the Amboina group, with the single addition of the monotypic *Melonycteris*; but all the species, except one, are different. No genus is strictly confined to New Guinea, the nearest approach being *Melonycteris*, which is known only from this island and the Bismarck Archipelago. No zoogeographical province has so rich a *Nyctimene* fauna, all four natural groups of this genus being represented, and two of the groups (the *cyclotis* and *aëlla* groups) found nowhere else. Six species are autochthonous, viz. *Pteropus epularius* (closely allied to *Pt. macrotis* from the Aru Islands), *Dobsonia minor* (no close relative elsewhere), *D. magna* (scarcely more than subspecifically distinct from *D. moluccensis* from the Amboina group and Aru Islands), *Nyctimene cyclotis* and *certans* (two closely allied peculiar species), and *N. aëlla* (peculiar species); to these may be added *Pteropus papuanus* (doubtfully distinct from *Pt. neohibernicus* from the Bismarck Archipelago), and *Pt. hypomelanus luteus* and *Nyctimene geminus*, both of which have spread only to the small islands at the eastern extremity of New Guinea; making, at the very highest, nine quite or nearly autochthonous forms out of a total of sixteen. The distribution of the seven forms not entirely

confined to New Guinea is: (1) occurring both west (Amboina group) and east of New Guinea (Solomon Islands), *Rousettus brachyotis*: (2) common with the Gilolo group, *Pteropus chrysauchen*: (3) common with the Key and Aru Islands, but not extending to Australia, *Macroglossus lagochilus nanus*: (4) common with Australia and also with either Key or Aru Islands (if not both), *Nyctimene papuanus* and *Syconycteris crassa papuana*: (5) direct invader from New Guinea through the Torres Straits islands into Australia, *Pteropus conspicillatus*: (6) common with the Bismarek Archipelago only, *Melonycteris melanops*. A faunistic contrast between the North-west and South-east of New Guinea is, so far, only indicated by *Pteropus chrysauchen* of the former area (extending to the Gilolo group) being replaced in the latter by its geminate species, *Pt. conspicillatus* (extending to N. Australia); but more definite suggestions for a subdivision of New Guinea into faunistic districts may be derived from the distribution of the species of *Nyctimene* when better known.

*Key Islands*.—Four genera have been recorded, *Pteropus*, *Dobsonia*, *Nyctimene*, and *Syconycteris*, each (so far as known with certainty) represented by one form; in addition to these, *Macroglossus* probably occurs in the islands. Of the four forms three are peculiar, viz. *Pteropus keyensis*, a species allied to *Pt. melanopogon* from the Amboina group, Banda Islands, and Timor Laut, but with no close relative in New Guinea; *Dobsonia viridis viridis*, also with Amboinan affinities (no equivalent in New Guinea); and *Syconycteris crassa keyensis*, which is more intimately connected with the New Guinean than with the Australian race of the species. The fourth form, *Nyctimene papuanus*, is common to the Key Islands and New Guinea. As evident from this, the Fruit-bat fauna shows both New Guinean and Amboinan affinities, and the former are in so far more intimate than the latter, as the two Amboinan forms have differentiated the one into a distinct species, the other into a subspecies, whereas of the two New Guinean forms the one is unchanged, the other distinguishable as a subspecies.

*Aru Islands*.—*Nyctimene* has not been recorded from these islands, otherwise the genera are the same as in the Key Islands, but the relative distinctness of the Aru fauna is shown by the fact that no form is known with certainty to be common to both groups (*Dobsonia moluccensis* and *Macroglossus lagochilus nanus* may occur in both). The affinities point partly toward the Key Islands and the Amboina group (*Pteropus aruensis*, a peculiar species, related to *Pt. keyensis* and to the Amboinan *Pt. melanopogon*; and *Dobsonia moluccensis*, indistinguishable from the Amboinan form), partly and more decidedly toward New Guinea (two common forms, *Macroglossus lagochilus nanus* and *Syconycteris crassa papuana*; one distinct species, *Pteropus macrotis*, closely allied to the New Guinean *Pt. epularius*).

*Bismarck Archipelago*.—7 genera, 8 species. Four (or, if *Pteropus neohibernicus* is distinguishable from *Pt. papuanus*, five) forms are peculiar. Naturally the fauna is chiefly influenced by that of the neighbouring New Guinea; the genera are the same, and of the species and subspecies *Rousettus brachyotis*, *Macroglossus lagochilus nanus*, *Melonycteris melanops*, and (probably) *Pteropus neohibernicus* are direct invaders, *Nyctimene major* and *Syconycteris crassa finschi* only slightly altered indigenous representatives of New Guinean forms. But at the same time there seems to be a distinct Moluccan (non-Papuan) element, represented by *Pteropus capistratus* and *Dobsonia predatrix*, both of which, though well-differentiated indigenous species, have their closest relatives in the Gilolo and Amboina groups, but (so far as known) none in New Guinea.

*Solomon Islands*.—7 genera, 16 species. Whether the genera are compared with those of New Guinea or with those of the Bismarck Archipelago, the result is the same: *Syconycteris* is absent, *Melonycteris* is replaced by the closely related *Nesonycteris*, and *Pteralopex* is added, otherwise there is no change. But the amount of autochthonous forms is enormous, all being peculiar, except *Rousettus brachyotis*, and of the seven genera two (with altogether three species) are peculiar, viz. those just referred to, *Pteralopex* and *Nesonycteris*. The sixteen species may be classed according to their probable faunistic and natural affinities as follows:—(1) Direct invader from west, *Rousettus brachyotis*, ranging from Amboina, through New Guinea and the Bismarck Archipelago, to these islands: (2) Indigenous representatives of New Guinean types, three, viz. *Nyctimene scutulus*, most closely allied to *N. geminus* from New Guinea and *N. major* from the Bismarck Archipelago; *Macroglossus lagochilus microtus*, the most closely allied races of which are found in the Bismarck Archipelago and New Guinea; *Nesonycteris woodfordi*, as mentioned above the Solomon Islands representative of *Melonycteris melanops* from New Guinea and the Bismarck Archipelago: (3) Indigenous species having their closest known relatives in the Moluccas only or both in the Moluccas and Bismarck Archipelago, but apparently none in New Guinea (compare remarks on the Moluccan element in the fauna of the Bismarck Archipelago); here belong, first, five species of *Pteropus*, viz. *Pt. grandis*, *lavellanus*, *rubianus*, *rayneri*, and *coquatus*, all representatives of the *Pt. rayneri* group, the only other known species of which inhabits the Amboina group: second, the two species of *Dobsonia*, *D. incrimis* and *nesea*, representing a group of the genus inhabiting the Amboina group, Gilolo group, and Bismarck Archipelago, but not known to occur on the continent of New Guinea: (4) Indigenous species having their closest relatives in Australia, three, viz. *Pteropus woodfordi*, a species strikingly similar in all essential characters to the peculiar Australian *Pt. scapulatus*, only much smaller; *Pteropus colonus* and *solomonis*, two species of the *Pt. hypomelanus* group and both perhaps most closely related to the Australian *Pt. brunnescens*:

(5) Indigenous representatives of a chiefly Polynesian type, the peculiar genus *Pteralopex* (two species), allied to the *Pteropus pselaphon* group, the members of which are North-west Polynesian in distribution, with the exception of one species occurring in the Philippines.

A discussion of the distribution of the various species throughout the Solomon Archipelago would to a great extent be premature; the Fruit-bat fauna of northern chain of islands (Choiseul, Isabel, Malayta) is as yet entirely unknown, that of the extreme eastern islands (San Christoval group) very imperfectly explored, and there is probably not a little to be added to our knowledge of the Fruit-bats of the other islands as well. But two important facts are already now sufficiently well established to call for some comment here. First, that some species (*Rousettus brachyotis*, *Nyctimene scitulus*, *Nesonycteris woodfordi*, and probably *Pteropus woodfordi*) are evidently uniformly distributed from the Bougainville group in the west eastward through the southern chain at least as far as Guadalcanar. Second, that in spite of this spreading of a few species over the greater part (if not the whole) of the Archipelago, there is unmistakable evidence that the Fruit-bat fauna of the Solomon Islands consists in reality of a series of more or less distinctly separated "faunulæ." This is most clearly shown by the distribution of the species of the *Pteropus rayneri* group: *Pt. grandis* inhabits the Bougainville group, is in Vella Lavella replaced by *Pt. lavellanus*, in the New Georgia group by *Pt. rubianus*, in the Guadalcanar group by *Pt. rayneri*, and in the San Christoval group by *Pt. cognatus*. Other, though much less complete, evidence to the same effect is afforded by the two species of the *Pteropus hypomelanus* group (*Pt. colonus* in the Bougainville group, replaced by *Pt. solomonis* in the New Georgia group), the two species of *Pteralopex* (*uniceps* in the Bougainville group, replaced by *atrata* in the Guadalcanar group), and the two *Dobsonia* (*nesca* in the Bougainville and New Georgia groups, replaced by *inermis* in the San Christoval group) [compare the distribution of the three known Solomon Islands species of the Microchiropteran genus *Hipposiderus*, *H. dinops* in the New Georgia group, *H. oceanitis* in Guadalcanar, and *H. demissus* in San Christoval]. The faunistic areas of the Solomon Archipelago indicated by the distribution of the five species of the *Pteropus rayneri* group are very nearly the same as those lately recognized by ornithologists.

#### *Australian subregion (Continent of Australia).*

3 genera (none peculiar), 8 species (six peculiar). The only genera which have reached the Australian continent are *Pteropus* (five species), *Nyctimene* (two), and *Syconycteris* (one); all of these occur also in New Guinea, which however is inhabited, in addition, by four genera which have not spread to Australia, viz. *Rousettus*, *Dobsonia*, *Macroglossus* (extends to the Torres Straits islands, but has thus far not been recorded from Australia), and *Melonycteris*.



As might be expected New Guinean affinities are predominant, no less than five of the eight species pointing in their origin, either undoubtedly or at least probably, toward the great neighbouring island: *Pteropus conspicillatus* and *Nyctimene papuanus* are direct unchanged invaders from New Guinea; *Pteropus poliocephalus* is probably the Australian representative of *Pt. epularius* (New Guinea) and *Pt. macrotis* (Aru Islands); *Nyctimene robinsoni*, a rather peculiar species, is perhaps most closely related to *N. geminus* (New Guinea) and *N. lullula* (Woodlark Island); and *Syconycteris australis* differs only in trivial characters from *S. crassa*, a species which, differentiated into several local forms, ranges over New Guinea and its satellites, west to the Amboina group. Two Australian species of *Pteropus*, *scapulatus* and *brunneus*, have, so far as known, no equivalent in New Guinea, but related forms inhabit the Solomon Islands (*woodfordi*; *colonus* and *solomonis*). And one species, *Pteropus gouldi*, points toward the Lesser Sunda Islands and Celebes, being very closely allied to *Pt. alecto*. No Fruit-bat has been recorded from Western Australia, south of the Kimberley Division, or from Southern Australia, west of Melbourne; and the single record (by Temminck, but contradicted by Gould) of a Fruit-bat from Tasmania (*Pteropus poliocephalus*) remains unsupported by recent evidence.

#### *Polynesian subregion.*

*Pteropus* (18 species) and *Notopterus* (2) are the only genera represented. All species of *Pteropus*, as well as the genus *Notopterus*, are peculiar. The eighteen species of *Pteropus* represent five natural groups of the genus: the *Pt. hypomelanus* group has spread only to New Caledonia (one species) and the Loyalty Islands (another); the closely related *Pt. mariannus* group covers (with seven species) practically the whole of the subregion, so far as inhabited by Fruit-bats, except the Bonin Islands, and the group is entirely Polynesian, except for one species that has established itself in the South Liu-Kiu Islands; the *Pt. lombocensis* group is represented only in the Carolines (one species); the *Pt. pselaphon* group ranges (with five species) over north-western Polynesia, from the Bonin Islands, south through the Pelew Islands and Carolines, to the Santa Cruz Islands, and is again entirely Polynesian, except for one species inhabiting the Philippines; farther south and east in Polynesia (New Hebrides, Fijis, Samoas) it is replaced by the related and purely Polynesian *Pt. samoensis* group (three species). Each of the eighteen species is (so far as known) confined to one group of islands, except *Pt. geddiei*, which is common to the New Hebrides and the neighbouring New Caledonia, and *Pt. tonganus*, which is common to the Fijis, Tongas, and Samoas. The autochthonous genus *Notopterus* has its closest relatives in the Solomon Islands (*Nesonycteris*) and the Bismarck Archipelago and New Guinea (*Melonycteris*): it has thus far been recorded from the Carolines in the north, and New Caledonia, New Hebrides, and Fiji Islands in the south.

Indications are not wanting that the Megachiropteran fauna of the Carolines, spread as it is over many islands covering a large area, may fall into at least two sections. Thus, the *Pteropus mariannus* group is in the extreme west represented by one species (*yapensis*), in the extreme east by a clearly distinct species (*ualanus*); the *Pteropus pselaphon* group has so far been recorded only from two places in the Carolines, the Ruck Atoll and Mortlock, but specimens from the former (*insularis*) seem to differ from the single available specimen from the latter (*phaeocephalus*).

## V. SYNOPSIS OF THE SUBFAMILIES AND GENERA OF MEGACHIROPTERA.

### I. Molariform teeth not multicuspidate; lower canines not proclivous.

A. Tongue simple: fixed to floor of mouth by posterior half, and without unfringed filiform papillæ at tip (figs. 65 A-H, p. 725) . . . . .

a. Facial axis of skull conspicuously deflected against basicranial axis: alveolar line, if projected backward, passing through middle or upper edge of occipital condyle or even through some point of supraoccipital. . . . .

a'. Incisors never  $\frac{1}{1}-\frac{1}{1}$ , lower canines normal in position, cheek-teeth  $\frac{5}{6}$  or (in *Styloctenium* only)  $\frac{5}{5}$ ; cranial rostrum not shortened, premaxillæ not more reduced than usual; second finger clawed.

a<sup>2</sup>. Occipital (sublambdoid) region of skull not elongate; a short tail (third metacarpal nearly always slightly but distinctly longer than fourth and fifth). [ROUSETTUS SUBSECTION.]

a<sup>3</sup>. Incisors  $\frac{2}{2}-\frac{2}{2}$ .

a<sup>4</sup>. Tympanic forming a short bony auditory meatus, premaxillæ spaced in front; m<sub>1</sub> equal in length to m<sub>2</sub> and m<sub>3</sub> combined. [3 species: Ethiopian and Malagasy regions.] . . . . .

b<sup>4</sup>. No bony auditory meatus, premaxillæ in contact or co-ossified in front; m<sub>1</sub> shorter than m<sub>2</sub> and m<sub>3</sub> combined. [14 species: Ethiopian, E. Mediterranean, Oriental, Austro-Malayan.] . . . . .

b<sup>3</sup>. Incisors  $\frac{1}{2}-\frac{1}{2}$  (i<sup>1</sup> lost), premaxillæ spaced in front. [1 species: Celebes.]

[p. 1.  
I. PTEROPODINÆ,

[ROUSETTUS SECTION.]

1. *Eidolon*, p. 2.

2. *Rousettus*, p. 16.

3. *Boneia*, p. 55.

- U*<sup>2</sup>. Occipital (sublambdoid) region of skull elongate, subtubular; no tail (fifth metacarpal nearly always slightly but distinctly longer than third and fourth. [PTEROPUS SUBSECTION.]
- c*<sup>3</sup>. Incisors  $\frac{2}{2}-\frac{2}{2}$ , cheek-teeth  $\frac{5}{6}$ .
- c*<sup>4</sup>. Premaxillæ in simple contact in front; *i*<sub>2</sub> once and a half to six times the bulk of *i*<sub>1</sub>, upper canines without secondary cusp (except in *Pteropus tuberculatus*).
- a*<sup>5</sup>. No well-differentiated antero-internal tubercle in *p*<sup>1</sup> and *m*<sup>1</sup>, no sharply defined inner basal ledge in *p*<sub>4</sub>, *m*<sub>1</sub>, and *m*<sub>2</sub> (except in *Pt. anetianus*). [85 species, 103 forms: Malagasy, Oriental, Austro-Malayan, Australian, Polynesian; one Ethiopian species.] . . . . . 4. *Pteropus*, p. 61.
- b*<sup>6</sup>. A well-differentiated antero-internal tubercle in *p*<sup>4</sup> and *m*<sup>1</sup> (sometimes also in *p*<sup>3</sup> and *p*<sub>3</sub>), a sharply defined inner basal ledge in *p*<sub>4</sub>, *m*<sub>1</sub>, and *m*<sub>2</sub>. [6 species, 9 forms: Philippines, W. Austro-Malaya.] . . . . . 5. *Acerodon*, p. 412.
- d*<sup>7</sup>. Premaxillæ co-ossified in front (in adults); *i*<sub>2</sub> twelve to fifteen times the bulk of *i*<sub>1</sub>, upper canines with large external secondary cusp, upper molariform teeth with prominent anterior and posterior basal ledges, external main cusp of *p*<sub>4</sub>, *m*<sub>1</sub>, and *m*<sub>2</sub> distinctly bilobed. [2 species: Solomon Islands.] . . . . . 6. *Pteralopex*, p. 432.
- d*<sup>8</sup>. Incisors  $\frac{2}{1}-\frac{2}{1}$  (*i*<sub>1</sub> lost), cheek-teeth  $\frac{5}{6}$  (*m*<sub>3</sub> lost). [1 species: Celebes.] . . . . . 7. *Styloctenium*, p. 442.
- b*<sup>9</sup>. Incisors  $\frac{1}{1}-\frac{1}{1}$  (*i*<sup>1</sup> and *i*<sub>1</sub> lost), lower canines at extremity of mandible, cheek-teeth  $\frac{4}{6}$  (*p*<sup>1</sup> lost); cranial rostrum at least slightly, often considerably shortened, premaxillæ sublinear; second finger without claw, a short tail, wings from spinal line, back seemingly naked (the furred back being covered by the naked wing-membranes). [12 species, 13 forms: Austro-Malayan.] . . . . . 8. *Dobsonia*, p. 448.
- b*. Facial axis very little deflected against basicranial axis: alveolar line, if projected backward, passing through lower edge of occipital condyle or even some distance below condyle (exceptions: *Plerotes* and *Sphærias*).

- c'*. Brain-case peculiarly flattened posteriorly; a small whitish hair-tuft at base of ear-conch anteriorly and posteriorly (except in *Scotonycteris*). [All genera Ethiopian.] ..... [EPOMOPHORUS SECTION.]
- c''*. Cheek-teeth  $\frac{4}{6}$  ( $m^2$  absent), molariform teeth sublinear, with flattened crowns; palate-ridges simple (fig. 29 B, p. 485). [1 species.] ..... 9. *Pterotes*, p. 483.
- d''*. Cheek-teeth  $\frac{3}{5}$  ( $p^1$ ,  $m^2$ , and  $m_3$  absent); some or all of the palate-ridges peculiarly modified.
- e''*. Cranial rostrum long: orbit to tip of nasals much more than lachrymal breadth.
- e''*. Rostrum long and broad, post-dental palate flattened posteriorly.
- c'''*. Rostrum not deeper than usual, premaxillæ in simple contact anteriorly; lower incisors and canines biting against corresponding upper teeth, outer ridge of lower molars simple; muzzle without cutaneous leaves, tail rudimentary (two free caudal vertebræ); males with shoulder pouches and erectile shoulder brushes. [3 species, 4 forms.] .. 10. *Epomops*, p. 487.
- d'''*. Rostrum considerably increased in depth, premaxillæ ankylosed together anteriorly; lower incisors and canines closing some distance in front of upper, outer ridge of lower molars bilobed or trilobed; upper lip with cutaneous leaves, tail absent (no free caudal vertebræ); no shoulder pouches or brushes in either sex. [1 species.] ..... [p. 501.]
- f'''*. Rostrum long and narrow, post-dental palate deeply depressed posteriorly. [8 species, 9 forms.] ..... 11. *Hypsignathus*, [p. 514.]
- f'''*. Cranial rostrum short: orbit to tip of nasals equal to or less than lachrymal breadth. .... 12. *Epomophorus*,
- g'''*. Postzygomatic palate not (or scarcely) narrower posteriorly than anteriorly; head without whitish markings (except for the usual Epomophorine whitish tufts at base of ear-conch anteriorly and posteriorly).
- e'''*. Postzygomatic palate at least as long as broad; maxillary tooth-row extending backward very nearly to ventral margin of orbital

- cavity; soft palate with a deep median groove, narrowing posteriorly. [1 species.] ..... 13. *Micropteropus*, [p. 551.]
- f*<sup>5</sup>. Postzygomatic palate almost twice as broad as long; maxillary tooth-row not nearly reaching ventral margin of orbital cavity; soft palate with a prominent median keel. [1 species.] ..... 14. *Nauonycteris*, p. 559.
- h*<sup>1</sup>. Postzygomatic palate either much narrower posteriorly than anteriorly or entirely absent; head with peculiar white markings.
- g*<sup>5</sup>. Postzygomatic palate long, its lateral margins forming straight lines converging posteriorly; no whitish tufts at base of ear-conch. [1 species.] ..... 15. *Scotonycteris*, p. 563.
- h*<sup>5</sup>. No postzygomatic palate, the mesopterygoid fossa continued forward nearly to level of posterior molar; small whitish hair-tufts at base of ear-conch anteriorly and posteriorly. [1 species.] ..... 16. *Casinycteris*, p. 568.
- d*<sup>1</sup>. Brain-case not flattened posteriorly; no whitish tufts at base of ear-conch ..... [CYNOPTERUS SECTION.]
- e*<sup>2</sup>. Cheek-teeth  $\frac{5}{6}$ ; rostrum less shortened: orbit to tip of nasals subequal to lachrymal breadth. [The only Ethiopian genus of the section: 4 species.] ..... 17. *Myonycteris*, p. 576.
- f*<sup>2</sup>. Cheek-teeth less than  $\frac{5}{6}$ ; rostrum much shortened: orbit to tip of nasals much less than (only in *Sphaerias* subequal to) lachrymal breadth.
- g*<sup>3</sup>. Two or one pair of lower incisors, lower canines normal in position; nostrils not tubular; tongue with three circumvallate papillae.
- i*<sup>1</sup>. Postorbital foramen (through base of postorbital process) present.
- i*<sup>5</sup>. Postorbital foramen large, premaxillae in simple contact in front; cheek-teeth  $\frac{4}{5}$  ( $m^2$  and  $m_3$  lost); membranes from first toe.
- a*<sup>6</sup>. Cranial rostrum much lower at canine than at  $p^3$ ; upper canines with secondary cusp at inner edge; tail present.
- a*<sup>7</sup>. Incisors  $\frac{2}{2}$ — $\frac{2}{2}$ ,  $i^2$  not shortened; upper canines without vertical groove on front face. [6 species, 16 forms: Oriental, W. Austro-Malayan.] ..... 18. *Cynopterus*, p. 586.

- $b^7$ . Incisors  $\frac{2}{1}-\frac{2}{1}$  ( $i_1$  lost),  $i^2$  much shortened; upper canines with distinct vertical groove on antero-medial surface. [1 species: Philippines.] ..... 19. *Ptenochirus*, p. 643.
- $b^6$ . Cranial rostrum as deep in front (at canine) as at  $p^3$ ; no secondary cusp in upper canines; tail absent. [1 species: Indo-Malaya.] ..... 20. *Megacerops*, p. 646.
- $j^1$ . Postorbital foramen extremely small; premaxillæ ankylosed together in front; cheek-teeth  $\frac{3}{5}$  (also  $p^1$  lost); membranes from second toe, tail present. [1 species: Indo-Malaya.] ..... 21. *Dyacopterus*, p. 651.
- $j^4$ . Postorbital foramen absent.
- $k^5$ . Incisors simple (terete, crown not peculiarly differentiated), subvertical, cheek-teeth not narrow; interfemoral and calcar unmodified.
- $c^6$ .  $p^3$  with antero-external basal lobe or cusp.
- $c^7$ . Premaxillæ in simple contact anteriorly; incisors  $\frac{2}{1}-\frac{2}{1}$  ( $i_1$  lost),  $i^2$  much shortened, cheek-teeth  $\frac{5}{5}$  (only  $m_3$  lost),  $p^3$  with large antero-external basal lobe; wings spotted. [1 species: Borneo.] ..... 22. *Balimnyceris*, p. 654.
- $d^7$ . Premaxillæ solidly united anteriorly; incisors  $\frac{2}{2}-\frac{2}{2}$ ,  $i^2$  normal, cheek-teeth  $\frac{4}{5}$  ( $m_3$  and  $m^2$  lost),  $p^3$  with well-defined antero-external basal cusp; wings (probably) not spotted. [1 species: Java.] ..... 23. *Chironax*, p. 658.
- $d^6$ .  $p^3$  unmodified.
- $e^7$ . Incisors  $\frac{2}{2}-\frac{2}{2}$ ,  $i^2$  normal,  $p_4$  and  $m_1$  with surface cusp; tail rudimentary, wings from second toe. [1 species: W. Austro-Malaya.] ..... 24. *Thoopterus*, p. 662.
- $f^7$ . Incisors  $\frac{2}{1}-\frac{2}{1}$  ( $i_1$  lost).  $i^2$  much shortened, no surface cusp in any cheek-tooth; tail about half as long as foot with claws, wings from first toe. [1 species: Indo-Malaya.] ..... 25. *Penthetor*, p. 665.
- $l^5$ . Upper and lower incisors ( $\frac{2}{2}-\frac{2}{2}$ ) procivous, crowns highly differentiated, triangularly pointed,

- cheek-teeth ( $\frac{4}{5}$ ) unusually narrow; interfemoral not extending beyond middle of tibia, calcar and tail absent. [1 species: Indo-China.] ..... 26. *Sphærias*, p. 671.
- h*<sup>3</sup>. Incisors  $\frac{1}{0}-\frac{1}{0}$  (*i*<sup>2</sup>, *i*<sub>1</sub>, *i*<sub>2</sub> lost), cheek-teeth  $\frac{4}{5}$  (*m*<sup>2</sup>, *m*<sub>3</sub> lost), lower canines close together at extremity of mandible; nostrils elongated into cylindrical tubes, tongue with four circumvallate papillæ, tail not much shorter than tibia, wings spotted. [13 species: Austro-Malaya, Australia.] ..... 27. *Nyctimene*, p. 681.
- B. Tongue more extensible, fixed to floor of mouth by its posterior third, its terminal fourth or fifth covered above with unfringed filiform papillæ (figs. 65 I-L, p. 725.) ..... II. MACROGLOSS-
- c*. Premaxillæ not broader in upper than in lower half, infraorbital canal shorter; third metacarpal longest, or third, fourth, and fifth subequal, terminal phalanx of third finger always much shorter than third metacarpal. (*p*<sup>1</sup> and *p*<sub>1</sub> often unusually large, never absent.) ..... [EONYCTERIS SECTION.]
- e*<sup>1</sup>. Premaxillæ in simple contact in front or slightly spaced; cheek-teeth less reduced in size; second finger without claw, tail subequal in length to foot with claws. (Facial axis not strongly deflected: incisors  $\frac{2}{2}-\frac{2}{2}$ , cheek-teeth  $\frac{5}{6}$  or, by suppression of small *m*<sub>3</sub>,  $\frac{5}{5}$ .) [3 species: Indo-Malaya, Celebes.] ..... 28. *Eonycteris*, p. 728.
- f*<sup>1</sup>. Premaxillæ solidly fused in front; cheek-teeth much more reduced; second finger clawed, tail rudimentary or absent.
- g*<sup>2</sup>. Upper incisors minute, crowns not peculiarly differentiated, lower incisors subequal in size; interfemoral and calcar unmodified. (Incisors  $\frac{2}{2}-\frac{2}{2}$ , cheek-teeth  $\frac{5}{6}$ , but individual anomalies in number of cheek-teeth of frequent occurrence in *Macroglossus*.)
- i*<sup>1</sup>. Facial axis much less deflected, premaxillæ less proclivous; *p*<sup>1</sup> (second premolar) much higher than *p*<sub>1</sub>, lower incisors bilobate, subequally spaced; fifth metacarpal much shorter than third, fourth intermediate; males with large neck-tufts. [1 species: Ethiopian.] ..... 29. *Meiaglossus*, p. 738.

- j*<sup>1</sup>. Facial axis strongly deflected, premaxillæ more proclivous; *p*<sup>3</sup> more reduced, little higher than *p*<sup>1</sup>, lower incisors simple, *i*<sub>1</sub>—*i*<sub>1</sub> widely spaced; third, fourth, and fifth metacarpals subequal; males without neck-tufts. [2 species, 6 forms: Indo-China to Solomon Islands.] . . . 30. *Macroglossus*, p. 746.
- h*<sup>2</sup>. Upper incisors large, crown well differentiated, narrowly chisel-shaped, *i*<sub>2</sub> much larger than *i*<sub>1</sub> and with obliquely triangular crown; lateral interfemoral unusually narrow, calcar rudimentary. (Incisors  $\frac{2}{2}$ — $\frac{2}{2}$ , cheek-teeth  $\frac{5}{6}$  or, by suppression of small *m*<sub>3</sub> and *m*<sub>2</sub>,  $\frac{4}{5}$ .) [3 species, 7 forms: Austro-Malaya, Australia.] 31. *Syconycteris*, p. 771.
- d*. Premaxillæ twice or thrice as broad in upper as in lower half, infraorbital canal long; fifth metacarpal longest, terminal phalanx of third finger subequal to or longer than third metacarpal. (*p*<sup>1</sup> and *p*<sub>1</sub> minute or absent.) . . . [NOTOPTERIS SECTION.]
- g*<sup>1</sup>. Premaxillæ in simple contact in front or slightly spaced, angular process of mandible large; *p*<sup>1</sup> and *p*<sub>1</sub> present (cheek-teeth  $\frac{5}{6}$ ), *p*<sub>3</sub> smaller than *m*<sub>1</sub> and *m*<sub>2</sub>; tail absent, membranes from flanks and third or fourth toe, back furred, tibia much less than half the length of forearm.
- i*<sup>2</sup>. Incisors  $\frac{2}{2}$ — $\frac{2}{2}$ ; second finger clawed. (Underparts much darker than back.) [1 species: New Guinea, Bismarck Archipelago.] . . . 32. *Melonycteris*, p. 785.
- j*<sup>2</sup>. Incisors  $\frac{2}{1}$ — $\frac{2}{1}$  (*i*<sub>1</sub> lost); second finger without claw. (Underparts paler than back.) [1 species: Solomon Islands.] . . . 33. *Nesonycteris*, p. 790.
- h*<sup>1</sup>. Premaxillæ co-ossified in front, angular process of mandible small; *p*<sup>1</sup> and *p*<sub>1</sub> absent (cheek-teeth  $\frac{4}{5}$ ), incisors  $\frac{2}{1}$ — $\frac{2}{1}$  (or in adults, *i*<sup>1</sup> being deciduous,  $\frac{1}{1}$ — $\frac{1}{1}$ ), *p*<sub>3</sub> the largest lower cheek-tooth; tail very long, subequal to forearm, membranes from spinal line and first and second toe, back seemingly naked at middle (the furred back being covered by the naked membranes), second finger without claw, tibia longer than usual (half as long as forearm). [2 species: Polynesia.] . . . 34. *Notopterus*, p. 793.



- II. Molariform teeth multicuspidate, lower canines strongly proclivous (crossing upper canines at nearly right angles). . . . .
- Premaxillæ co-ossified in front; incisors  $\frac{1}{1}-\frac{1}{1}$  ( $i^1$  and  $i_1$  lost), lower pair rudimentary, upper canines bicuspidate, lower canines tricuspidate and situated close together at extremity of mandible, cheek-teeth  $\frac{5}{6}$ ; second finger clawed, tail absent, tibia unusually short. [1 species: Philippines.] . . . . .
- III. HARPYIO-  
NYCTERINÆ, p. 799. [p. 799.]
35. *Harpyionycteris*\*,

“Key” to the genera, based entirely on dental and cranial characters.

In the subjoined artificial “key” to the genera such characters of the skull and dentition have been selected as are easily observable and readily understood by anybody with an elementary knowledge of Mammalian osteology and odontology. But the simplification of the key has had to be bought by sacrifice of the serial arrangement of the genera adopted in this Catalogue. [A complete key to the genera of Megachiroptera based entirely or chiefly upon their external characters is an impossibility; a large number of genera, even though they may belong to widely distinct groups of the Suborder, cannot be discriminated with certainty from each other without an examination of the skull and dentition.]

- a. No lower incisors. . . . . *Nyctimene*, p. 681.
- b. One or two pairs of lower incisors.
- a<sup>1</sup>. One pair of lower incisors.
- a<sup>2</sup>. One pair of upper incisors.
- a<sup>3</sup>. Cheek-teeth  $\frac{2}{6}$  on each side . . . . . *Harpyionycteris*, p. 799.
- b<sup>3</sup>. Cheek-teeth  $\frac{1}{6}$  on each side . . . . . *Dobsonia*, p. 148.
- b<sup>2</sup>. Two pairs of upper incisors (middle pair deciduous in *Notopterus*).
- a<sup>4</sup>. Cheek-teeth  $\frac{2}{6}$  on each side . . . . . *Nesonycteris*, p. 799.
- a<sup>5</sup>. Cheek-teeth less than  $\frac{5}{6}$  on each side.
- a<sup>4</sup>. Cheek-teeth  $\frac{5}{5}$ .
- a<sup>5</sup>. Length of rostrum (orbit to tip of nasal) greater than lachrymal breadth (across lower edges of lachrymal foramina);  $m^1$  (penultimate upper cheek-tooth) equal in size to  $p^1$  (antepenultimate) . . . . . *Stylactenium*, p. 112.
- b<sup>5</sup>. Length of rostrum much less than lachrymal breadth;  $m^1$  much smaller than  $p^1$  . . . . . *Balaustopterus*, p. 651.
- b<sup>4</sup>. Cheek-teeth  $\frac{1}{5}$ .
- a<sup>6</sup>. Rostrum long, strongly deflected; lower incisors widely spaced; reduced number of cheek-teeth due to loss of anterior premolar above and below ( $p^1$  and  $p$ ) . . . . . *Notopterus*, p. 793.
- a<sup>7</sup>. Rostrum short, scarcely deflected; lower incisors close together; reduced number of cheek-teeth due to loss of posterior molar above and below ( $m^2$  and  $m_3$ ).
- a<sup>6</sup>. Postorbital foramen (through base of postorbital process) large.

\* On the affinities of *Harpyionycteris*, see p. 803.

- a*<sup>7</sup>. Surface cusps in  $p_4$  and  $m_1$  (third and fourth lower cheek-tooth); upper canines grooved .... *Ptenochirus*, p. 613.  
*b*<sup>7</sup>. No surface cusps in cheek-teeth; upper canines without groove ..... *Megaptrops*, p. 616.  
*b*<sup>6</sup>. Postorbital foramen absent ..... *Penthetor*, p. 665.  
*b*<sup>5</sup>. Two pairs of lower incisors.  
*c*<sup>2</sup>. One pair of upper incisors ..... *Boncia*, p. 55.  
*d*<sup>2</sup>. Two pairs of upper incisors (outer pair often deciduous in *Epomops*).  
*e*<sup>3</sup>. 5 upper cheek-teeth on each side (anterior tooth often deciduous in *Pteropus* and *Acrodon*).  
*e*<sup>4</sup>. A short bony auditory meatus ..... *Eidolon*, p. 2.  
*d*<sup>4</sup>. No bony auditory meatus.  
*e*<sup>5</sup>. Occiput elongate, subulular.  
*e*<sup>6</sup>. Outer lower incisor not more (but generally less) than six times the bulk of inner.  
*e*<sup>7</sup>. No well-defined antero-internal tubercle in  $p^4$  and  $m^1$  (third and fourth upper cheek-tooth). .... *Pteropus*, p. 61.  
*d*<sup>7</sup>. A well-defined antero-internal tubercle in  $p^4$  and  $m^1$  ..... *Acrodon*, p. 112.  
*d*<sup>6</sup>. Outer lower incisor twelve to fifteen times the bulk of inner. .... *Pterolopex*, p. 132.  
*f*<sup>5</sup>. Occiput not elongate.  
*e*<sup>6</sup>. Length of rostrum (orbit to tip of nasals) subequal to lachrymal breadth (across lower edges of lachrymal foramina) ..... *Myonycteris*, p. 576.  
*f*<sup>6</sup>. Length of rostrum conspicuously greater than lachrymal breadth.  
*e*<sup>7</sup>. Outer lower incisor much higher than inner ..... p. 771.  
*f*<sup>7</sup>. Lower incisors subequal in height. *Syconycteris* (pt.).  
*d*<sup>8</sup>. Cheek-teeth not linear ..... *Roussettus*\*, p. 16.  
*b*<sup>8</sup>. Cheek-teeth linear. *Eonycteris*\*, p. 728.  
*a*<sup>9</sup>. Premaxillæ much broader in upper than in lower half ..... *Melonycteris*, p. 785.  
*b*<sup>9</sup>. Premaxillæ not broader above than below.  
*a*<sup>10</sup>. Lower incisors subequally spaced ..... *Megachlossus*, p. 738.  
*b*<sup>10</sup>. Inner pair of lower incisors widely spaced ..... *Macroglossus*, p. 716.  
*f*<sup>9</sup>. Less than 5 upper cheek-teeth on each side.  
*e*<sup>4</sup>. 4 upper cheek-teeth on each side.  
*g*<sup>7</sup>. 6 lower cheek-teeth on each side ..... *Pterotes*, p. 483.  
*h*<sup>8</sup>. 5 lower cheek-teeth on each side.  
*g*<sup>6</sup>. Postorbital foramen (through base of postorbital process) large.  
*g*<sup>7</sup>. Rostrum short, scarcely deflected; inner secondary cusp in upper canines ..... *Cynopterus*, p. 586.  
*h*<sup>7</sup>. Rostrum long, strongly deflected; no secondary cusp in canines ..... *Syconycteris* (pt.), p. 771.  
*h*<sup>6</sup>. Postorbital foramen absent.  
*i*<sup>7</sup>. Incisors proclivous, highly differentiated, triangularly pointed ..... *Sphærias*, p. 671.

\* As pointed out elsewhere (p. 733), it would be difficult to give any reliable (and practically useful) cranial or dental character by which *Eonycteris spelau* and *major* (*E. rosenbergi* differs by the loss of  $m_3$ ) can be discriminated from any species of *Roussettus*, although these two genera belong to different subfamilies. Externally they are easily distinguished (*Roussettus* with, *Eonycteris* without, claw in second finger).

- j*<sup>7</sup>. Incisors subvertical, simple.  
*c*<sup>8</sup>. Surface cusp in third and fourth lower cheek-tooth (*p*<sub>4</sub> and *m*<sub>1</sub>) . . . . . *Theopterus*, p. 662.  
*d*<sup>8</sup>. No surface cusp in any cheek-tooth . . . . . *Chironax*, p. 658.  
*f*<sup>1</sup>. 3 upper [and 5 lower] cheek-teeth on each side.  
*i*<sup>1</sup>. Length of rostrum (orbit to tip of nasals) much greater than lachrymal breadth (across lower edges of lachrymal foramina).  
*i*<sup>6</sup>. Postdental palate deeply depressed posteriorly . . . . . *Epomorphurus*, p. 511.  
*j*<sup>6</sup>. Postdental palate flattened posteriorly.  
*k*<sup>7</sup>. Outer ridge of lower molars simple . . . . . *Epomops*, p. 487.  
*l*<sup>7</sup>. Outer ridge of lower molars bilobed or trilobed . . . . . *Hypsignathus*, p. 501.  
*j*<sup>5</sup>. Length of rostrum less than or subequal to lachrymal breadth.  
*k*<sup>6</sup>. Palate not extending beyond tooth-rows (choanae at level of last molar) . . . . . *Cusinycteris*, p. 568.  
*l*<sup>6</sup>. Palate extending behind tooth-rows.  
*m*<sup>7</sup>. Premaxilla fused anteriorly . . . . . *Dyacopterus*, p. 651.  
*n*<sup>7</sup>. Premaxilla separated by suture anteriorly.  
*e*<sup>8</sup>. Postzygomatic palate much narrower posteriorly than anteriorly . . . . . *Scotonycteris*, p. 543.  
*f*<sup>8</sup>. Postzygomatic palate subequal in breadth throughout.  
*a*<sup>9</sup>. Upper tooth-rows extending practically to ventral margin of orbital cavity . . . . . *Micropteropus*, p. 551.  
*d*<sup>9</sup>. Upper tooth-rows not nearly reaching ventral margin of orbital cavity . . . . . *Neonycteris*, p. 559.



## Order CHIROPTERA.

### Suborder I. MEGACHIROPTERA.

*Differential characters*, as compared with the suborder Microchiroptera.—Second digit retaining an evident degree of independence from third, its ungual phalanx present, though the claw is sometimes wanting. Deltoid crest of humerus low; *tuberculum majus* and *t. minus* small, the former never articulating with the scapula. Facial portion of skull variable in length, but never specialized in form; cochlea small, basioccipital and basisphenoid not narrower than usual; glenoid fossa of squamosal unmodified; angular process of mandible broad and low, or practically absent. External ear not specialized, tragus never present, margin of ear forming a complete ring.

*Range*.—Tropical and subtropical portions of Old World, including the whole of the Malagasy region, and extending to Australia and Polynesia, as far east as the Carolines and Samoa, but not to New Zealand.

### Family PTEROPODIDÆ.

#### Subfamily I. PTEROPODINÆ.

*Differential characters*.—Tongue not highly extensible. Incisors normal.

*Range*.—The same as that of the Megachiroptera (*supra*).

1. EIDOLON, *Rafin.**Cynonycteris* (pt.), Dobson, Cat. Chir. B. M. p. 70.

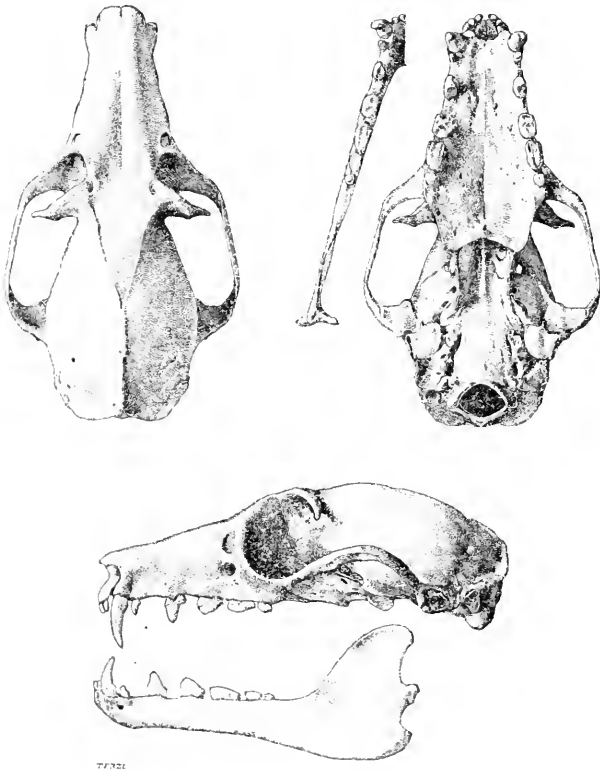
1815. Eidolon, *Rafinesque, Analyse de la Nature*, p. 54 . . . E. <sup>Type.</sup> *helvum*.  
 1861. Pterocyon, *Peters, MB. Akad. Berlin*, p. 423 . . . . . E. *helvum*.  
 1881. Leiponyx, *Jentink, Notes Leyden Mus.* iii. p. 60 (Jan.  
 1881) [*nee* Liponyx, *Vieillot*, 1816, a genus of birds]. E. *helvum*.  
 1882. Liponyx, *Forbes, Zool. Record*, xviii. (for 1881),  
*Mamm.* p. 13 (nom. emend.).

*Diagnosis*.—Basiscranial axis distinctly deflected; occiput not elongated and tubular; a short bony auditory meatus; palate much broader posteriorly than between canines; length of rostrum much greater than lachrymal width; front of orbit vertically above middle or posterior half of  $m^1$ ; premaxillaries separated in front. Incisors  $\frac{2}{2} - \frac{2}{2}$ ; cheek-teeth  $\frac{5}{6}$ ;  $p^1$  in cross section much larger than an upper incisor;  $m_1$  equal in length to  $m_2$  and  $m_3$  combined. Second digit clawed; membranes from sides of back; a short tail. Forearm 114–132 mm.

*Skull* (fig. 1).—Brain-case moderately deflected: alveolar line projected backward passing very nearly through bases of posttympanic and paroccipital processes and upper margin of occipital condyle. Occiput not (as in *Pteropus*) produced backward and downward into a conspicuous tube. Tympanic elongated externally into a short tubular bony auditory meatus (a peculiarity unique among Bats). Palate broadest between  $m^2$ – $m^2$ , breadth at palation border much greater than between canines, and about equal to breadth between inner sides of  $p^4$  (cf. *Pteropus*). Rostrum long: length from front of orbit to tip of nasals much greater than lachrymal width of skull, subequal to (a little longer or shorter than) length of maxillary tooth-row; front margin of orbit vertically above middle or posterior half of  $m^1$  (cf. *Myonycteris*). Tip of nasals nearly vertically above front of premaxillaries (cf. *Pteropus*). Premaxillaries slightly, but distinctly and constantly, separated in front (cf. *Rousettus*, *Myonycteris*, *Pteropus*). Width of frontals at interorbital constriction slightly less than (or at most equal to) width at postorbital constriction. Postorbital processes in aged specimens reaching about halfway between frontal and zygoma. Sagittal crest short and low, the temporal ridges sometimes remaining separate throughout the life of the individual; lambdoid crest strong, projecting backward considerably beyond the plane of the supraoccipital. Posttympanic processes longer than paroccipital processes. Ectopterygoid processes small.

*Dentition* (fig. 1).— $\frac{p^1 \ i^2 \ c \ p^1 \ p^3 \ p^4 \ m^1 \ m^2}{i_1 \ i_2 \ c \ p_1 \ p_3 \ p_4 \ m_1 \ m_2 \ m_3} \times 2 = 34$ .  $p^1$  and  $m^2$ ,  $p_1$  and  $m_3$  reduced. One skull of *E. helvum* in the collection (ad., teeth slightly worn; no history; specimen  $c^3$  in the list—*infra* p. 15) has a minute  $m^3$  on one side.

Teeth without special modifications; no secondary cusps in canines or cheek-teeth. General structure of molars: a median longitudinal groove, flanked by a higher outer and lower inner ridge, each ridge rising, or tending to rise, into a cusp in front of middle of tooth; in the upper molars the outer ridge represents



77221

Fig. 1.—*Eidolon helvum*, ♂. Bilelipi, Fernando Po. No. 4.7.1.15. 1.

cusps 4 and 5 in the typical molar in Insectivorous Bats, the inner ridge cusps 6 and 7; in the lower molars, the inner ridge cusps 1-3, the outer ridge cusps 4 and 5.

Upper incisors small, terete, very nearly equal in size (the outer incisors, if anything, faintly smaller in cross section); crown indistinctly differentiated from shaft, subcircular in cross section,

cutting-edge blunt;  $i^1-i^1$  widely separated (chiefly owing to separation of premaxillaries), the interspace being nearly equal to diastema  $i^2-c$ ;  $i^1-i^2$  rather closely approximated. Canines simple; ingulum not sharply pronounced, no secondary cusps; surface of crown as a rule marked by three shallow vertical grooves, one anterior, one internal, and one posterior. All post-canine teeth more or less separated; interspace  $c-p^3$  much greater than diastema  $i^2-c$ .  $p^1$  small, but much less reduced than in *Roussettus*, being in cross section at base of crown from three to six times the size of an upper incisor, and nearly equal to  $m^2$ ; as a rule situated nearer to the canine than to  $p^3$ ; as clearly seen on comparison with  $p^3$  and  $p^4$ , the crown of  $p^1$  is formed by the completely fused cusps 4 and 6, a slight (sometimes obsolete) depression on its posterior face representing the remnants of the median groove.  $p^3$  almost caniniform, its principal cusp (formed by the anteriorly completely fused cusps 4 and 6) from one half to two thirds the height of the canine, acutely triangular, sharply pointed; a vertical furrow on its posterior face corresponding to the longitudinal groove in the posterior cheek-teeth.  $p^4$  molariform, longer (antero-posteriorly) than broad; outer ridge raised into an obtusely triangular cusp, much lower than  $p^3$ ; inner ridge forming a low cusp opposite the outer cusp; the inner bases of the cusps so closely approximated as to form a narrow, more or less complete bridge across the median groove.  $m^1$  similar in structure to  $p^1$ , but outer and inner ridge lower, more flatly rounded; no indication of a transverse bridge.  $m^2$  small, subcircular in outline, equal to about one sixth of  $m^1$ .

Lower incisors similar in form and size to upper ones, in contact with each other and with canines, or separated by minute spaces; row slightly convex; cutting-edges blunt, without any trace of a median emargination. All postcanine teeth more or less separated.  $p_1$  small, from twice to four times the bulk of a lower incisor, but not reaching above level of cutting-edges of incisors; as a rule situated nearer to the canine than to  $p_3$ . Principal cusp of  $p_3$  (formed by the anteriorly completely fused cusps 2 and 4) about two thirds the height of the canine, acutely triangular, sharply pointed; posterior face of crown marked by a vertical groove (the remnant of the original longitudinal groove).  $p_4$  rather longer than broad; outer ridge raised into an obtusely triangular cusp, lower than  $p_3$ ; the opposite cusp on the inner ridge much lower, bluntly rounded; anteriorly the outer and inner ridges are closely approximated, in some individuals completely fused (as in  $p_3$ ).  $m_1$  long, with rare individual exceptions equalling or exceeding the combined length of  $m_2$  and  $m_3$ ; ridges lower than in  $p_4$ , more flatly convex; sometimes a slight indication of a transverse bridge from the inner base of the outer cusp.  $m_2$  similar in structure to  $m_1$ , but less than half the size of this tooth.  $m_3$  very small, subcircular in outline, equal to (or smaller than)  $p_1$ .

*Palatiridges*.—In *E. helvum*: 4+3+3, i. e. four anterior, undivided, three middle, separated in the median line, three posterior,



First ridge terminating at or closely behind the canine; second at or closely behind  $p^1$ ; third at  $p^3$ ; fourth at front of  $p^4$ ; fifth at front of  $m^1$ ; sixth closely behind  $m^2$ ; seventh far behind  $m^2$ ; eighth to tenth situated near palation border. Palate-ridges in *E. sabæum* and *E. dupreanum* not examined.

*Head*.—Muzzle long, from front of eye to tip of nostrils almost equal to distance from front of eye to base of ears. Nostrils separated by a deep groove; inner margins moderately projecting. Inner margins of lips fringed with short papillæ. Median portion of tongue with oblique rows of rounded papillæ, each papilla with three small, straight, sharply pointed, backwardly directed horny spines.

*Ears*.—Tip of ear-conch reaching hinder corner of eye; outer margin much more convex than inner, tip broadly rounded off. Antitragal lobe practically wanting.

*Wings*.—Chief characters: second digit clawed; wings from sides of dorsum, rather closer to spine than to flanks, and from back of first toe.

First phalanx of first digit twice the length of metacarpal. Second digit subequal to third metacarpal. Third metacarpal between six and seven tenths the length of the forearm, a little longer than the fourth metacarpal, which is a little longer than the fifth. First phalanx of third digit equal to two thirds of metacarpal; second phalanx subequal in length to metacarpal. First phalanx of fourth digit rather more than half of metacarpal; second phalanx always somewhat longer than first. First phalanx of fifth digit less than half of metacarpal; second phalanx subequal in length to first. See wing-indices, *infra*.

First digit included in the membrane by the metacarpal and base of first phalanx. Notopatagium acutely triangular. 16-20 long fasciæ in the plagiopatagium, viz. 4-6 postaneoneal, 12-16 preaneoneal.

	Pollex.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
<i>E. dupreanum</i> .....	355	473	141	125	690	461	721	668	369	422	641	299	283
<i>E. helvum</i> & <i>sabæum</i> .	368	446	131	111	690	431	695	646	347	418	612	272	284

*Tail*.—Less than half the length of the hind foot; basal portion connected with interfemoral by its dorsal integument, terminal two or two and a half vertebrae freely projecting.

*Sexual differentiation*.—Adult males of all species have the glandular hairs on the foreneck and sides of the neck brighter coloured than females; females of *E. helvum* and *E. sabæum* are lighter coloured above and below than males; females of *E. helvum* and *E. sabæum* (and *dupreanum*?) average a trifle larger than males.

*Range*.—Madagascar; African continent, from Sennar and Senegambia in the north. to Nyasaland and Namaqualand in the south; S. Arabia.

*Habits*.—On the Middle and Upper Nile, v. Heuglin found "*Pteropus palmarum*" (i. e. *Eidolon helvum*) mostly in flocks, frequenting *Borassus aethiopicus*, the fruits of which, together with those of *Ficus* and *Cordia*, seem to be their favourite food; they sometimes literally eat themselves into the *Borassus* fruit, a shot bringing the fruit together with the bat to the ground. They fly by night as well as by day, their sight being apparently unimpaired even in the brightest sunshine, though their flight by day is somewhat flickering and unsteady; by night it is owl-like, straight, and they occasionally pursue each other, making rapid turnings with audible flapping of the wings. They are noisy and quarrelsome, alighting with great uproar on their roosting-places.—In Fernando Po F. Newton found them feeding on the fruits of *Carica papaya* and *Persica gratissima*.—The British Museum specimens obtained by A. Whyte at Mt. Malosa, Nyasaland, were found suspended from the upper branches of tall trees, but "they also frequent caves in the rocks, where they probably breed"; those collected by E. Seimund in Fernando Po were mostly shot in palm or plantain trees; ripe embryos or new-born young were obtained in Fernando Po by the same collector between the middle of February and the middle of March.

*E. sabaeum* was seen in considerable numbers near Lahej, Aden, early in March (Col. Yerbury) and in the middle of August (A. B. Percival); they frequent the tops of the tallest trees, where they collect in large ball-like clusters of 10 to 50, but are by no means easy to detect; "were it not for the characteristic chattering that they keep up incessantly, they would probably be overlooked altogether" (Yerbury). Percival found them very noisy in the roosting-places, "squeaking and swearing, making a great fuss early in the morning"; they were apparently feeding on dates  $\pm$  high (in August) were just ripe; when the dates are ripening every bunch is put into a bag made of palm-leaves, for protection against these bats and the crows.

*Affinities*.—*Eidolon* is related, though not very closely, to *Rousettus*, with which it was united by Dobson in the genus "*Cynonycteris*." It differs from *Rousettus* chiefly in the development of a short bony auditory meatus, in the distinctly separated premaxillaries, the proportionally longer rostrum, the less reduced size of  $p^1$ , the unusually long  $m_1$ , the smaller  $m^2$ , the larger number of posterior palate-ridges, the increased number of fasciæ in the lateral wing-membrane, the much larger size, and in being restricted to the Malagasy and Ethiopian regions (including S. Arabia). In the larger size of  $p^1$  and proportionally longer rostrum, it would seem to be more primitive than *Rousettus*, but it is on a higher level of development in the peculiar tubular lengthening of the tympanic, the separation of the premaxillaries,

the lengthening of  $m_1$ , the reduction of  $m^2$ , the considerably larger dimensions, and the more pronounced sexual differentiation in colour.

The three species are closely interrelated. *E. dupreanum*, from Madagascar, with its relatively longer rostrum and less modified fur structure, is apparently the least specialized form. *E. sabaeum*, from S.W. Arabia, is a small-skulled and broad-toothed representative of the African *E. helvum*.

*Nomenclature*.—In 1810 (Ann. Mus. d'Hist. Nat. xv. pp. 90–98), E. Geoffroy divided the genus *Pteropus* into three sections, viz., “Roussettes sans queue” (*Pt. edulis*, *edwardsi*, *vulgaris*, *rubricollis*, *griseus*), “Roussettes à queue” (*Pt. stramineus*, *egyptiacus*, *amplexicaudatus*, *marginatus*, *minimus*), and “Roussettes à ailes sur le dos” (*Pt. palliatus*). Five years later (1815, *l.s.c.*), Rafinesque raised these sections to the rank of distinct genera, restricting the genus *Pteropus* to the species of Geoffroy's first section, proposing the name *Eidolon* for the second, and *Pteronotus* for the third section. *Pteropus stramineus*, Geoff. (i. e. *Vespertilio vampyrus helvus*, Kerr), as being the earliest known of the five species included by Geoffroy in the section “Roussettes à queue,” may be fixed as the type species of *Eidolon*, Raf. (Cf. K. Andersen, Ann. & Mag. N. H. (8) i. p. 432; 1 May, 1908.)

### *Synopsis of the Species.*

- |   |                                |
|---|--------------------------------|
| a. Rostrum relatively longer: front of orbit to tip of nasals equalling or exceeding maxillary tooth-row; fur longer, more woolly, not closely adpressed; colour darker; forearm 127–131 mm. (Madagascar) . . . . . | 1. <i>E. dupreanum</i> , p. 7. |
| b. Rostrum relatively shorter: front of orbit to tip of nasals less than maxillary tooth-row; fur very short, closely adpressed; colour lighter.  |                                |
| a'. Skull larger: total length 54.5–62.2 mm.; tooth-rows longer: c- $m^2$ 21–23.8; molars narrower; forearm 117.5–132. (African continent) . . . . .  | 2. <i>E. helvum</i> , p. 8.    |
| b'. Skull smaller: total length 51.5–55 mm.; tooth-rows shorter: c- $m^2$ 19.2–20.8; molars broader; forearm 114–127. (S.W. Arabia) . . . . .   | 3. <i>E. sabaeum</i> , p. 15.  |

### 1. *Eidolon dupreanum*, Schl. & Poll.

*Cynonycteris dupreana*, Dobson, Cat. Chir. B. M. p. 78.

*Cynonycteris stramineus* (nec Geoff.), Peters, MB. Akad. Berlin, 1866, p. 885 (Nossi Bé).

*Pteropus dupreanus*, Schlegel & Pollen, P. Z. S. 1866, p. 419 (N.W. Madagascar); *ibid.*, in Pollen & v. Dam, Rech. Faune Madagascar, ii. pp. 17, 172 (1868: N.W. Madagascar).

- Cynonycteris dupreana* \*, *Peters, M.B. Akad. Berlin*, 1867, p. 866; *Jentink, Cat. Ostéol. Mamm.* p. 264 (1887); *id., Cat. Syst. Mamm.* p. 152 (1888) (types: N.W. Madagascar); *Trouessart, Cat. Mamm.* i. p. 85 (1897); *Seabra, Journ. Sci. Math. Lisboa*, (2) v. no. 19, p. 159† (1898).  
*Cynopterus (Xantharpyia) dupreana, Trouessart, Rev. & Mag. Zool.* (3) vi. p. 207 (1878).  
*Cynonycteris straminea var. dupreana, Bartlett, P. Z. S.* 1879, p. 769 (S.E. Madagascar).  
*Xantharpyia dupreana, Matschie, Megachiroptera*, p. 63 (1899).  
*Rousettus dupreanus, Trouessart, Cat. Mamm., Suppl.* p. 59 (1904).  
*Pterocyon dupreanus, K. Andersen, Am. & Mag. N. H.* (7) xix. p. 504 (1907); *Miller, Fam. & Gen. Bats*, p. 56 (1907).

Differs from *E. helvum* in the following particulars:—Cranial rostrum relatively longer and slenderer: measured from front of orbit to tip of nasals equalling or slightly exceeding the length of the upper tooth-row from front of canine to back of  $m^2$ ; posterior premolars and molars slightly broader;  $m^1$  comparatively longer, being conspicuously longer than  $p^1$ ;  $p_1$  and  $m_2$  comparatively larger; fur on body longer, more woolly, and not closely adpressed; colour of fur browner (details see below); length of forearm as in large specimens of *E. helvum*, but metacarpals and phalanges rather longer, as shown by the wing-indices, p. 5.

Distribution of fur on ears, limbs, and membranes as in *E. helvum*.

*Colour*.—General aspect: brownish above, tawny olive below; a tawny half-collar in adult males.—Upperside of head, back, and ribs brownish, approaching Prout's brown; base of hairs tawny olive. Glandular hairs on foreneck tawny, paler on the sides of the neck; absent in the only female examined. Breast and belly tawny olive on flanks, washed with dark hair-brown in the middle.

*Measurements*. See table, p. 16.

*Range*. Madagascar.

*Cotypes* (two specimens) in the Leyden Museum.

a. ♀ ad. sk.; skull.	Madagascar.	E. Bartlett [C.].	77.7.5.1.
b. ♂ ad. sk.; skull.	Vinamilelo, Betsileo, Madagascar; 27 May, 1896 ( <i>Dr. C. I. Forsyth Major</i> ).	Royal Society [P.].	97.9.1.30.
c. ♂ ad. sk.; skull.	Itambelo, Betsileo, Madagascar; 6 June, 1896 ( <i>Dr. C. I. Forsyth Major</i> ).	Royal Society [P.].	97.9.1.31.

## 2. *Eidolon helvum*, Kerr.

*Cynonycteris straminea*, Dobson, *Cat. Chir. B. M.* p. 77.

Chauve-Souris, *Des Marchais, Voyage en Guinée*, i. p. 81 (1720: off Guinea Coast).

Lesser Ternate Bat, *Pennant, Syn. Quadr.* p. 362, no. 274 β, pl. xxxi.

\* Various written *C. dupreanus* and *dupreana*.

† Misspelt *C. dupressa*.

- fig. 1 (1771); *id.*, *Hist. Quadr.* ii. p. 552, pl. lii. fig. 1 (1781); *id.*, *op. cit.* 3rd ed. ii. p. 308, pl. civ. fig. 1 (1793).
- Roussette jaune, *G. Curvier*, *Tabl. élém. d'Hist. Nat.* p. 104 (1798).
- Vespertilio vampyrus (*nec L.*), var. C, *Schreber*, *Säug.* i. p. 154 (1774). Var.  $\gamma$ , *Gmelin*, *Linn. Syst. Nat.* ed. 13, i. p. 45 (1788). Var. 4, *Turton*, *Linn. Syst. Nat.* i. p. 24 (1802).
- Pteropus vampyrus, var.  $\gamma$ , *Erxleben*, *Syst. Regn. An., Mamm.* p. 133 (1777). Var.  $\gamma$ , *Donndorff*, *Zool. Beytr.* i. p. 62 (1792). Var. A, *Bechstein*, *Pennant's Uebers. vierf. Th.* ii. pp. 619, 733, pl. liv. fig. 3 (1800). *Illiger*, *Abh. Akad. Berlin*, 1804-11, p. 78, *cf.* p. 84 (1815).
- Vespertilio vampyrus helvus, *Kerr*, *Animal Kingdom*, i. pt. i. pp. xvii, 91, no. 108 (1792).
- Pteroeon helvus, *K. Andersen*, *Ann. & Mag. N. H.* (7) xix. p. 504 (1907).
- Pteropus stramineus, *E. Geoffroy*, *Cat. Mamm. Mus. Nation. d'Hist. Nat.* p. 48 (1803: habitat unknown); *id.*, *Ann. Mus. d'Hist. Nat.* xv. p. 95 (1810: Timor, errore); *G. Fischer*, *Zoognosia*, iii. p. 557 (1814); *Oken*, *Lehrb. Naturgesch.* iii. Abth. ii. p. 934 (1816); *G. Curvier*, *Règne An.* i. p. 124, footnote (1817); *Desmarest*, *Nour. Dict. d'Hist. Nat.* xxix. p. 512 (1819); *id.*, *Encycl. Méth.*, *Mamm.* i. p. 110, no. 143 (1820); *Temminck*, *Mon. Mamm.* i. p. 195, pl. xv. figs. 12-13 (skull) (1825); *Lesson*, *Mon. Mamm.* p. 112, no. 291 (1827); *Gray*, in *Griffith's Anim. Kingd.* v. p. 57, no. 160 (1827); *Desmarest*, *Dict. Sci. Nat.* xlv. p. 366 (1827); *Is. Geoffroy*, *Dict. Class. d'Hist. Nat.* xiv. p. 702 (1828); *J. B. Fischer*, *Syn. Mamm.* p. 86, no. 15 (1829); *Wagler*, *Syst. d. Amphibien*, p. 9 (1830); *Lesson*, *Hist. Nat. Mamm. (Compl. Buffon)* v. p. 55 (1836); *Temminck*, *Mon. Mamm.* ii. p. 84 (1837: Senaar, Senegal); *Gray*, *Mag. Zool. & Bot.* ii. p. 503 (1838); *Blainville*, *Ostéogr. Mamm.* i. livr. 5, p. 100, *Atlas, Chéiropt.* pl. vi. fig. 2 (skull) (1840: Senaar); *Wagner*, *Schreber's Säug., Suppl.* i. p. 357 (1840); *Lesson*, *N. Tabl. Règne An.* p. 14, no. 188 (1842); *Sundervall*, *K. Sv. Vet.-Akad. Handl.* 1842, pp. 198, 206 (1843: Senaar); *Schinz*, *Syst. Verz. Säug.* i. p. 129 (1844); *Temminck*, *Esq. Zool.* p. 54 (1853: Gold Coast); *Wagner*, *Schreber's Säug., Suppl.* v. p. 603 (1853-55); *Gervais*, *Hist. Nat. Mamm.* i. p. 189 (1854); *Giebel*, *Säug.* p. 999 (1855); *Heuglin*, *Reise N.O.-Afrika*, ii. p. 14 (1877).
- Xantharpyia straminea, *Gray*, *List Mamm. B. M.* p. 38 (1843); *Gerrard*, *Cat. Bones Mamm. B. M.* p. 58 (1862); *Fitzinger*, *SB. Akad. Wien*, liv. Abth. i. no. 10, p. 544 (1866: Senaar, Bahr el Abiad, Bahr el Asrak, Kordofan); *id.*, *op. cit.* lx. Abth. i. Heft 9, p. 458 (1870); *Gray*, *Cat. Monk. &c.* p. 116 (1870); *Rochebrune*, *Faune Sénégal*, pt. 2, p. 40\* (1883); *Matschie*, *Säug. D. Ost-Afrikas*, p. 17 (1895); *Thomas*, *P. Z. S.* 1896, p. 790 (Zomba, Nyasa); *id.*, *P. Z. S.* 1897, p. 927 (Mt. Mulosa, Nyasa); *Matschie*, *Megachiroptera*, p. 62 (1899); *Cligny*, *Miss. Sénégal*, p. 292† (1900: Saint Louis, Senegal).
- Pachysoma stramineum, *Tomes*, *P. Z. S.* 1860, p. 44.
- Cynonycteris straminea †, *Peters*, *MB. Akad. Berlin*, 1867, p. 866

\* Misspelt *Xantharpyia straminea*.† Misspelt *Xantharpyia straminea*.‡ Various written *Cynonycteris* or *Cynonycterus* - *C. stramineus*, *straminea*, *stramineum*.

- (from Sennaar and Abyssinia to Guinea); *id.*, v. d. *Decken's Reisen*, iii. 1, Säug. p. 5 (1869); *Greef, SB. Ges. Naturw. Marburg*, 1884, p. 44 (San Thomé); *Martinez y Saez, An. Soc. Españ. Hist. Nat.* xv. p. 339 (1886: Fernando Po); *Jentink, Notes Leyden Mus.* x. p. 52 (1887: Liberia); *Monticelli, Ann. Mus. Civ. Genova*, (2) v. p. 524 (pt.) (1887: Somaliland); *Jentink, Cat. Ostéol. Mamm.* p. 264 (1887); *id.*, *Cat. Syst. Mamm.* p. 152 (1888); *H. Allen, Proc. Ac. Nat. Sci. Philad.* 1889, p. 336 (wing-membranes); *Bocage, Journ. Sci. Math. Lisboa*, (2) no. 1, p. 15 (1889: Rio Cuillo, Caconda); *Büttikofer, Reisebilder aus Liberia*, ii. pp. 362, 471 (1890); *Brehm, Tierleben*, 3 ed. i. p. 349 (1890: habits); *Bocage, Journ. Sci. Math. Lisboa*, (2) no. 7, p. 173, fig. (palate-ridges) (1892); *Matschie, Mitth. deutsch. Schutzgeb.* vi. Heft 3, p. 7 (1893: Liberia, Gaboon); *Bocage, Journ. Sci. Math. Lisboa*, (2) iv. no. 13, p. 4 (1895: Fernando Po, note on food); *Pousargues, Ann. Sci. Nat., Zool.* iii. p. 256 (1896: French Congo); *Sjöstedt, Bih. K. Sv. Vet.-Akad. Handl.* xxiii. Afd. iv. no. 1, p. 46 (1897: Cameroen); *Trouessart, Cat. Mamm.* i. p. 85 (1897); *Bocage, Journ. Sci. Math. Lisboa*, (2) v. no. 19, p. 137, fig. (palate-ridges) (1898: Angola, S. Thomé); *Seabra, ibid.* pp. 159, 169, pl. i. fig. 13 (palate-ridges) (1898); *Bocage, op. cit.* (2) vii. no. 25, pp. 27, 46, 55 (1903: Fernando Po, Principe I., Annobon); *id.*, *op. cit.* (2) vii. no. 26, p. 66 (1904: S. Thomé); *Seabra, ibid.* p. 103 (1904: Lucinda, Angola).
- Pterocyon stramineus*, *Peters, Journ. Sci. Math. Lisboa*, iii. no. 10, p. 123 (1871: Ajuda); *id.*, *MB. Akad. Berlin*, 1876, p. 474 (Cameroon, Cap Lopez); *Miller, Fam. & Gen. Bats*, p. 55, fig. 7 (auditory bulke) (1907: Liberia).
- Cynonycteris* (Pteropus) stramineus, *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 517 (1872-73) (structure of hairs).
- Cynopterus* (Xantharpyia) straminea, *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 206 (1878).
- Rousettus*\* stramineus, *W. L. Sclater, Mamm. S. Africa*, ii. p. 109 (1901: Namaqualand, Mashonaland); *Thomas, in H. H. Johnston's The Uganda Protectorate*, i. p. 422 (1902); *Thomas, P. Z. S.* 1903, i. p. 295 (Khartoum); *id.*, *P. Z. S.* 1904, ii. p. 187 (Fernando Po; sexual colour-difference); *Trouessart, Cat. Mamm., Suppl.* p. 59 (1904); *H. H. Johnston, Liberia*, ii. p. 690 (1906).
- Rousettus* (Pteropus) stramineus, *Anderson & de Winton, Zool. Egypt, Mamm.* p. 91 (1902: Upper Nile).
- Vespertilio caninus* (*nec Blumenb.*), var. b, *Goldfuss, Vergl. Naturbesch. Säug.* p. 98 (1809).
- Pterocyon paleaceus*, *Peters, MB. Akad. Berlin*, 1861, p. 423 (Africa).
- Pteropus mollipilosus*, *H. Allen, Proc. Ac. Nat. Sci. Philad.* 1861, p. 159 (1862: Gaboon).
- Pteropus palmarum*, *Heuglin, Leopoldina*, Heft v. nos. 3-4, p. 34 (June 1865: Middle and Upper Nile); *id.*, *Reise N.O.-Afrika*, ii. p. 15 (1877).
- Xantharpyia palmarum*, *Fitzinger, SB. Akad. Wien*, lx. Abth. i. H. 9, p. 456 (1870).
- Xantharpyia leucomelas*, *Wagner in litt. (fide Fitzinger)*; *Fitzinger, SB. Akad. Wien*, liv. Abth. i. H. 10, p. 544 (1866: Sennaar,

\* Variouslly spelt *Rousettus* or *Roussettus*.

- Bahr el Abiad, Bahr el Asrak, Kordofan); *id.*, *op. cit.* ix. Abth. i. H. 9, p. 461 (1870).  
*Leiponyx büttikoferi*, *Jentink, Notes Leyden Mus.* iii. p. 59 (Jan. 1881: Liberia); *id.*, *op. cit.* x. p. 53 (1887: Liberia); *id.*, *Cat. Syst. Mamm.* p. 152 (1888: Liberia); *Büttikofer, Reisebilder aus Liberia*, ii. pp. 362, 471 (1890); *Trouessart, Cat. Mamm.* i. p. 89 (1897); *Matschie, Megachiroptera*, p. 85 (1899); *Trouessart, Cat. Mamm., Suppl.* p. 64 (1904).  
*Pterocyon büttikoferi*, *Müller, Fam. & Gen. Bats*, p. 56 (1907).

The characters of this species, as compared with *E. dupreanum* and *subceum*, are pointed out on pp. 8 & 15.

*Fur*.—Fur on head, back, breast, and belly short, closely adpressed, on neck longer, more woolly. Face in front of and below eyes almost naked. Ears naked posteriorly except at base. Above, humerus, proximal two thirds or three fourths of forearm, femur, and tibia clothed with short, adpressed hair; interfemoral hairy in the middle and for a broad space along the tibiæ, extreme lateral margin naked; upperside of feet short-haired. Below, humerus, and proximal half of forearm, membrane along inner and outer side of forearm, lateral membrane next to body, femur, proximal half of tibia, interfemoral in the middle and along sides of tibiæ, short-haired.

*Colour*.—General aspect: grizzled straw-yellow and hair-brown above, with a more or less pronounced tawny half-collar in adults. Sexual difference: females lighter than males, half-collar paler.

Adult male—Base of hairs of upperside almost buff, broad tips hair-brown; the colour of the hair-tips predominant, giving the whole of the upperside a darker aspect than in females, darkest on the head, posterior part of back, and upperside of tibiæ. Half-collar tawny, brighter than in females. Breast and belly yellowish-buff on sides, washed with hair-brown in the middle.

Adult female—Base of hairs of upperside buff, tips hair-brown; the colour of the hair-bases predominant, giving the whole of the upperside a lighter, more buffy aspect, grizzled with hair-brown on the crown, middle and posterior part of back, and upperside of tibiæ. Half-collar less pronounced, rarely brighter than ochraceous buff. Breast and belly buff on sides, grizzled with hair-brown in the middle.

Young and immature specimens are rather similar in colour to adult males, but generally of a somewhat darker shade, and with no tawny colour on the neck.

*Sexual difference in size*.—Inconsiderable; in 15 fully adult males the length of the forearm ranges from 117·5 to 129 mm. (average 122·2), in 14 fully adult females from 119 to 131 (average 124·7).

*Measurements*. On p. 16.

*Range*. Africa: from Somaliland, Sennaar, and Senegambia in the north, to Nyasaland, Mashonaland, and Namaqualand in the south.

*Type* probably not in existence.

*Vespertilio vampyrus helvus*, Kerr; 1792.—The species of *Eidolon* described above was well known to the early post-Linnean systematists, who put it down as a variety of *Vespertilio* (or *Pteropus*) *vampyrus*, L. The earliest recognizable figure and description appear to be those given by Pennant, in 1771 (*l. s. c.*), under the name "Lesser Ternate Bat," so called because Pennant considered it a lesser variety of Seba's "*Canis volans Ternatanus orientalis*." Kerr's *V. vampyrus helvus* is based on Pennant's description and figure of this bat. Type originally in Museum Leverianum; no habitat given by Pennant, nor by Kerr. Senegal may be fixed as the type locality of *E. helvum*.

*Pteropus stramineus*, Geoff.: 1803.—Based on three examples in the collection of the Paris Museum, viz., two specimens (nos. 92 and 93) from unknown locality, presented by Professor Fourcroy, and one (no. 94) "de la collection du Stathouder," this latter wrongly supposed by Geoffroy to be the original of Seba's description and figure of *Canis volans Ternatanus orientalis* (Thes. i. pp. 91-92, pl. lvii. figs. 1, 2). None of the specimens now in the collection of the Paris Museum can be pointed out, with certainty, as the true cotypes of *Pt. stramineus*. Four characters in Geoffroy's description of this bat are, however, decisive evidence that his specimens were *E. helvum*, viz., upper incisors "très-écartées"; a short tail (10 mm.); total length 150 mm., expanse 640 mm.; colour "jaunâtre."—The "Cat. Mamm. Mus. Nation. d'Hist. Nat." (1803) was suppressed by Geoffroy himself, and the name *Pteropus stramineus* is therefore usually dated from his well-known paper in *Ann. Mus. d'Hist. Nat.* xv. (1810). In this latter Geoffroy based *Pt. stramineus* on two specimens, the one stated to be from Timor (Péron and Lesueur), the other without details (and possibly one of the cotypes from 1803). The error as to the locality of the former of these specimens was pointed out by Temminck (1837, *l. s. c.*).

*Pterocyon paleaceus*, Pet.; 1861.—Type locality, Africa; no type. Owing to Geoffroy's statement that *Pteropus stramineus* had been obtained in Timor by Péron and Lesueur, and evidently unaware of the fact that this error had been corrected by Temminck, Peters proposed for the African species the name *Pterocyon paleaceus*. But *Pt. stramineus* was in reality not from Timor, but from Africa; and the very species named by Peters *paleaceus*.

*Pteropus mollipilosus*, H. Allen; 1862.—Type locality: "W. Africa"; as belonging to Du Chaillu's collections, the type is no doubt from Gaboon; type presumably in the Philadelphia Museum. The essence of the original description is this: a very small tail present; first upper premolar larger than incisors; third digit 8". *Eidolon helvum* is the only known African bat for which the combination of these characters holds good.

*Pteropus palmarum*, Hengl.; 1865.—Type locality: "Am mittlern und obern weissen Nil und zwischen Senar und Fazogl längs des blauen Flusses"; type not in existence(?) (see Heuglin, *Reise in N.O.-Afrika*. ii. p. 15). Differs, according to Heuglin, from *Pt. stramineus* "durch Mangel eines Schwanzrudiments und mit



Ausnahme der Basis ganz freien Daumen." The pollex is in *E. helvum* always included in the membrane only by the metacarpal and the extreme base of the first phalanx. That the specimen had no tail is no doubt a mistake; if, when skinning an *Eidolon*, the tail-vertebræ are extracted together with the body, the empty tail-skin shrinks so much that the specimen seems to be tailless.

*Xantharpyia leucomelas*, Fitz.: 1866.—In Schreber's 'Säugethiere,' Suppl. i. p. 358, footnote (1840), Wagner describes a female of "*Pteropus stramineus*" (presumably in the Munich Museum) "aus den oberen Nilgegenden." Even if Wagner had not recorded the sex of this specimen, it would be easy to see, from the description of the colour of the fur, that it is a female of *E. helvum*. Fitzinger, being unaware of the sexual colour difference in this species, proposed for the specimen referred to by Wagner the name *X. leucomelas*. A skin in the British Museum (specimen *c* in the list below) belongs to the same series as the type of *X. leucomelas*.

*Leiponyx büttikoferi*, Jent.: 1881.—Type locality: St. Paul's River, Millsburg, Liberia; type in the Leyden Museum. Chief characters, according to Jentink: postcanine teeth  $\frac{4}{6}$ ; second digit without claw.—I have examined the type in the Leyden Museum, and find it in every respect indistinguishable from *E. helvum*, nor can I see any difference between British Museum specimens obtained at places near the type locality of *L. büttikoferi* (Nigeria, Ashantee, Dahomey) and specimens from other places of Africa; the considerable amount of individual variation in this species, in external dimensions and in the size of the skull and teeth, is well shown in a British Museum series of fifteen adult individuals from Fernando Po.—The teeth in the type of *L. büttikoferi* are excessively worn, some of the posterior molars entirely lost and their alveoli filled out. This explains Jentink's statement that the number of cheek-teeth is  $\frac{4}{6}$ , a result evidently arrived at as follows:—Upper jaw, left side:  $p^1, p^3$  (these premolars entire), two roots of  $p^4$  ( $m^1$  lost and alveolus closed; of  $m^2$  a rudiment of posterior root present, but no doubt undetectable when the skull was *in situ*), giving an apparent total of four teeth; upper jaw, right side:  $p^1, p^3$ , two roots of  $p^4$  ( $m^1$  and  $m^2$  entirely disappeared and alveoli closed), giving similarly a total of four; mandible, left side:  $p_1, p_3, p_4$  (these premolars entire), a broad interspace representing  $m_1$  (disappeared, alveolus closed), two roots of  $m_2$  ( $m_3$  entirely wanting), giving seemingly a total of six; mandible, right side:  $p_1, p_3, p_4$ , two roots of  $m_1$ , anterior root of  $m_2$  (posterior root of  $m_2$  and  $m_3$  lost), giving similarly a total of six.—As to the absence of the claws of the second digits, it must be said that not the claws only but the whole ungual (third) phalanx is wanting; the distal articular surface of the second phalanx is, however, in both wings laid bare, nakedly projecting, so that the missing phalanges have undoubtedly been violently torn off. The fresh condition of the wounds shows that this must have been done shortly before, or perhaps after, the death of the individual.

a. ♂ ad. sk. ; skull.	Khartoum, Sudan ; 15 Aug. 1902.	Surg.-Major H. N. Dunn [P.].	3.2.8.1.
b. ♂ ad. skull.	Khartoum, Sudan.	Surg.-Major H. N. Dunn [P.].	3.2.8.1 a.
c. ♀ ad. sk. ; skull.	Sennaar. (Represents <i>Xantharpyia leucomelas</i> , Fitz.)	Purchased (Parreys).	47.5.27.28.
d. ♂ imm. al. ; skull.	Ituri forest, betw. Mawambi and Avakubi, 2500' (R. E. Dent).	Ruwenzori Explor- ation Comm. [P.].	7.1.2.8.
e-f. 2 ♀ ad. sks. ; skull of e.	Ugaya I., Victoria Nyanza, 3000' ; 30 Dec. 1901.	R. J. Cuninghame, Esq. [P.].	2.7.5.1-2.
g. Ad. skull.	Ugaya I., Victoria Nyanza, 3000'.	R. J. Cuninghame, Esq. [P.].	2.7.5.3.
h. ♂ ad. al.	Zanzibar.	Sir J. Kirk [C.].	68.3.16.13.
i-l. 3 ♂ ad., 1 ♀ ad. sks. ; skulls.	Mt. Malosa, Nyasa, 5500' ; Nov. 1896 (A. Whyte).	Sir H. H. John- ston [P.].	97.10.1.14-17.
m. ♂ jun. al. ; skull.	Zomba, Nyasa ; Jan. 1896 (A. Whyte).	Sir H. H. John- ston [P.].	96.10.28.5.
n-o. 1 ♂ ad., 1 juv. sks. ; skulls.	Zomba, Nyasa ; 11 Aug. 1898 (J. Mc- Clounie).	General Manning [P.].	99.6.28.1-2.
p. ♂ ad. sk. ; skull.	Mukimvika, mouth of Congo R. ; Jan. 1892.	Rev. J. M. Lewis [P.].	92.5.7.1.
q. ♂ jun. al.	Gaboon.	Purchased (W. H. Higgins).	73.4.24.1.
r. ♂ jun. al. ; skull.	Elloby District, Gaboon.	H. Ansell, Esq. [P.].	74.10.6.3.
s-b <sup>2</sup> . 4 ♂ ad., 5 ♀ ad., 1 ♀ imm. sks. ; skulls.	Bilelipi, Fernando Po, 10 m. ; 20 Feb. 1904 (E. Sei- mund).	Fernando Po Com- mittee [P.].	4.7.1.12-21.
c <sup>2</sup> -h <sup>2</sup> . 2 ♂ ad., 3 ♀ ad., 1 ♂ pull. sks. ; skulls.	Bantabiri, Fernando Po, 10 m. ; Feb.- Mar. 1904 (E. Sei- mund).	Fernando Po Com- mittee [P.].	4.7.1.22-27.
i <sup>2</sup> -j <sup>2</sup> . 1 ♀ ad., 1 pull. al.	Bantabiri, Fernando Po, 10 m. (E. Seimund).	Fernando Po Com- mittee [P.].	4.7.1.137.
k <sup>2</sup> . Juv. sk. ; skull.	Lella Vista, Principe I. ; June 1901 (A. Mocquerys).	Hon. W. Rothschild [P.].	4.1.1.2.
l <sup>2</sup> -m <sup>2</sup> . ♂ ad., ♀ ad. sks. ; skulls.	San Thomé ; Nov. 1899.	A. Mocquerys [C.].	0.7.27.1-2.
n <sup>2</sup> . ♂ ad. sk. ; skull.	Roca Laura, San Thomé ; April 1901 (A. Moc- querys).	Hon. W. Rothschild [P.].	4.1.1.1.
o <sup>2</sup> -p <sup>2</sup> . ♂ jun., ♀ jun. al. ; skull of p <sup>2</sup> .	Old Calabar.	A. Murray, Esq. [P.].	70.3.29.14-15.
q <sup>2</sup> -r <sup>2</sup> . ♂ ad., ♂ jun. sks. ; skulls.	Abuchi, S. Nigeria, 140 m. ; 19 Nov.	A. J. Braham, Esq. [C.].	2.11.10.1 2.
s <sup>2</sup> . ♀ ad. al.	Asaba, S. Nigeria.	Dr. W. H. Crosse [C. & P.].	95.5.3.5.
t <sup>2</sup> . ♂ ad. sk.	Near Gombi, N. Ni- geria, 12° N. 10° E.	Alexander-Gosling Expedition [P.].	7.7.8.20.

<i>u</i> <sup>2</sup> . Jun. sk. ; skull.	Whydah, Dahomey.	L. Fraser [C.].	44.7.4.20.
<i>v</i> <sup>2</sup> . ♂ ad. sk. ; skull.	Whydah, Dahomey.	L. Fraser [C.].	52.2.22.1.
<i>w</i> <sup>2</sup> . ♂ ad. sk. ; skull.	Gambaga, Ashantee, 1300' ; 2 May, 1898.	Lieut.-Col. W. Giffard [P.].	98.10.24.2.
<i>x</i> <sup>2</sup> . ♂ ad. sk. ; skull.	Kumasi, Ashantee ; 1 July, 1898.	Lieut.-Col. W. Giffard [P.].	98.10.24.3.
<i>y</i> <sup>2</sup> . Jun. sk. ; skull.	Gambia.	G. Rendall, Esq. [C.].	39.10.5.8.
<i>z</i> <sup>2</sup> . ♂ imm. sk. ; skull.	Gambia.		66.1.10.2.
<i>a</i> <sup>3</sup> - <i>b</i> <sup>3</sup> . 2 juv. sks. ; skulls.	Senegal.	Purchased (Par-zudaki).	44.1.18.16-17.
<i>c</i> <sup>3</sup> . Ad. sk. ; skull.			Not reg.

### 3. *Eidolon sabæum*, K. And.

*Cynonycteris straminea* (*nec Geoff.*), *Monticelli, Ann. Mus. Civ. Genova*, (2) v. p. 524 (pt.) (1887 : Yemen) ; *Matschie, SB. Ges. naturf. Fr. Berlin*, 1893, p. 20 (Lahej ; note on habits).

*Xantharpyia straminea*, *Yerbury & Thomas, P. Z. S.* 1895, p. 545 (Lahej ; note on habits) ; *Matschie, Megachiroptera*, p. 62 (pt.) (1899 : Lahej).

*Rousettus stramineus*, *Thomas, P. Z. S.* 1900, p. 98 (Lahej ; note on habits).

*Pterocyon sabæus*, K. Andersen, *Ann. & Mag. N. H.* (7) xix. p. 505 (1907, June 1 : Lahej).

Differs from *E. helvum* in the following particulars :—Skull smaller : total length (one male ad., six females ad.) 51.5-55 mm., against 54.5-62.2 in *E. helvum* (nineteen males ad., twelve females ad.) ; maxillary tooth-row (c-m<sup>2</sup>) 19.2-20.8, against 21-23.5 ; cranial rostrum slenderer ; posterior premolar and molars, above and below, markedly broader than in the larger-skulled *E. helvum*. The external dimensions average slightly smaller.

Other characters as in *E. helvum*.

*Measurements.* On p. 16.

*Range.* S. Arabia (Lahej, Aden).

*Type* in collection.

<i>a-b</i> . ♂ ad., ♂ imm. al.	Lahej, Aden.	Col. J. W. Yerbury [C. & P.].	95.6.1.1-2.
<i>c-e</i> . ♂ ad., ♀ ad., jun. sk. ; skulls.	Lahej, Aden ; 5 Mar. 1895.	Col. J. W. Yerbury [C. & P.].	95.6.1.44-46.
<i>f</i> . ♀ ad. sk. ; skull.	Lahej, Aden ; 27 Nov. 1898 ( <i>W. R. O. Grant</i> ).	Royal Society [P.].	99.3.14.1.
<i>g</i> . ♀ ad. sk. ; skull.	Lahej, Aden ; 19 Aug. 1899.	W. Dodson [C.]. ( <i>Type of species.</i> )	99.11.6.3.
<i>h-j</i> . ♂ juv., 2 ♀ ad. sks. ; skulls.	Lahej, Aden ; 19 Aug. 1899.	W. Dodson [C.].	99.11.6.2, 4-5.

## Measurements.

	<i>E. dupreanum.</i>		<i>E. helvum.</i>		<i>E. subæum.</i>	
	Min.	Max.	Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.	mm.
Forearm .....	127	131	117.5	132	114	127
Pollex, c. u. ....	49	49.8	42	50.5	42	47
2nd digit, metacarpal .....	58	63.2	51.2	62	51	58.8
„ 1st phalanx .....	17	19.3	15.3	18.5	15	16.5
„ 2nd-3rd phalanx, c. u. ....	15.2	16	10.5	16.8	12.8	15.5
3rd digit, metacarpal .....	88	89	76.5	88.8	72	84.5
„ 1st phalanx .....	59	59.8	50.2	56.2	49	57
„ 2nd phalanx .....	91	93.5	74.5	91.5	76	87
4th digit, metacarpal .....	84	87	74	86	72	80.5
„ 1st phalanx .....	47	47.8	39.8	46.8	39	44
„ 2nd phalanx .....	54	54.8	47.2	55	45.5	52.8
5th digit, metacarpal .....	79.8	84	70.5	84.5	70.7	78
„ 1st phalanx .....	37	40	30	39.7	30	35
„ 2nd phalanx .....	33.5	40.7	32.3	40	30.8	36
Ear, length from notch .....	...	...	27.2	28	26.8	27
„ greatest width, flattened.....	...	...	18.5	20	19.5	20
Front of eye to tip of muzzle .....	...	...	23.2	25	21	24
Tail .....	...	...	10	15.5	15	15.5
Lower leg .....	...	2.59	47	52	47	52
Foot, c. u. ....	39	40	31.5	38.5	30.8	36
Skull, total length to front of premax. ....	58	60	54.5	62.2	51.5	55
„ width of brain-case at zygomata.....	22	23	20.8	23.5	20.5	22
„ zygomatic width .....	32.8	34.7	32	36	30	32.2
„ width across m <sup>2</sup> , externally .....	16	17.5	16	18	15.8	17
„ width across c, externally .....	11.7	12.2	9.8	11	9	10.5
„ palation to incisive foramina .....	28.2	28.8	26	30	25.4	27
„ front of orbit to tip of nasals .....	21.7	22.8	19	22.8	18.3	21
Mandible, length .....	45.2	47.2	43	49.5	41	43.8
Upper teeth, c-m <sup>2</sup> .....	21.2	22	21	23.8	19.2	20.8
Lower teeth, c-m <sub>3</sub> .....	24	25.2	23	26.2	22	23.8

## 2. ROUSETTUS, Gray.

*Cynonycteris* (pt.), Dobson. Cat. Chir. B. M. p. 70.

Type.

1821. Rousettus, Gray, *London Medical Repository*, xv. p. 299 (Apr. 1, 1821)..... R. ægyptiacus.
1829. Cercopteropus, *Burnett, Quart. Journ. Sci. Lit. Art*, 1829, pt. 1, p. 269 (Apr.-June, 1829)..... R. ægyptiacus.
1843. Eleutherua, Gray, *List Mamm. B. M.* p. xix. Nomen nudum.
1843. Xantharpyia, Gray, *List Mamm. B. M.* pp. xix, 37..... R. amplexicaudatus.
1844. Eleutherura, Gray, *Voyage 'Sulphur'*, i. p. 29. R. leachi.
1852. Cynonycteris, *Peters. Reise Mossamb., Zool. i. Südg.* p. 25..... R. leachi.
1870. Senonycteris, Gray, *Cat. Monb. &c.* p. 115... R. seminudus.

*Diagnosis*.—General shape of skull as in *Eidolon*, but no bony auditory meatus, premaxillaries in contact or co-ossified in front. Incisors  $\frac{2}{2} - \frac{2}{2}$ ; cheek-teeth  $\frac{5}{6}$  or  $\frac{4}{6}$ ; lower incisors (when unworn) bifid;  $p^1$  subequal in bulk to an upper incisor;  $m_1$  shorter than  $m_2$  and  $m_3$  combined. Second digit clawed; membranes from sides of back; a short tail. Forearm 69.5-99 mm.

*Skull* (figs. 2-4 \*).—Brain-case in most species deflected very nearly to the same degree as in *Eidolon*, the alveolar line projected backward passing through upper part of occipital condyle or upper

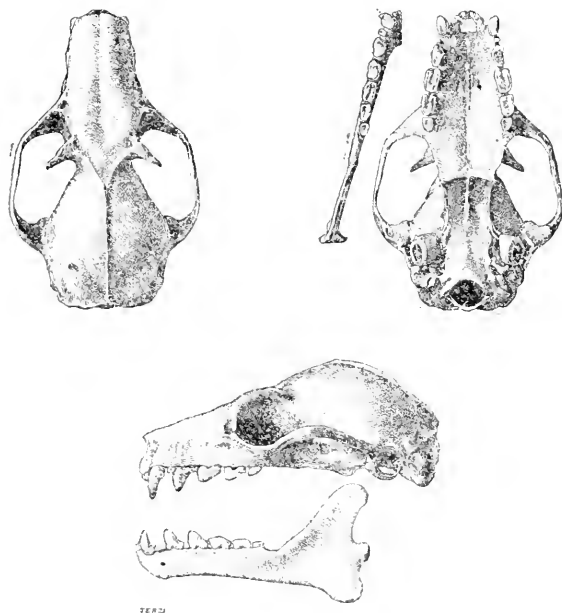


Fig. 2.—*Rousettus aegyptiacus*, ♂. Cairo, Egypt. No. 3.12.8.1. ♂.

margin of foramen magnum; in one species (*R. lanosus*: subgenus *Stenonycteris*) the deflection is so strong that the prolongation of the alveolar line goes through the middle of the supraoccipital, in another (*R. angolensis*: subgenus *Lissonycteris*) so slight that the line passes below, or through the lower margin of, the occipital condyle; in all species the deflection is distinctly greater in immature and young than in fully adult individuals. Tympanic never elongated externally into a bony auditory meatus. Rostrum comparatively

\* Fig. 3 on p. 49, fig. 4 on p. 52.

a little shorter than in *Eidolon*; from front of orbit to tip of nasals less than length of maxillary tooth-row (except in *R. lanosus*, owing to reduction of cheek-teeth in this species), but much greater than lachrymal width of skull; front of orbit vertically above middle or posterior half of  $m^1$  (cf. *Myonycteris*). Nasals not produced quite as far forward as front of premaxillaries. Premaxillaries in perfect contact in front, in one species (*R. angolensis*) co-ossified without any trace of the original suture. Postorbital processes not reaching halfway between frontal and zygoma. Sagittal crest low or undeveloped, the temporal ridges often remaining separate throughout the life of the individual.

Other cranial characters as in *Eidolon*.

*Dentition* (figs. 2-4 \*).—Normally  $\frac{i^1 i^2 c p^1 p^3 p^1 m^1 m^2}{i_1 i_2 c p_1 p_3 p_1 m_1 m_2 m_3} \times 2 = 34$ .  $p^1$  and  $m^2$ ,  $p_1$  and  $m_3$  reduced;  $p^1$  permanent in most species, deciduous in *R. seminudus* and *brachyotis*. A minute  $m^3$  occasionally present on one side or both sides †. In one skull in the collection (*R. angolensis*, ♂ ad.; 6.12.4.5) a small supernumerary molar (very broad, but excessively compressed antero-posteriorly) is present on the right side, closely wedged in between  $m^1$  and  $m^2$ .

Upper incisors equidistant, or  $i^1$ - $i^1$  slightly more separated than  $i^1$ - $i^2$ . Upper canine and  $p^3$  generally widely separated, sometimes rather closely approximated (individually in *R. amplexicaudatus* and, particularly, *R. brachyotis*), very rarely in actual contact (occasionally in *R. brachyotis* when  $p^1$  is wanting).  $p^1$  much more reduced than in *Eidolon*, being in cross section only equal to (or smaller than) an upper incisor, in some species deciduous (*R. seminudus*, *brachyotis*).  $m^2$  much smaller than  $m^1$ , but not reduced to the same degree as in *Eidolon*.

Lower incisors subequal in height and bulk, or the outer ones slightly larger in cross section; cutting-edge in youngish individuals distinctly bifid; the median notch of the cutting-edge continued for a short distance down the front of the crown as a faint vertical groove; this groove is usually detectable even when the cutting-edge has been worn straight.  $p_1$  small, in most species from twice to four times the bulk of a lower incisor, in one species (*R. angolensis*) not, or scarcely, exceeding a lower incisor; as a rule situated nearer to the canine than to  $p_3$ .  $m_1$  nearly always exceeding (sometimes only equalling)  $p_1$  in length, but never quite as long as  $m_2$  and  $m_3$  combined.  $m_3$  smaller than, sometimes only half the size of,  $m_1$ .  $m_3$  much smaller than  $m_2$ , elliptical or subcircular in outline.

The molariform teeth, above and below, are unusually narrow in *R. lanosus*; an approximation to this is found in *R. celebensis*.

\* Fig. 3 on p. 49, fig. 4 on p. 52.

† Details from 88 skulls examined, representing all species known:— $m^3$  present on one side: *R. leachi*, one adult, teeth well worn (37.4.23.67); *R. seminudus*, one adult, teeth unworn (not registered);  $m^3$  present on both sides: *R. aegyptiacus*, one adult, teeth practically unworn (4.4.9.2).

*Palate-ridges*.—Slightly varying according to species and individuals:—(1) In most species (*R. leachi*, *arabicus* (sometimes), *leschenaulti*, *seminudus*, *amplexicaudatus*, *celebensis*)  $4+3+1$ ; first ridge terminating at  $p^1$ , or between  $c$  and  $p^1$ ; second at  $p^3$ ; third at front of  $p^1$ ; fourth at front of  $m^1$ , or between  $p^1$  and  $m^1$ ; fifth at  $m^2$ , or between  $m^1$  and  $m^2$ ; sixth more or less closely behind  $m^2$ ; seventh far behind  $m^2$ ; eighth situated at palation border. Sometimes the fourth ridge is interrupted in the median line, the formula being  $3+4+1$ ; this I have seen in *R. lanosus*, *R. brachyotis*, and some individuals of *R. leachi*, and according to Bocage it is (normally?) the case in *R. angolensis*. A ninth, more or less indistinct, ridge is occasionally detectable (formula  $4+3+2$ , or  $3+4+2$ ; see *R. angolensis*). (2) In some species (*R. aegyptiacus*, often in *arabicus*, rarely in *amplexicaudatus*) an additional divided ridge is developed behind the sixth; formula  $4+4+1$ ; but the extremities of this ridge are either connected with, or situated closely behind, those of the sixth ridge.

*Head*.—Muzzle proportionally somewhat shorter than in *Eidolon*; measured from front of eye to tip of nostrils shorter than (only in *R. lanosus* almost equal to) distance from front of eye to base of ear. Nostrils separated by a deep groove; inner margins moderately projecting. Inner margins of lips fringed with short papillæ. Median portion of tongue with oblique rows of rounded papillæ, each papilla with three small, straight, sharply pointed, backwardly directed horny spines.

*Ears*.—Tip of ear-conch reaching hinder corner of eye; outer much more convex than inner margin, tip rounded; in some species (*R. arabicus*, *angolensis*, *lanosus*) a shallow, but distinct, emargination of outer margin below tip of ear. Antitragal lobe small, flatly rounded (most species) or triangular (*R. angolensis*), in one species (*R. lanosus*) practically wanting.

*Wings*.—Chief characters: second digit clawed; membranes from sides of dorsum and back of first or second toe.

First phalanx of first digit one and a half the length of metacarpal. Second digit subequal to (a little longer or shorter than) third metacarpal. Third metacarpal from six to seven tenths the length of the forearm, a little longer than fourth metacarpal, which is a little longer than fifth. First phalanx of third digit two thirds to three fourths the length of the metacarpal; second phalanx four fifths to six sevenths of metacarpal. First phalanx of fourth digit rather more than half of metacarpal; second phalanx a little longer than first. First phalanx of fifth digit equal to, or a little less than, half of metacarpal; second phalanx a little longer or shorter than first. See wing-indices, on p. 20.

First digit included in the membrane by the metacarpal and base of first phalanx. 9–15 long fasciæ in the lateral membrane, viz. 2–4 postaneoneal, 7–13 preaneoneal.

*Tail*.—From less than one half to five sixths the length of the hind foot; basal portion connected with interfemoral by its dorsal integument, terminal portion freely projecting.

	Pollex.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
<i>R. leachi</i> , <i>egyptiacus</i> , <i>arabicus</i> .	361	442	105	105	644	438	601	635	344	379	622	315	286
<i>R. leschenaulti</i> , <i>seminudus</i> , <i>amplexicaudatus</i> , <i>brachyotis</i> }	335	415	93	100	612	405	521	595	313	353	556	291	323
<i>R. celebensis</i> .....	392	436	99	119	640	453	553	620	326	367	620	288	336
<i>R. lanosus</i> .....	400	426	109	129	669	454	648	660	342	407	622	299	332
<i>R. angolensis</i> .....	440	534	121	131	705	514	611	692	383	393	692	333	361

*Foot*.—Tarso-metatarsal portion of foot long: measured on plantar surface equal to or more than two thirds the length of phalanges with claw of third toe (compare *Myonycteris*).

*Fur*.—In most species: fur on body short, adpressed; face in front of and below eyes very short-haired; notopatagium naked; upperside of tibiæ short-haired or naked. In three species (*R. celebensis*, *angolensis*, and *lanosus*) the coat is longer, velvet or (*lanosus*) rather coarse; face more distinctly haired; notopatagium and upperside of tibiæ well haired. In all species the fur of the body extends on the proximal half or two thirds of the forearm.

*Sexual differentiation*.—Inconsiderable. Glandular hairs on fore-neck and sides of neck more brightly coloured in adult males of certain species (*R. angolensis*, *amplexicaudatus*). Females seem to average a trifle larger than males, but the difference, if any, is infinitesimal. In some species (e. g. *R. leachi* and *leschenaulti*), of which the majority of individuals are dark-coloured, specimens occur which have the upperside more or less suffused with Prout's brown or mars-brown, the underparts with wood-brown; the available material is not extensive enough to show whether this colour-difference is sexual, dependent on age, or indicative of the existence of two colour-phases.

*Range*.—The African continent, exclusive of the Mediterranean countries W. of Egypt; S. Asia, from Palestine and Cyprus to S. China; the Indo- and Austro-Malayan Archipelagos, as far east as the Solomon Islands.

*Habits*.—The fruit of *Eriobotrya* ("Loquat") is the favourite food of the S. African *R. leachi*; when eating the bat throws itself on to a neighbouring branch or suspends itself on quivering wings, and seizing the fruit in its mouth either bites a portion of it away at once or pulls it off from its hold; in this way it destroys far more fruit than it eats; in default of fruit it devours insects, snapping them off the flowers and leaves without alighting. (*Layard*.)

In Egypt, *R. egyptiacus* is found in ancient tombs and temples, old mosques, and Sheiks' graves, or in crevices of rocks; in the days of Etienne Geoffroy it frequented the recesses of the Great Pyramid, but now (Dr. J. Anderson writes, in 1902) it is not found in that building; it is also met with in trees in gardens, and in



date-plantations around villages, in sycamore, mulberry, and other trees; occasionally it is found singly, but generally a few are associated together; feeds on fruits of the date-palm, wild figs, &c. Visiting Cyprus in 1901-2, Miss D. M. A. Bate found *R. aegyptiacus* excessively common; it does considerable damage to the fruit-crops, particularly to the oranges and dates, though while the latter are ripening they are often enveloped in sacks or matting for protection; during the summer it roosts in thick trees, in winter in closely packed bunches in the roofs of old buildings and caves; it is very restless, and extremely noisy, even in daytime and when undisturbed (P. Z. S. 1903, ii. p. 342).

*R. leachi* has repeatedly been bred in captivity (Zoological Gardens, London and Cologne). During the act of copulation the male is suspended (as usual by the hind feet) behind the female, its underparts being in contact with the lower back of the female; an embracing with the anterior extremities does not take place; period of gestation (in one case, Cologne gardens) precisely 15 weeks after last copulation; during the first months after birth the young bat was rarely seen, suspended as it was from the mammae of the female and completely covered by her wing-membranes; by the end of the third month the young commenced to take part in the meals of the parents (the juice, not the flesh, of moist fruit), but remained in its protected position at the breast of the mother till the end of the fourth month; at the age of eight months it was still not quite full-grown (Wunderlich, Zool. Garten. xxxii. pp. 78-81, 1891).—According to Dr. J. Anderson, young of *R. aegyptiacus* are born generally in February and March; a female of *R. arabicus* killed on March 29 at Lahaj, Aden, had a single young one at her breast, and other gravid females had single foetuses (Yerbury & Thomas, P. Z. S. 1895, p. 545); a female of *R. amplexicaudatus* obtained by A. Everett in Alor Island, N. of Timor, had one young on March 24 (collector's label, British Museum).

Scarcely anything is known about the habits of the Oriental and Austro-Malayan species. Hodgson's account of the habits and extensive nightly migrations of "*Pteropus pyrovorus*," i. e. *R. leschenaulti*, in Nepal (J. A. S. B. iv. p. 700, 1835)—copied by Hutton, P. Z. S. 1872, pp. 693-94, under the head of *Cynopterus marginatus*, and by Dobson, in his Catalogue, under *Cynonycteris amplexicaudatus*, and again, by an oversight, under *Cynopterus marginatus*—is based wholly on a misconception, as pointed out by Scully (J. A. S. B. lvi. pp. 237-38, 1887). Dobson was informed that a colony of *R. leschenaulti* living near the sea at Moulmein were seen to feed on Mollusca left exposed by the tide (J. A. S. B. xlii. p. 200, 1873); this would seem to explain the occurrence of an allied species (*R. arabicus*) in so dreary a desert as the island of Kishm, Persian Gulf, where an exclusively fruit-eating mammal could hardly exist.

*Affinities*.—*Roussettus* is allied (though not very closely) to *Eidolon*; the two genera represent no doubt diverging branches from one common stem. In having no bony auditory meatus, the

premaxillaries in contact (not separated),  $m_1$  not lengthened, and  $m^2$  less reduced in size, *Rousettus* is less specialized than *Eidolon*; but it is on a higher level in the rather shorter rostrum and more reduced  $p^1$ . The range of the genus over the whole of the Ethiopian and Oriental regions, the close affinity of *R. arabicus* to the S. African *R. leachi*, the absence of any representative of the genus from the whole of the Mediterranean subregion \* (except Egypt), are evidence that its origin dates back to a time when, owing to different physiographic conditions, Africa and S. Asia were much more intimately connected than now. *Eidolon* is a peculiarly modified Ethiopian offshoot of the common prototype.

The eleven known species fall into three natural, rather sharply separated groups (subgenera):—

(1) Subgenus *ROUSETTUS*:—Brain-case moderately deflected; premaxillaries in contact, not co-ossified (except sometimes in *R. aegyptiacus*); cheek-teeth unmodified in size and shape;  $p_1$  much larger in bulk than a lower incisor; wings from first toe; antitragal lobe small, but distinct.—This is the least specialized of the three subgenera of *Rousettus*, in all essential characters perhaps the most primitive group of living Megachiroptera. Range: the Ethiopian Region, through Egypt, Cyprus, Palestine, Arabia, S. Asia, the Indo-Malayan and Austro-Malayan Archipelagos, eastward to the Solomon Islands. The nine species are referable to three types:—(a) *R. leachi*, *aegyptiacus*, and *arabicus*: rather heavily built species, with strong rostrum and teeth, the second phalanx of third digit lengthened, the pollex comparatively long; distributed over Africa generally, Cyprus, Palestine, Syria, and Arabia, as far as Sind (Karachi). *R. aegyptiacus* is a larger-skulled modification of the *R. leachi* type: *R. arabicus* is more closely allied to the S. African *R. leachi* than to *R. aegyptiacus*.—(b) *R. leschenaulti*, *seminudus*, *amplexicaudatus*, *minor*, and *brachyotis*: very closely related to the species of the former section, but rather more delicately built, with slenderer rostrum, feebler teeth, the second phalanx of the third digit not lengthened, the pollex comparatively shorter. The members of this section are probably on the whole slightly less specialized than those of the former. *R. leschenaulti* (continental S. Asia) and *seminudus* (Ceylon) come near to the S. African *R. leachi* in the width of the interspace between  $c$  and  $p^3$ , the size and shape of  $m_3$ , the width of the ears, and the shortness of the tail; in the Indo-Malayan *R. amplexicaudatus* there is a tendency to a reduction of the diastema  $c-p^3$ ,  $m_3$  is smaller and more circular in outline, the ears narrower, the tail averaging longer, the general dimensions smaller; most of these characters

\* *Rousettus guillardii*, Trouessart (Cat. Mamm., Suppl. p. 60, 1904; based on *Cynonycteris* (?) sp., Claude Gaillard, C. R. Acad. Sci. cxv. p. 620, 1897, and Arch. Mus. d'Hist. Nat. Trop. vii., 2 mém. p. 6, fig. 1, 1899), known from a complete right humerus and the distal extremities of a right and left humerus, from the Middle Miocene of La Grive Saint-Alban, Isère, is not a *Rousettus*, nor even a Fruit-Bat, but some large species of Microchiroptera, as proved by Gaillard's figure of the humerus (l. s. c.: high, flange-like deltoid crest).

find a climax in the Austro-Malayan *R. brachyotis*: diastema e-p<sup>3</sup> still more reduced, p<sup>1</sup> deciduous, ears still smaller, size smaller.—(e) *R. celebensis*: palate and cheek-teeth narrower than usual, fur longer and richer, size small, wings proportionately long; probably a modification of the *R. amplexicaudatus* type.

(2) *STENONYCTERIS*\* (subg. nov.):—Brain-case strongly deflected; premaxillaries never co-ossified; cheek-teeth excessively narrow: width of p<sup>1</sup> about one fifth (in *Rousettus* s. str. about one third) that of palate between fronts of p<sup>1</sup>; p<sub>1</sub> much larger in bulk than a lower incisor; wings from second toe; antitragal lobe obsolete; fur long and rather coarse. Ethiopian. One species: *R. lanosus*, Thos.—So far as the reduction of the cheek-teeth is concerned, this peculiar species stands in the same relation to the rest of the genus *Rousettus* as the narrow-toothed species of *Pteropus* (*Pt. subniger*, *personatus*, *woodfordi*, *scapulatus*) to the normal-toothed *Pteropi*. If its habits were known, *R. lanosus* would probably prove to subsist chiefly on food (juice of fruits) that requires little or no mastication.

(3) *LISSENYCTERIS*† (subg. nov.):—Brain-case only slightly deflected; premaxillaries co-ossified in front, even in young adults; cheek-teeth peculiarly short and broad, subquadrate; p<sub>1</sub> reduced in size, being only subequal to a lower incisor; wings from second toe; antitragal lobe distinct; fur long and silky. Ethiopian. One species: *R. angolensis*, Boc.—This is the most aberrant species of the genus; although in all important respects a "*Rousettus*," it shows, in the small deflection of the brain-case, the shape of the occipital region of the skull, and the outline of the cheek-teeth, leanings towards the genus *Epomophorus*.

*Rousettus*, Gray: 1821.—No description. Type (only species): *Pteropus aegyptiacus*, Geoff. The name *Rousettus* must have been suppressed or forgotten by Gray; it does not occur in any of his later papers. Revived by Palmer, Proc. Biol. Soc. Wash. xii. p. 112 (30 April, 1898).

*Cercopithecus*, Burnett; 1829.—No description. Two species mentioned: *C. aegyptiacus* and *C. amplexicaudatus*. The former, as being the first-named, may be fixed as the type.

*Xantharpyia*, Gray; 1843.—No description. Three species, enumerated in the following order: The Xantharpye, *Xantharpyia amplexicaudata*; Egyptian Xantharpye, *X. aegyptiaca*; The Pale Xantharpye, *X. straminea*. Both on the "first species principle" and on the "tautology principle" *X. amplexicaudata* must be regarded as the type of the genus. It should be mentioned that the two examples referred by Gray in this book (List Mamm. B. M. p. 37, 1843) to "*X. amplexicaudata*" are in reality not this species but *Dobsonia palinata*; however, by his reference to Geoffroy's original description and figure of *Pteropus amplexicaudatus* Gray

\* *Στενός* (narrow), *νυκτερίς* (bat); in allusion to the excessively narrow molars.

† *Λισσός* (soft), *νυκτερίς*; from the silky character of the fur.

clearly indicates which species is meant by the name *amplexicaudata*.—A brief diagnosis of the genus *Xantharpyia* was given by Gray in Voyage of the 'Sulphur,' i. p. 29 (1844): distinguished from *Eleutherura* by having the "tail with the base inclosed in the underside of the interfemoral membrane."

*Eleutherura*, Gray; 1844.—First occurrence of the name in Gray's List Mamm. B. M. p. xix (1843): no description, no species. Second occurrence in Voyage of the 'Sulphur,' i. p. 29 (1844): type (only species mentioned), *E. hottentotta*, Temm.; a brief diagnosis showing that Gray based the genus on Temminck's erroneous description of *Pteropus hottentottus*: tail free (not connected with interfemoral), projecting from "a nick on the middle of the narrow interfemoral"; but Temminck's *Pt. hottentottus* is A. Smith's *Pt. leachi*.

*Cynonycteris*, Peters; 1852.—Type (only species mentioned): *Pteropus collaris*, Licht. (nec Ill.), i. e. *Pteropus leachi*, A. Smith.—The genus *Cynonycteris*, as understood by Peters in 1867 (Revision of Megachiroptera, MB. Akad. Berlin, 1867, pp. 865–866), included all the then known species of *Rousettus* and *Eidolon*. Dobson's *Cynonycteris* (Cat. Chir. 1878) corresponds to the genera *Eidolon*, *Rousettus*, and *Myonycteris* of this Catalogue.

*Senonycteris*, Gray; 1870.—A subgenus of *Xantharpyia*. Type (only species): *Xantharpyia seminula*, Gray. Separated from *Xantharpyia* s. str. on account of its "very sparse and short" fur, "especially on the back," and "nearly bald" forearm.

### *Synopsis of the Species.\**

- |  |                                   |
|--|-----------------------------------|
| 1. Brain-case conspicuously deflected; premaxillaries in contact; $p_1$ much larger in bulk than a lower incisor.  |                                   |
| A. Brain-case moderately deflected; width of $p^1$ about one third that of palate between fronts of $p^1$ ; wings from 1st toe; antitragal lobe distinct | Subg. ROUSETTUS.                  |
| a. Pollex 30–37.5; 2nd phalanx of third digit 50.5–61.5 mm.  |                                   |
| a'. Ears not attenuated at tip; lower leg 40–45.5 mm.  |                                   |
| a". Length of skull 40.5–43.8 mm.; rostrum slenderer; palate-ridges normally 4+3+1; forearm 89–99 mm. (S. Africa)  | 1. <i>R. leachi</i> , p. 25.      |
| b'. Length of skull 43.6–46.7 mm.; rostrum heavier; palate-ridges 4+4+1; forearm 88–99 mm. (Angola to Palestine)   | 2. <i>R. aegyptiacus</i> , p. 29. |
| b'. Ears attenuated at tip; lower leg 37–39.5 mm.; forearm 87–96. (Arabia to Sind)   | 3. <i>R. arabicus</i> , p. 33.    |
| b. Pollex 24–30; 2nd phalanx of 3rd digit 36–47.2 mm.  |                                   |

\* On *R. albanus* see p. 43 and Addendum at end of Volume.

c'. Molars not unusually narrow; fur short; notopatagium naked.

c<sup>2</sup>. m<sub>3</sub> elliptical in outline, once and a half or twice as long as broad; width of ears 14.5–15.8 mm.

a<sup>3</sup>. p<sup>1</sup> not deciduous; fur on nape and shoulders not unusually scarce; forearm 80.5–87.5 mm. (India, Himalaya, to S. China)

[p. 35.]

4. *R. leschenaulti*,

b<sup>3</sup>. p<sup>1</sup> deciduous; nape and shoulders seminaked; forearm 79–85.5 mm. (Ceylon)

5. *R. seminudus*, p. 33.

d<sup>2</sup>. m<sub>3</sub> subcircular in outline, only slightly longer than broad; width of ears 10–13 mm.

c<sup>3</sup>. p<sup>1</sup> not deciduous; forearm 77–87.2 mm. (Indo-Malayan)

[p. 40.]

6. *R. amplexicaudatus*,

d<sup>3</sup>. p<sup>1</sup> deciduous; forearm 69.8–75 mm. (Austro-Malayan)

8. *R. brachyotis*, p. 44.

d'. Molars unusually narrow; bony palate narrow; fur longer; notopatagium and tibiæ well haired; forearm 72.5–75 mm. (Celebes)

9. *R. celebensis*, p. 46.

B. Brain-case strongly deflected; cheek-teeth excessively narrow; width of p<sup>1</sup> about one fifth that of palate between fronts of p<sup>4</sup>; wings from 2nd toe; antitragal lobe obsolete

Subg. STENONYCTERIS.

c. Fur long and coarse; lower leg 39–40; forearm 88.5–90 mm. (Ethiopian)

10. *R. lanosus*, p. 49.

II. Brain-case slightly deflected; premaxillaries co-ossified; p<sub>1</sub> subequal in bulk to a lower incisor; molars short and broad; wings from 2nd toe; antitragal lobe distinct

Subg. LISSONYCTERIS.

d. Fur long and silky; lower leg 29–31; forearm 79–83.5 mm. (Ethiopian)

11. *R. angolensis*, p. 51.

### 1. *Rousettus leachi*, A. Sma.

*Cynonycteris collaris*, Dobson, Cat. Chir. B. M. p. 75.

*Pteropus collaris* (nec Ill.), Lichtenstein, Verz. Doubl. Mus. Berlin, p. 3, no. 47, p. 5 (1823; Terra Caffrorum); Giebel, Säug. p. 1000 (1855).

*Cynonycteris collaris*, Peters, Reise Mossambique, Säug. p. 25 (1852; Inhambane); id., M.B. Akad. Berlin, 1867, p. 865 (S. Africa); P. L. Selater, P. Z. S. 1868, p. 404 (at sea off Natal); op. cit. 1869, p. 602 (Natal); op. cit. 1870, p. 127 (fig. of ♀ ad. with young); op. cit. 1871, p. 478 (breeding in captivity); op. cit. 1873, p. 193 (specimens in captivity); Dobson, Cat. Chir. Ind. Mus. p. 2 (1874; S. Africa); Gulliver, P. Z. S. 1875, p. 493, pl. iv. fig. 7 (red blood-corpuscles); Dobson, Mon. Asiat. Chir. p. 190 (1876; S. Africa); J. Anderson, Cat. Mamm. Ind. Mus. i. p. 104 (1881; S. Africa); Jentink, Cat. Ostéol. Mamm. p. 263 (1887; Cape); id., Cat. Syst. Mamm. p. 151 (1888); H. Allen, Proc. Acad. Nat. Sci. Philad. 1889, p. 337 (wing-membranes); Brehm, Tierleben, 3 ed. i. p. 350 (1890); Wunderlich, Zool. Garten, XXX, no. 3, p. 78, text-fig. (1891; breeding in captivity); Trouessart, Cat. Mamm. i. p. 84 (pt.) (1897).

- Cynopterus collaris*, *Kolenati, Mon. europ. Chir.* p. 11 (1860: Cape, Mozambique).
- Eleutherura collaris*, *Gray, Cat. Monk. &c.* p. 118 (1870: Cape, Natal).
- Cynopterus* (*Cynonycteris*) *collaris*, *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 206 (pt.) (1878: Cape of G. H., Natal).
- Xantharpyia collaris*, *Matschie, Megachiroptera*, p. 66 (pt.) (1899).
- Rousettus collaris*, *W. L. Slater, Mamm. S. Afr.* ii. p. 106, text-fig. 118 (1901: Cape, Natal); *Anderson & de Winton, Zool. Egypt, Mamm.* pp. 86, 88 (1902); *Trouessart, Cat. Mamm., Suppl.* p. 60 (pt.) (1904); *Thomas & Schwann, P. Z. S.* 1906, p. 161 (Knysna); *Miller, Fam. & Gen. Bats*, p. 54 (1907).
- Pteropus amplexicaudatus* (*nec Geoff.*), *Temminck, Mon. Mamm.* i. p. 260 (1827: Cape); *J. B. Fischer, Syn. Mamm.* p. 86 (pt.) (1829: Cape).
- Cynonycteris amplexicaudata*, *Dobson, Cat. Chir. B. M.* p. 73, specimens *e-j* (1878).
- Pteropus leachi*, *A. Smith, Zool. Journ.* iv. p. 433 (1829: Cape); *id., Bull. Sci. Nat.* xviii. p. 272 (1829: Cape); *Temminck, in Smuts's Enum. Mamm. Capens.* p. 5 (1832: Cape); *A. Smith, S. Afr. Quart. Journ.* ii. p. 53 (1833: Cape); *Lesson, Hist. Nat. Mamm. (Compl. Buffon)* v. p. 49 (1836: Cape); *Temminck, Mon. Mamm.* ii. p. 88 (1837: Cape); *Gray, Mag. Zool. & Bot.* ii. p. 503 (1838: Cape); *Wagner, Schreber's Säug., Suppl.* i. p. 361 (1840: Cape); *Rüppell, Mus. Senck.* iii. Heft 2, p. 154 (1842: S. Africa); *Lesson, N. Tabl. Règne An.* p. 14, no. 192 (1842: Cape); *Schinz, Syst. Verz. Säug.* i. p. 131 (1844: Cape); *A. Smith, Ill. Zool. S. Afr.* pl. 48 (whole fig., head, skull) (1847: Cape); *Wagner, Schreber's Säug., Suppl.* v. p. 604 (1853-55: Cape, Mozambique); *Gervais, Hist. Nat. Mamm.* i. p. 191 \* (1854); *Schlegel, Dierkunde*, i. p. 53 (1857: S. Africa); *Layard, Cat. S. Afr. Mus., Mamm.* p. 19 (1861).
- Xantharpyia leachi*, *Gerrard, Cat. Bones Mamm. B. M.* p. 57 (1862: Natal); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. Heft 8, p. 466 (1869: Cape, Mozambique).
- Rousettus leachi*, *K. Andersen, Ann. & Mag. N. H.* (7) xix. p. 506 (1907); *Lönnberg, Kilimandjaro-Meru Expedition*, pt. 2, p. 6 (1908: Tanga).
- Pteropus hottenottus* †, *Temminck, in Smuts's Enum. Mamm. Capens.* p. 3 (1832: Cape); *id., Mon. Mamm.* ii. p. 87, pl. xxxvi. figs. 16, 17 (skull) (1837: Cape); *Wagner, Schreber's Säug., Suppl.* i. p. 360 (1840: Cape); *Rüppell, Mus. Senck.* iii. Heft 2, p. 154 (1842: S. Africa); *Lesson, N. Tabl. Règne An.* p. 14, no. 191 (1842: Cape); *Schinz, Syst. Verz. Säug.* i. p. 131 (1844: Cape); *Wagner, Schreber's Säug., Suppl.* v. p. 604 (1853-55: Cape); *Gervais, Hist. Nat. Mamm.* i. p. 191 (1854: S. Africa); *Giebel, Säug.* p. 1000 (1855); *Grill, K. Sv. Vet.-Akad. Handl.* n. s. ii. no. 10, pp. 9, 13 (1860: Knysna).
- Xantharpyia hottenotta*, *Blyth, Cat. Mamm. Mus. As. Soc.* p. 21, no. 56 (1863: S. Africa); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. Heft 8, p. 468 (1869: Cape).
- Cynopterus breviaudatus* (*nec Is. Geoff.*), *Gray, List Mamm. B. M.* p. 39 (1843).
- Rousettus sjöstedti*, *Lönnberg, Kilimandjaro-Meru Expedition*, pt. 2, p. 7 (1908: Tanga) ‡.

\* Misspelt *Pteropus Erachii*.

† Earliest spelling: *hottenottus*: misspelt *hottenottus* by a few of the authors quoted.

‡ See Addenda.

*Diagnosis*.—Distinguished from all other species of the genus by the combination of the following characters:—Frontal region of skull between postorbital processes flattened; premaxillaries in contact, but rarely co-ossified; total length of skull 40·5–43·8 mm.; palate-ridges normally 4+3+1. Wings from back of first toe, or interspace between first and second toe; pollex (with claw) 31–35·5 mm.; second phalanx of third digit 50·5–60 mm.; second phalanx of fifth digit nearly always shorter than first phalanx; ears not attenuated at tip; fur short. Forearm 89–99 mm.

*Skull*.—Brain-case moderately deflected (compare *R. lanosus* and *R. angolensis*). Premaxillaries in contact in front, but rarely, even in very aged individuals, co-ossified (compare *R. aegyptiacus* and *R. angolensis*). Frontal region between postorbital processes flattened (compare *R. angolensis*); region between orbits comparatively narrow, the width of the interorbital constriction in fully adult specimens being almost always distinctly less than the width of the postorbital constriction (compare *R. aegyptiacus*). Temporal crests uniting into a sagittal crest at level with root of zygomata, but very often remaining separate throughout the life of the individual.

*Teeth*.—Upper incisors almost equidistant, or the interspace between  $i^1$  and  $i^1$  much less than between  $i^2$  and  $c$ . Distance  $c$ – $p^3$  equal to or larger than between  $i^2$  and  $c$ .  $p^1$  small, equal in size to  $i^2$ .  $m^1$  equalling or exceeding  $p^1$  in length.  $m^2$  rather less than half the size of  $m^1$ .—Lower incisors crowded. A broad interspace between  $c$  and  $p_3$ .  $p_1$  in cross section from twice to four times the size of a lower incisor, situated nearer to the canine than to  $p_3$ .  $m_1$ ,  $m_2$ , and  $m_3$  elliptical oval or almost elliptical in outline;  $m_2$  somewhat smaller than  $m_1$ ;  $m_3$  from two thirds to less than one half the size of  $m_2$ .

*Palate-ridges*.—Normally 4+3+1. Variations from the rule: the fourth ridge in some individuals interrupted in the median line (formula: 3+4+1); a 9th, more or less indistinct, ridge occasionally detectable (formula: 4+3+2).

*Ears*.—Outer much more convex than inner margin; tip not attenuated, broadly rounded off above (compare *R. arabicus*). Antitragal lobe flatly rounded.

*Wings*.—Pollex with claw equal in length to four fifths of second metacarpal (or equal to first phalanx of fourth digit). Second digit equal to metacarpal of third digit. First phalanx of third digit equal to two thirds of metacarpal; second phalanx only a little shorter than metacarpal. Second phalanx of fifth digit, with rare individual exceptions, shorter than first phalanx (compare *R. angolensis*). Wing-indices, see *antea*, p. 20.—Notopatagium semicircular in outline, naked: lateral membrane inserted on end of first metatarsal, or between first and second toe. 10–14 long fasciae in the lateral membrane, viz. 2–3 postanconal, 8–10 preanconal.

*Tail*.—From one half to three fourths the length of the hind foot.

*Fur*.—Ears naked posteriorly, except at base. Face in front of and below eyes short-haired. Fur on back short, soft; longer,

more woolly, and less closely adpressed on foreneck. Fur of body extending upon upperside of humerus and proximal half or two thirds of forearm; front margin of antebrachial membrane fringed with short hairs; notopatagium naked; femur well haired; tibia and hind foot to claws clothed with very short and thinly spread hairs; central portion of interfemoral well haired, lateral portion along tibiæ almost naked. Below, proximal two thirds of forearm, plagiopatagium next to body, femur, and central portion of interfemoral covered with short, thinly spread, woolly hair.

*Colour*.—General aspect: above, uniform dark brown with a tinge of slate, or more or less suffused with Prout's brown; below, uniform smoke-grey, or more or less suffused with wood-brown.

Back and rump varying from dark hair-brown tinged with slate to bistre; sides of back and rump next to membranes, in adult specimens of both sexes, often approaching Prout's brown, this colour sometimes extending over the whole of the upperside of the body; crown and occiput markedly darker than back; nape of neck lighter hair-brown. Underside uniform grizzled smoke-grey; in adult specimens of both sexes the foreneck, flanks, and under surface of humerus and forearm are often more or less suffused with wood-brown.

*Measurements*. On p. 34.

*Range*. Cape Colony, Natal, Lower Zambesi (Inhambane), north to German East Africa (Tanga).

*Cotype* in collection.

*Pteropus collaris*, Ill.; 1815.—Type locality: "die ostlichen [afrikanischen] Inseln."—Illiger's *Pteropus collaris* (Abh. Akad. Berlin, 1804-11, pp. 71, 84; published 1815) is Brisson's "Roussette à col rouge" (1756), Buffon's "Rougette" (1763), Kerr's *Vespertilio vampyrus subniger* (1792), E. Geoffroy's *Pteropus rubricollis* (1810). In 1823 Lichtenstein (*l. s. c.*) wrongly identified Illiger's *Pt. collaris* with the S. African Fruit-Bat here under consideration, but the error, hidden as it was in the little-known "Verz. Doubl. Mus. Berlin," passed for many years unnoticed, the species being constantly referred to as *Pteropus leachi* or *Pt. hottentottus*. In 1852 Peters ('Reise nach Mossambique') confirmed Lichtenstein's wrong identification of *Pt. collaris*, and from about that year the names *leachi* and *hottentottus* gradually went out of fashion, being replaced by *collaris*: from about 1870 *leachi* and *hottentottus* only appear in the lists of synonyms of *collaris*.

*Pteropus leachi*, A. Sm.; 1829.—Type locality: "Gardens about Cape Town"; cotype in collection.—Summary of description: "suprà fusco-cinereus, infrà sordido-cinereus, caudà liberâ." The earliest available technical name of the species.

*Pteropus hottentottus*, Temm.; 1832.—Type locality: "circa urbem Capensem"; type in the Leyden Museum (authentic specimens in the British Museum, see list below, specimens *a-e*).—Original description contributed by Temminck to Smuts's 'Enumeratio Mammalium Capensium.' Temminck points out the differences between *Pt. hottentottus* and *Pt. amplexicaudatus*, but was admittedly in doubt whether the former was separable from *Pt. leachi*



("de *Pteropo leachi* tenendum videtur, eum fortasse a præcedente [i. e. *Pt. hottentotto*] non distinctum esse specie"). Owing to a passage in the original description ("ad basin caudæ perbrevis cernitur incisura, figuram inversæ V præ se ferens: juxta hanc cauda, quæ plane est libera, exoritur"), *Pt. hottentottus* was by subsequent writers (Gray, Wagner, and others) supposed to differ from *Pt. leachi* by a V-shaped emargination of the interfemoral at the base of the tail, and by having the tail perfectly free from the interfemoral, differences which undoubtedly were due to shrinkage of the median part of the interfemoral in the mounted type of *hottentottus*.

a-e.	4 ad., 1 imm. sks.; skulls.	Near Cape Town ( <i>J. Smuts</i> ).	Purchased (Leyden Museum).	37.4.28 33-34, 38, 40, 67.
(Authentic specimens of <i>Pteropus hottentottus</i> , Temm.)				
f-h.	2 ♂ ad., 1 ♂ juv. al.; skull of f.	Cape Town.	Trustees of the S. African Museum [P.].	75.8.9.1 3.
i.	Ad. skull.	Cape Town ( <i>Sir A. Smith</i> ).	H. Ford, Esq. [P.].	73.12.8.5.
(Figured in Ill. Zool. S. Afr.)				
j.	♀ ad. al.	Cape Town ( <i>Sir A. Smith</i> ).	Surg.-Gen. G. E. Dobson [E.].	75.11.3.2.
(Cotype of species.)				
k.	♂ juv. sk.; skull.	Cape of Good Hope.	Purchased (Ver- reaux).	43.12.7.21.
l-s.	4 ♂ ad., 4 ♀ ad. sks.; skulls.	Knysna, 3 April, 1905 ( <i>C. H. B. Grant</i> ).	C. D. Rudd, Esq. [P.].	5.5.7.5-12.
t-v.	♂ ad., ♀ ad., ♀ juv. al.	Knysna ( <i>C. H. B. Grant</i> ).	C. D. Rudd, Esq. [P.].	6.4.3.126-127.
w.	Ad. st.; skull.	Natal.	Purchased (Stock- holm Museum).	{ 46.6.2.9. 49.8.16.3.
x.	♂ ad. al.	Natal.	Dr. Seeman [C.].	71.4.21.1.
y.	Ad. sk.; skull.	S. Africa.	Purchased (Brandt).	46.6.18.2.

## 2. *Rousettus ægyptiacus*, E. Geoff.

*Cynonycteris ægyptiaca*, Dobson, Cat. Chir. B. M. p. 74.

*Pteropus ægyptiacus*\*, E. Geoffroy, *Ann. Mus. d'Hist. Nat.* xv. p. 96 (1810: Lower Egypt); Oken, *Lehrb. Naturgesch.* iii. Abth. ii. p. 934 (1816); G. Cuvier, *Règne Anim.* i. p. 124 (1817); E. Geoffroy, *Descr. de l'Égypte, Hist. Nat.* ii., *Mamm.* p. 134, pl. iii. fig. 2 (1818); Desmarest, *Nouv. Dict. d'Hist. Nat.* xxix. p. 513 (1819: Cairo); id., *Encycl. Méth.*, *Mamm.* i. p. 111, no. 144 (1820); Gray, *London Medical Repository*, xv. p. 299 (1821); Lichtenstein, *Verz. Doubl. Mus. Berlin*, p. 3† (1823: Egypt); Lesson, *Man. Mamm.* p. 112, no. 292 (1827: Egypt); Gray, in *Griffith's Anim. Kingd.* v. p. 5†, no. 161 (1827: Egypt); Desmarest, *Dict. Sci. Nat.* xlv. p. 367 (1827: Egypt, "Senegal"); J. B. Fischer, *Syn. Mamm.* pp. 85, 549 (1829: Egypt, "W. coast of Africa"); E. Geoffroy, *Hist. Nat. Mamm.*, leç. 13, p. 24 (1829: Egypt); A. Smith, *S. Afr. Quart. Journ.* ii. p. 53 (1833: Egypt); Waterhouse, *Cat. Mamm. Mus. Zool. Soc.* 2nd ed. p. 13, no. 104 (1838); Gray, *Mag. Zool.*

\* Spelt *ægyptiacus* by Geoffroy in 1810 (original description of the species, *l. s. c.*), in 1818 by the same author (*Descr. de l'Égypte, l. s. c.*) *ægyptiacus*; the former may therefore be considered a slip or misprint corrected by the author himself.

† Spelt *Pt. ægypticus*.

- & *Bot.* ii. p. 503 (1838: N. & E. Africa); *Blainville, Ost. Mamm. Atlas, Chéiropt.* pl. xiii. fig. 2 (teeth) (1840); *Gervais, Hist. Nat. Mamm.* i. p. 191, fig. (teeth) (1854: Egypt, Nubia); *Giebel, Säug.* p. 999 (1855); *id.*, *Odontogr.* p. 9, pl. iv. fig. 3 (teeth) (1855); *Unger & Kotschy, Die Insel Cypern*, p. 570 (1865); *Gasco, Viaggio in Egitto*, pt. ii. p. 95 (1876); *Klunzinger, Upper Egypt*, p. 148 (1878).
- Xantharpyia ægyptiaca*, *Gray, List Mamm. B. M.* p. 37 (1843: Egypt); *id.*, *List Osteol. Specim. B. M.* p. 10 (1847); *Kolenati, SB. Akad. Wien*, xxix. p. 344\*, fig. 30 (palate-ridges) (1858); *Gerrard, Cat. Bones Mamm. B. M.* p. 57 (1862: Egypt); *Tristram, P. Z. S.* 1866, p. 93 (Palestine); *Fitzinger, SB. Akad. Wien*, liv. Abth. i. p. 544 (1866: Egypt); *id.*, *op. cit.* lx. Abth. i. p. 463 (1869: Egypt, Syria); *Matschie, Megachiroptera*, p. 66 (1899).
- Pachysoma ægyptiacum*, *Tomes, P. Z. S.* 1860, p. 44.
- Cynonycteris ægyptiaca*, *Peters, MB. Akad. Berlin*, 1867, p. 865 (Egypt); *Dobson, Mon. Asiat. Chir.* p. 32 (1876); *Tristram, Western Palestine*, p. 25 (1884); *Jentink, Cat. Osteol. Mamm.* p. 263 (1887: Egypt); *id.*, *Cat. Syst. Mamm.* p. 151 (1888: Egypt, "Senegal"); *H. Allen, Proc. Acad. Nat. Sci. Philad.* 1889, p. 337 (wing-membranes); *Brehm, Tierleben*, 3ed. i. p. 350 (1890: habits); *Noack, Jahrb. Hamb. Wiss. Anst.* ix. p. 56 (1891: Egypt); *Trouessart, Cat. Mamm.* i. p. 84 (pt.) (1897); *Seabra, J. Sci. Math. Lisboa*, (2) v. no. 19, pp. 158, 169 (1898: Syria).
- Eleutherura ægyptiaca*, *Gray, Cat. Monk. Sc.* p. 117 (pt.) (1870: Egypt).
- Cynopterus (Cynonycteris) ægyptiaca*, *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 206 (pt.) (1878: Egypt, Palestine).
- Rousettus*† *ægyptiacus*, *Anderson & de Winton, Zool. Egypt. Mamm.* p. 84, pl. xv. (whole fig.) (1902); *D. M. A. Bule, P. Z. S.* 1903, ii. p. 341 (Cyprus); *Trouessart, Cat. Mamm., Suppl.* p. 60 (pt.) (1904); *Senna, Arch. Zool. Napoli*, ii. fasc. 3, p. 256 (1905: Erythrea); *K. Andersen, Ann. & Mag. N. H.* (7) xix. p. 507 (1907); *Miller, Fam. & Gen. Bats*, p. 54 (1907).
- Pteropus geoffroyi*, *Temminck, Mon. Mamm.* i. p. 197 pl. xv. figs. 14, 15 (skull) (1825: Egypt, "Senegal"); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 702 (1828); *Lesson, Hist. Nat. Mamm. (Compl. Buffon)* v. p. 50 (1836: Egypt, "Senegal"); *Wagner, Schreber's Säug., Suppl.* i. p. 358 (1840: Egypt, "Senegal"); *Rüppell, Mus. Senck.* iii. Heft 2, p. 154 (1842: Egypt); *Lesson, N. Tabl. Règne An.* p. 14, no. 189 (1842: Egypt, "Senegal"); *Schinz, Syst. Verz. Säug.* i. p. 130 (1844: Lower Egypt, "Senegal"); *Wagner, Schreber's Säug., Suppl.* v. p. 603 (1853-55: Egypt, "Senegal"); *Heuglin, Reise N.O.-Afrika*, ii. p. 15 (1877: Egypt).
- Cynonycteris (Pteropus) geoffroyi*, *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 517 (1872-73: structure of hairs).
- Eleutherura unicolor*, *Gray, Cat. Monk. Sc.* p. 117 (1870: Gaboon).
- Cynonycteris collaris (nec Ill.)*, *Dobson, Cat. Chir. B. M.* p. 76, specimen a (1878: Gaboon); *Günther, P. Z. S.* 1879, p. 741 (Cyprus); *Dobson, Rep. Brit. Assoc.* 1880, p. 173 (Cyprus); *Trouessart, Cat. Mamm.* i. p. 84 (pt.) (1897: Cyprus); *Bocage, Journ. Sci. Math. Lisboa*, (2) v. no. 19, p. 137 (pt.), text-fig. 5 (1898: palate-ridges); *Seabra, ibid.* pp. 159, 169, pl. i. fig. 14 (1898: palate-ridges).

\* Spelt *Xantharpyia ægyptica*.

† Various spelt *Rousettus* or *Roussettus* by the authors quoted.

*Cynopterus* (*Cynonycteris*) *collaris*, Trouessart, *Rev. & Mag. Zool.*

(3) vi. p. 206 (pt.) (1878: Gaboon).

*Xantharpyia collaris*, Matschie, *Megachiroptera*, p. 66 (pt.) (1899).

*Rousettus collaris*, Trouessart, *Cat. Mamm., Suppl.* p. 60 (pt.) (1904).

*Cynonycteris* sp., Bocage, *Journ. Sci. Math. Lisboa*, (2) ii. no. 7, p. 176, text-fig. 3 (palate-ridges) (1892: Pungo Audongo).

*Diagnosis*.—Similar to *R. leachi*, but with larger skull, broader rostrum, broader frontal region, and heavier teeth; palate-ridges normally 4+4+1. Forearm 88–99 mm.

*Skull* (fig. 2, on p. 17).—Similar to that of *R. leachi*, but larger (see measurements, p. 34), and with markedly deeper and broader rostrum. Premaxillaries often co-ossified. Frontal region between orbits comparatively very broad, the width of the interorbital constriction in fully adult specimens distinctly larger than the width of the postorbital constriction. Owing to a stronger development of the temporal muscle (heavier cheek-teeth), the temporal crests unite into a sagittal crest at a short distance behind the postorbital processes, a sagittal crest being always developed in mature age and often present even in individuals with almost unworn teeth. For the same reason the coronoid process of the mandible is higher, the angular portion stronger and more projecting.

*Teeth* (fig. 2, on p. 17).—As in *R. leachi*, but averaging markedly larger.

*Palate-ridges*.—4+4+1, *i. e.* essentially as in *R. leachi*, but with an additional middle (divided) ridge behind the molars; the formula given here is taken from a few alcoholic specimens only; some slight individual variation may be found.

*External characters*.—General size averaging a trifle larger than that of *R. leachi*, head proportionally much larger, muzzle deeper and broader, ears larger, but precisely of the same shape as in *R. leachi*; wing-structure as in *R. leachi*; upperside of tibia and foot, to the claws, more densely haired.

Colour rather similar to that of *R. leachi*, but of a somewhat lighter shade. Back and rump hair-brown, with a slight tinge of brownish slate; crown of head and occiput darker than back; nape of neck light hair-brown, or drab. Underside grizzled smoky grey; foreneck and flanks in adult specimens often more or less suffused with wood-brown. In dried specimens exposed to light the slaty tinge of the upperside very soon disappears, the colour fading into brown or yellowish brown.

*Measurements*. On p. 34.

*Range*. From Loanda and Gaboon to Egypt, Erythrea, Syria, Palestine, and Cyprus.

*Type* in the Paris Museum.

*Pteropus aegyptiacus*, Geoff.; 1810.—Type locality: “la basse Egypte” (“le plafond d’une des chambres de la grande Pyramide”). Based by Geoffroy on “plusieurs individus”; of these one only appears now to be in the Paris Museum, an adult male, mounted, in bad condition, much faded, skull *in situ*; labelled Egypt (Reg. no. A. 69). The species was figured eight years later in ‘Description de l’Egypte’ (*l. s. c.*).

*Pteropus geoffroyi*, Temm.; 1825.—Namo proposed in lieu of *egyptiacus*, "vu que l'espèce se trouve au Sénégal, et probablement sur toute la côte septentrionale d'Afrique."

*Eleutherura unicolor*, Gray; 1870.—Type locality: Gaboon; type in collection.—Gray did not give any tangible character by which to discriminate *E. unicolor* from *E. egyptiacus*. The type is a faded specimen, indistinguishable in cranial and dental characters from examples from Egypt; a specimen in the British Museum from Loanda (Pungo Andongo) is further evidence of the occurrence of *R. egyptiacus* in W. Africa.

*Remarks*.—*R. egyptiacus* is a large-skulled northern representative of the *R. leachi* type. It has not rarely been confused with the allied *R. leachi* and *R. arabicus*, more frequently with the very different *R. lunosus*. Its distribution in Africa between Angola and Egypt, and the exact limits of its area in Syria and Palestine (as compared with that of *R. arabicus*), remain to be determined.

a. ♂ ad. sk.; skull.	Pungo Andongo, Loanda, 1200 m.; 9 June, 1903.	Dr. W. J. Ansorge [C.].	4.4.9.2.
b. ♀ ad. sk.; skull.	Gaboon.	Purchased (Verreaux).	62.8.26.1.
(Type of <i>Eleutherura unicolor</i> , Gray.)			
c-d. Ad. sks.; skulls.	Egypt.	Dr. Turnbull Christie [C. & P.].	39 a, b.
e-f. Ad. skulls.	Egypt.	Dr. Turnbull Christie [C. & P.].	39 c, f.
g-h. 2 ♀ ad. sks.; skulls.	Egypt.	Jas. Burton, Esq. [P.].	39 c, d.
i. Imm. sk.; skull.		Tomes Coll. (Vigors).	7.1.1.262.
j-n. 2 ♂ ad., 2 ♀ ad., 1 foet. al.; skulls of j, l, n.	Cairo, Egypt (Dr. Innes).	Mrs. J. Anderson [P.].	3.12.8.1-4.
o. ♀ ad. al.	Assiut, Egypt; 21 Jan. 1892.	Dr. J. Anderson [C. & P.].	92.9.9.1.
p-q. ♂ ad., ♀ ad. al.	Mehalleh el Kebir, Egypt (G. H. Kent).	Dr. J. Anderson [P.].	92.9.9.2-3.
r-s. 2 ♂ jun. al.; skull of r.	Wady Kurn, Acre, Palestine.	Canon H. B. Tristram [C.].	64.8.17.45-46.
t. ♀ ad. sk.; skull.	Mt. Lebanon; March, 1894.	Saleem Baroodi [C.].	94.5.7.2.
u-z. 3 ♂ ad., 3 ♀ ad. al.; skulls of y-z.	Cyprus.	Lord Lilford [P.].	79.10.16.1-6.
a <sup>2</sup> -b <sup>2</sup> . ♂ ad., ♀ ad. skulls.	Cyprus.	Lord Lilford [P.].	99.7.2.1-2.
c <sup>2</sup> -g <sup>2</sup> . ♂ ad., 2 ♂ jun., ♀ ad., ♀ jun. sks.; skulls of e <sup>2</sup> , g <sup>2</sup> .	Nicosia, Cyprus 440-700'; Apr., Oct., Nov., 1901-2.	Miss D. M. A. Bate [C.].	3.12.4.1-3, 5-6.
h <sup>2</sup> . ♀ jun. sk.; skull.	Ktema, Cyprus, 200'; 18 Mar. 1902.	Miss D. M. A. Bate [C.].	3.12.4.4.

3. *Rousettus arabicus*, *Andl. & de Wint.*

*Cynonycteris amplexicaudata* (*nec Geoff.*), *Dobson, Cat. Chir. Ind. Mus.* p. 2 (pt.) (1874: Kishm I.); *Blanford, E. Persia*, ii p. 81 (1876: Kishm I.); *Dobson, Mon. Asiat. Chir.* p. 190 (pt.) (1876: Kishm I.); *J. Anderson, Cat. Mamm. Ind. Mus.* i. p. 104 (pt.) (1881: Kishm I.); *Murray, Vert. Zool. Sind.* p. 3 (1884: Muklee Hills, Sind); *Trouessart, Cat. Mamm.* i. p. 81 (pt.) (1897: Kishm I.).

*Cynopterus* (*Cynonycteris*) *amplexicaudatus*, *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 20 (pt.) (1878: Persian Gulf).

*Xantharpyia amplexicaudata*, *Blanford, Fauna Brit. Ind., Mamm.* pt. ii. p. 262 (pt.) (1891: Kishm; Karachi); *Thomas, P. Z. S.* 1894, p. 449 (Muscat); *Matschie, Megachiroptera*, p. 67 (pt.) (1899).

*Rousettus amplexicaudatus*, *Thomas, P. Z. S.* 1900, p. 98 (Aden); *Trouessart, Cat. Mamm., Suppl.* p. 60 (pt.) (1904: Aden, Muscat, Kishm).

*Xantharpyia aegyptiaca* (*nec Geoff.*), *Yerbury & Thomas, P. Z. S.* 1895, p. 545 (Aden).

*Xantharpyia collaris* (*nec Ill.*), *Matschie, Megachiroptera*, p. 66 (pt.) (1899: Aden).

*Rousettus arabicus*, *Anderson & de Winton, Zool. Egypt, Mamm.* pp. 86, 88, 89-90 (1902: Aden); *K. Andersen, Ann. & Mag. N. H.* (7) xix. p. 507 (1907).

*Diagnosis.*—Similar to *R. leachi*, but with shorter and lower rostrum, narrower ear-tips, shorter tibia and foot. Forearm 87-96 mm.

*Details.*—The skull of *R. arabicus* averages in every respect smaller than in *R. leachi*: total length in fully adult individuals 38.7-41.8 mm., against 40.5-43.8 in *R. leachi*; rostrum markedly shorter and slenderer: length from front of orbit to tip of nasals 13-13.6 mm., against 13.8-15.2 in *R. leachi*. Teeth as in *R. leachi*, but smaller, and molars narrower. Palate-ridges sometimes 4+3+1, as in *R. leachi*, but very often there is, behind the 6th ridge, a more or less distinct additional ridge, the extremities of which are either in direct connection with or terminating very closely behind those of the 6th ridge, giving the formula 4+4+1, as in *R. aegyptiacus*.

Inner margin of ear-conch nearly straight, tip of ear much narrower than in *R. leachi*; tibia and foot noticeably shorter. Distribution and colour of fur as in *R. aegyptiacus*.

From *R. aegyptiacus* this species is readily distinguished by its much smaller skull, shorter and slenderer muzzle, much narrower ear-tips, shorter wings, and shorter tibia and foot.

*Measurements.* On p. 34.

*Range.* From Arabia (Aden, Muscat) to Sind (Karachi).

*Type* in collection.

*Remarks.*—*R. arabicus* is more closely related to the S. African *R. leachi* than to its geographical neighbour *R. aegyptiacus*. The exact limits of its area (to the west, north, and north-east) are still unknown: it is not unlikely that it extends into Syria and Palestine.

<i>a-c</i> , 2 ♂ ad., 2 ♀ ad., 1 juv. al.	Lahej, Aden.	Col. J. W. Yerbury [C. & P.]	95.6.13-6.
<i>f</i> , ♂ ad.sk.; skull.	Lahej, Aden; 21 Mar. 1895.	Col. J. W. Yerbury [C. & P.]	95.6.1.47.
( <i>Type of species.</i> )			
<i>g-h</i> , ♂ ad., ♀ imm. sks.; skulls.	Lahej, Aden; 21 Mar. 1895.	Col. J. W. Yerbury [C. & P.]	95.6.1.48-49.
<i>i-l</i> , ♂ ad., ♂ imm., ♀ ad., ♀ imm.sks.; skulls.	Lahej, Aden; 22 Aug. 1899.	W. Dodson [C.]	99.11.6.6-9.
<i>m-n</i> , ♂ ad., ♀ imm. al.	Lahej, Aden.	Percival & Dodson [C.]	99.11.6.89-90.
<i>o</i> , ♀ imm. al.	Muscat, Oman.	Dr. A. S. G. Jayakar [C. & P.]	85.11.5.6.
<i>p-q</i> , ♀ ad., ♀ imm. al.	Muscat, Oman.	Dr. A. S. G. Jayakar [C. & P.]	89.4.2.2-3.
<i>r</i> , ♀ ad. al.	Karachi, Sind.	Karachi Museum [E.]	82.1.2.2.

*Measurements of Rousettus leachi, R. ægyptiacus, and R. arabicus.*

	<i>R. leachi.</i>		<i>R. ægyptiacus.</i>		<i>R. arabicus.</i>	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.	mm.	mm.
Forearm .....	89	99	88	99	87	96
Pollex, c. u. ....	31	35.2	32	37.5	30	33
2nd digit, metacarpal .....	36.2	43.7	40	44	37	42.7
" 1st phalanx .....	8.8	10.5	8.7	11.7	8.2	9.8
" 2nd-3rd phalanx, c. u. ....	9	10	9.5	12.3	9	10.5
3rd digit, metacarpal .....	54.5	62	57.2	63	53.2	60
" 1st phalanx .....	38.2	42.2	39	44	37	39.8
" 2nd phalanx .....	50.5	60	53	61.5	50.5	56.5
4th digit, metacarpal .....	54.2	61	54	61	50.8	58.7
" 1st phalanx .....	29	33.8	30	34.5	28	31
" 2nd phalanx .....	32.2	38.7	33	39.8	31.8	36.7
5th digit, metacarpal .....	54.5	60	54	59.5	50.2	58.7
" 1st phalanx .....	27	30.8	28	30.8	26.2	30
" 2nd phalanx .....	25	28.5	25	31.8	21.2	28.8
Ear, length from notch .....	20	22.5	22	24	20	21.2
" greatest width, flattened .....	15	16	17	19.7	15	16.2
Front of eye to tip of muzzle .....	17	19.2	17.2	19.2	15.2	17.5
Tail .....	15	18.8	13	15.5	9	17
Lower leg .....	40	41.8	41	45.5	37	39.5
Foot, c. u. ....	24.5	27	25	27.8	22.7	25.5
Skull, total length to front of premax. ....	40.5	43.8	43.6	46.7	38.7	41.8
" width of brain-case at zygomata ..	16.7	18	17.7	18.8	16.3	17
" zygomatic width ..	24.7	26	26	29.2	23.2	25.8
" postorbital constriction .....	7.7	9.2	7.2	8.7	7.6	8.2
" interorbital constriction .....	7.8	8.7	8.2	9.8	7.7	7.8
" width across m <sup>2</sup> , externally .....	12.5	14.2	12.8	14.5	12	13
" width across e. externally .....	8.2	9.2	8.7	9.8	7.7	8.7
" palation to incisive foramina .....	19.7	21.2	20.8	23.7	18.2	20
" front of orbit to tip of nasals .....	13.8	15.2	15.2	16.7	13	13.6
Mandible, length .....	31.8	34.8	33	37.2	30.5	33
Upper teeth, c-m <sup>2</sup> .....	15.8	17.7	16.7	18.8	15.2	16.7
Lower teeth, c-m <sub>3</sub> .....	17.2	19	18	20.8	16.6	17.8

4. *Rousettus leschenaulti*, Desm.

*Cynonycteris amplexicaudata* (pt.), Dobson, Cat.  
Chir. B. M. p. 72.

- Pteropus leschenaulti*, Desmarest, *Encycl. Méth., Mamm.* i. p. 110, no. 142 (1820: Pondichery); *id.*, *Dict. Sci. Nat.* xlv. p. 365 (1827: Pondichery); Lesson, *Man. Mamm.* p. 110, no. 283 (1827: Pondichery); Gray, in *Griffith's Anim. Kingd.* v. p. 56, no. 158 (1827: Pondichery); Is. Geoffroy, *Dict. Class. d'Hist. Nat.* xiv. p. 702 (1828: Pondichery); J. B. Fischer, *Syn. Mamm.* pp. 86, 549 (1829: Pondichery); Lesson, *Hist. Nat. Mamm. (Compl. Buffon)* v. p. 47 (1836: Pondichery); Temminck, *Mon. Mamm.* ii. p. 86 (1837: Pondichery, Calcutta); Wagner, *Schreber's Säug., Suppl.* i. p. 359 (1840: Pondichery, Calcutta); Lesson, *N. Tabl. Règne An.* p. 14, no. 190 (1842: Pondichery, Calcutta); Schinz, *Syst. Verz. Säug.* i. p. 130 (1844: Pondichery); Wagner, *Schreber's Säug., Suppl.* v. p. 604 (pt.) (1853-55: Pondichery, Calcutta); Giebel, *Säug.* p. 999 (pt.) (1855: Pondichery); Blyth, *Cat. Mamm. Mus. As. Soc.* p. 21, no. 54 (pt.) (1863: Coromandel coast); Jerdon, *Mamm. Ind.* p. 19 (1867: Madras, Trichinopoly); Sterndale, *Mamm. India*, p. 40 (pt.) (1884: Calcutta, Madras, Pondichery, Trichinopoly).
- Xantharpyia leschenaulti*, Fitzinger, *SB. Akad. Wien*, lx. Abth. i. Heft 8, p. 472 (pt.) (1869: India).
- Cynonycteris* (*Pteropus*) *leschenaulti*, Marchi, *Atti Soc. Ital. Sci. Nat.* xv. p. 517 (1872-73: structure of hairs).
- Cynonycteris leschenaulti*, Peters, *MB. Akad. Berlin*, 1873, p. 485 (type of species re examined).
- Rousettus leschenaulti*, K. Andersen, *Ann. & Mag. N. H.* (7) xix. p. 507 (1907).
- Pteropus amplexicaudatus* (nec Geoff.), Temminck, *Mon. Mamm.* i. p. 200 (pt.) (1825: Siam); Desmarest, *Dict. Sci. Nat.* xlv. p. 367 (pt.) (1827: Siam); J. B. Fischer, *Syn. Mamm.* pp. 86, 549 (pt.) (1829: Siam); Giebel, *Säug.* p. 1000 (pt.) (1855: India).
- Cynonycteris amplexicaudata*, Peters, *MB. Akad. Berlin*, 1867, p. 865 (pt.) (Bengal, Siam); Swinhoe, *P. Z. S.* 1870, p. 616 (Amoy); Peters, *P. Z. S.* 1871, p. 513 (Burma); Dobson, *Proc. A. S. B.* 1872, p. 154 (Burma); Macalister, *Phil. Trans.* 1872, p. 125 & seq., pl. xiv. fig. 4 (myology); Dobson, *J. A. S. B.* xlii. pt. ii. p. 200, footnote (1873); *id.*, *op. cit.* xlii. pt. ii. p. 202 (pt.), pl. xiv. fig. 8 (ear) (1873); *id.*, *Cat. Chir. Ind. Mus.* p. 2 (pt.) (1874: Coromandel coast, Singbhoon, Pegu); *id.*, *Mon. Asiatic. Chir.* c. pp. 29, 190 (pt.) (1876: Indian Pen.); ? Leche, *Lauds Univ. Arssler.* xiv. p. 17, pl. ii. fig. 9 (1878) (milk-teeth); J. Anderson, *Cat. Mamm. Ind. Mus.* i. p. 103 (pt.) (1881: Coromandel coast, India); Scully, *J. A. S. B.* lvi. pt. ii. no. 3, p. 237 (1887: Nepal); Jentink, *Cat. Ostéol. Mamm.* p. 263 (pt.) (1887: Calcutta); *id.*, *Cat. Syst. Mamm.* p. 151 (pt.) (1888: Calcutta); Trouessart, *Cat. Mamm.* i. p. 84 (pt.) (1897).
- Xantharpyia amplexicaudata*, Fitzinger, *SB. Akad. Wien*, lx. Abth. i. Heft 8, p. 470 (pt.) (1869: Siam); Blanford, *J. A. S. B.* lvii. pt. ii. no. 3, p. 271 (1888); *id.*, *Faun. Brit. Ind., Mamm.* pt. ii. p. 261 (pt.), text-fig. 76 (ear) (1891: India, Himalaya, Burma); Thomas, *Ann. Mus. Civ. Genova*, (2) x. p. 921 (1892: Moulmein); Matschie, *Megachiroptera*, p. 67 (pt.) (1899); S. S. Flower, *P. Z. S.* 1900, p. 540 (Laos Mts.).

- Cynopterus* (*Cynonycteris*) *amplexicaudatus*, *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 206 (pt.) (1878: India, Nepal, Burma).
- Cynonycteris* (*Pteropus*) *amplexicaudatus*, *Theobald, in Mason's Burma*, i. p. 425 (1882: Bengal, S. India, Burma).
- Rousettus* *amplexicaudatus*, *Trouessart, Cat. Mamm., Suppl.* p. 60 (pt.) (1904: Himalaya).
- Pteropus* [sp.], *Hodgson, J. A. S. B.* no. 7, p. 340 (1832: Nepal).
- Pteropus pyrrivorus*, *Hodgson, J. A. S. B.* iv. no. 48, p. 700 (1835: Nepal); *id.*, *P. Z. S.* 1836, p. 46 (Nepal); *id.*, *Icon. ined.* (B.M. copy) pl. xii. fig. 1 (col. fig.), pl. xiii. fig. 2 (col. fig.).
- Pteropus pirivarus* (sic), *Hodgson, J. A. S. B.* x. p. 908 (1841: Nepal).
- Cynopterus affinis*, *Gray, List Mamm. B. M.* p. 39 (1843: Himalaya).
- Cynopterus marginatus* (*nec Geoff.*), *Gray, List Mamm. B. M.* p. 28, specimens *h, i* (1843: Nepal, the cotypes of *Pt. pyrrivorus*, *Hodgs.*); *Blyth, J. A. S. B.* xii no. 150, p. 479 (1844: Nepal); *Gray, Cat. Hodgson Coll. B. M.* p. 3 (1846: Nepal); *Hutton, P. Z. S.* 1872, p. 693 (N.W. Himalaya).
- Eleutherura marginata*, *Gray, Cat. Monk. Sc.* p. 118 (1870: "Nepal," really Nasirabad).
- Eleutherura fuliginosa*, *Gray, Cat. Monk. Sc.* p. 118 (1870: Laos Mts., Siam).
- Eleutherura fusca*, *Gray, Cat. Monk. Sc.* p. 119 (1870: "India?").
- Cynonycteris infusca*, *Peters, MB. Akad. Berlin*, 1873, p. 487 (Calcutta).

*Diagnosis*.—Allied to *R. arabicus*, but smaller, with the muzzle shorter and slenderer, the tip of the ears not attenuated, the pollex markedly shorter, wings shorter, especially the first and second phalanx of the third digit, and the foot smaller. Forearm 80·5–87·5 mm.

*Skull and teeth*.—Similar to those of *R. arabicus*, but skull averaging a little smaller, rostrum slenderer; premaxillaries rather more strongly projecting forward, palation border more sharply angulate. Teeth on the whole rather smaller, molars somewhat narrower;  $p^1$  not deciduous, unless perhaps in very aged individuals (cf. *R. semivivax*);  $m_2$  quite or almost equalling  $m_1$  in length;  $m_3$  elliptical in outline (cf. *R. amplexicaudatus*).

*Palate-ridges*.— $4 + 3 + 1$ ; number and arrangement as in *R. leachi*.

*External characters*.—Muzzle averaging shorter and slenderer than in *R. arabicus*. Shape of ears as in *R. leachi*: outer much more convex than inner margin, tip broad, not attenuated as in *R. arabicus*; antitragal lobe small, rounded.

General size nearly always smaller than in *R. arabicus*: forearm 80·5–87·5 mm., against 87–96. First digit absolutely shorter: length with claw 26·5–29·5 mm., against 30–33 in *arabicus*; also proportionally the difference in this respect is well marked: index of first digit in *R. leschenaulti* 335, in *R. arabicus* 361. Second digit shorter, the tip of its claw in *R. leschenaulti* as a rule falling a little short of, in *R. arabicus* as a rule being on a level with or reaching beyond, the tip of the third metacarpal. Metacarpals and



phalanges of third, fourth, and fifth digits (except the second phalanx of the fifth digit) shorter than in *R. arabicus*, the difference being specially noticeable in the absolute length of the first phalanx of the third digit (33·8–36·8 mm. in *R. leschenaulti*, 37–39·8 in *R. arabicus*) and the second phalanx of the third digit (41–46·2 mm. in *R. leschenaulti*, 50·5–60 in *R. arabicus*: index of this phalanx in *R. leschenaulti* 521, in *R. arabicus* 601). Length of tibia as in *R. arabicus*, but foot averaging smaller: measured with claws 20–23·5 mm. in *R. leschenaulti*, 22·7–25·5 in *R. arabicus*.

Quality and distribution of fur essentially as in *R. arabicus*, but tibia more thinly haired. Colour of a darker and browner shade, especially on the crown:—Back and rump dark and dull brown (darker than Prout's brown); crown and occiput brownish bistre; nape of neck varying from light drab to almost wood-brown; underside between drab and isabella colour. A considerably brighter-coloured phase occurs: mars-brown on back and rump, Prout's brown on crown, wood-brown on the whole of the underside.

*Measurements.* On p. 48.

*Range.* Himalayas (Nepal), extending southward over the Indian Peninsula, eastward through Bengal, Burma, Siam (Laos Mts.) to S. China (Amoy).

*Cotypes* in the Paris Museum.

*Pteropus leschenaulti*, Desm.; 1820.—Type locality: "les environs de Pondichéry." Cotypes, two adult males, mounted, much faded, labelled "Pondichéry, Leschenault"; Reg. nos. A. 82 and A. 83; skull of no. 82 extracted, of no. 83 *in situ*. Placed by Desmarest in the section "Roussettes sans queue," an error corrected by Is. Geoffroy in 1828, *l. s. c.*, on examination of the type: ("sa queue, très-visible, n'est qu'à peine engagée dans la membrane interfemorale, et a environ six lignes de long").

*Pteropus pyrrivorus*, Hodgs.; 1835.—Type locality: the central region of Nepal; cotypes in collection. Figured in Hodgson's unpublished drawings.

*Cynopterus affinis*, Gray; 1843.—No description. Two specimens were registered by Gray under this name, both from the "Himalaya," viz. no. 130 *a* [=38.3.13.37], which is the type, still in the collection of the British Museum, and 130 *b* [=38.3.13.36], "younger," not found in the collection. Indistinguishable from *R. leschenaulti*.

*Eleutherura fuliginosa*, Gray; 1870.—Type locality: Laos Mts., Siam (Mouhot Coll.); type in collection.—Brief description of the colour of the fur. I am unable to discriminate this specimen from *R. leschenaulti*.

*Eleutherura fusca*, Gray; 1870.—Type locality uncertain ("India?"; purchased from Parzudaki); type in collection.—Separated by Gray on account of its "much brighter and redder" colour. Is the brighter-coloured phase of *R. leschenaulti*.

*Conycteris infusca*, Pet.; 1873.—Type locality: "angeblich aus Calcutta" (a dealer's specimen); type in the Berlin Museum (no. 361). "Schr ähnlich der *C. leschenaultii*, in allen Verhältnissen

kleiner, dunkelbraun von Farbe, mit schwarzen Krallen und den ersten falschen Backzahn grösser"; detailed measurements given: forearm 68, third metacarpal 42, tibia 29 mm. The type, I am informed by Prof. Matschie, is a young (not full-grown) individual ("die Epiphysen an den Fingergelenken sind noch nicht mit den Phalangen verwachsen," Matschie, in litt.); hence its small size.

*Remarks.*—*R. leschenaulti* is at once discriminated from the foregoing species by the shortness of the second phalanx of the third digit, a character which it shares with all the Eastern species of the genus.

a. ♂ ad. sk. ;	Himalayas.	Purchased (J. Turner).	38.3.13.37.
skull.		(Type of <i>Cynopterus affinis</i> , Gray.)	
b-c. 2 ♂ ad. al. ;	Nepal.	B. H. Hodgson, Esq. [P.].	Not reg.
skull of b.		(Cotypes of <i>Pteropus pyrrhorus</i> , Hodgs.)	
d. Ad. skull.	Nepal.	B. H. Hodgson, Esq. [P.].	45.1.8.276.
e. ♀ ad. sk. ;	Nasirabad.	Capt. W. J. E. Boys	48.2.1.14.
skull.	Bengal.	[C.].	
f. ♀ ad. sk. ;	Nasirabad.	Capt. W. J. E. Boys	48.8.18.17.
skull.	Bengal.	[C.].	49.8.16.9.
		(e & f labelled <i>Eleutherura marginata</i> , Gray.)	
g h. ♀ ad., ♀	Myingyan,	Lieut. E. Y. Watson [P.].	95.2.22.1-2.
imm. al. ;	Burma.		
skull of g.			
i. Ad. sk. ; skull.	Laos Mts., Siam.	Mouhot Coll.	62.8.18.5.
		(Type of <i>Eleutherura fuliginosa</i> , Gray.)	
j. Imm. sk. ;		Purchased (Parzudaki).	49.8.23.10.
skull.		(Type of <i>Eleutherura fusca</i> , Gray.)	
k. ♀ ad. al.		Lidth de Jende Coll.	67.4.12.326.

### 5. *Rousettus seminudus*, Gray.

*Cynonycteris amplexicaudata* (pt.), Dobson, Cat.  
Chir. B. M. p. 72.

*Pteropus leschenaulti* (nec Desm.), Blyth, J. A. S. B. xx. no. 219, p. 155 (1851: Ceylon); *id.*, op. cit. xxi. no. 228, p. 345 (1852: Ceylon); *Kelaart, Prodr. Faun. Zeylan.* p. 27 (1852: Ceylon); *Wagner, Schreber's Säug., Suppl.* v. p. 604 (pt.) (1853-55: Ceylon); *Giebel, Säug.* p. 399 (pt.) (1855: Ceylon); *Blyth, Cat. Mamm. Mus. As. Soc.* p. 21, no. 54 (pt.) (1863: Ceylon); *Sterndale, Mamm. India*, p. 40 (pt.) (1884: Ceylon).

*Xantharpyia leschenaulti*, Fitzinger, SB. Akad. Wien. xlii. Heft 25, p. 389 (1861: Ceylon); *id.*, op. cit. lx. Abth. i. Heft 8, p. 472 (pt.) (1869: Ceylon).

*Cynonycteris* (*Pteropus*) *leschenaulti*, Zeller, Reise 'Norara,' Säug. p. 12 (1869: Ceylon).

*Cynonycteris amplexicaudata* (pt., nec Geoff.), Peters, MB. Akad. Berlin, 1867, p. 865 (Ceylon); *Dobson, J. A. S. B.* xlii. pt. ii. p. 202 (1873); *id.*, Cat. Chir. Ind. Mus. p. 2 (pt.) (1874: Ceylon); *id.*, Mon. Asiat. Chir. pp. 29, 190 (1876: Ceylon); *J. Anderson, Cat. Mamm. Ind. Mus.* i. p. 103 (1881: Ceylon); *Trouessart, Cat. Mamm.* i. p. 84 (1897).

*Cynopterus* (*Cynonycteris*) *amplexicaudatus*, Trouessart, Rev. & Mag. Zool. (3) vi. p. 206 (pt.) (1878: Ceylon).

*Xantharpyia amplexicaudata* (pt.). *Blanford, Faun. Brit. Ind., Mamm.* pt. ii. p. 261 (1891: Ceylon); *Matschie, Megachiroptera*, p. 67 (pt.) (1899).

*Xantharpyia seminuda*, *Gray, Cat. Monks. Sc.* p. 115 (1870: Ceylon).

*Rousettus seminudus*, *K. Andersen, Ann. & Mag. N. H.* (7) xix. p. 538 (1907).

*Diagnosis*.—Similar to *R. leschenaulti*, but  $p^1$  deciduous, nape and shoulders semi-naked, general colour of fur lighter. Forearm 79–85.5 mm.

*Details*.—Size and shape of skull as in *R. leschenaulti*.  $p^1$  deciduous\*;  $m_2$  quite or almost equalling  $m_1$  in length;  $m_3$  elliptical in outline. Palate-ridges as in *R. leschenaulti*.

Fur markedly shorter and more closely adpressed than in *R. leschenaulti*; nape and shoulders covered with such sparse and short hairs as to appear semi-naked; hairs on membranes and upperside of forearm and tibia shorter and sparser: in some individuals these parts appear to be almost naked. Colour lighter than in *R. leschenaulti*; upperside intermediate between mars-brown and wood-brown, or very nearly wood-brown; head darker; underside wood-brown.

*Measurements*. On p. 48.

*Range*. Ceylon.

*Type* in collection.

*Xantharpyia seminuda*, Gray: 1870.—Type locality: Ceylon.—The name *Pteropus seminudus* is commonly assigned to Kelaart, but Kelaart seems never to have published any description of the species: in the paper usually referred to by authors, viz. Blyth's account in *J. A. S. B.* xxi. p. 345 (1852) on a collection of mammals sent by Kelaart to the Asiatic Society of Bengal, the name appears only as a synonym, without comment, of *Pt. leschenaulti*, and the same is the case in Kelaart's 'Prodromus Fauna Zeylanicæ' (1852). It remained a *nomen nudum*, until in 1870 (*l. s. c.*) Gray published a brief description (quality of fur, colour, length of forearm) of "*Xantharpyia seminuda*," and the British Museum specimen on which he based this description is, therefore, the type of the species.

a. ♂ ad. al.; skull. Ceylon (*Ikhwaites*). Mr. Cuming's Coll. Not reg.

(Type of species.)

b. ♂ imm. sk.; skull. Ceylon. Dr. Kelaart [C. & P.]. 52.5.9.10.

(Authentic specimen of "*Pteropus seminudus*, Kel.")

c. ♂ ad. sk.; skull. Panduloya, Ceylon. E. E. Green, Esq. [P.]. 95.7.27.1. 4200'; 30 Apr. 1895.

---

\* Details from three skulls:—one immature,  $p^1$  present on both sides; one ad., teeth very slightly worn,  $p^1$  present on one, absent on the other side; one ad., teeth unworn,  $p^1$  absent on both sides.

6. *Rousettus amplexicaudatus*, E. Geoff.*Cynonycteris amplexicaudata* (pt.), Dobson, Cat.

Chir. B. M. p. 72.

*Pteropus amplexicaudatus*, E. Geoffroy, *Ann. Mus. d'Hist. Nat.* xv. p. 96, pl. iv. (whole fig.) (1810: Timor); *Oken, Lehrb. Naturgesch.* iii. Abth. ii. p. 934 (1816: Timor); *G. Cuvier, Règne Anim.* i. p. 124 (1817); *Desmarest, Nour. Dict. d'Hist. Nat.* xxix. p. 513 (1819: Timor); *id., Encycl. Méth., Mamm.* i. p. 111, no. 145 (1820: Timor); *Temminck, Mon. Mamm.* i. p. 200 (pt.), pl. xiii. (whole fig.), pl. xv. fig. 16 (head) (1825: Timor, Sumatra); *Lesson, Mon. Mamm.* p. 112, no. 293 (1827: Timor); *Gray, in Griffith's Anim. Kingd.* v. p. 57, no. 162 (1827: Timor); *Desmarest, Dict. Sci. Nat.* xvi. p. 367 (pt.) (1827: Timor, Sumatra); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 703 (pt.) (1828: Timor, Sumatra); *J. B. Fischer, Syn. Mamm.* pp. 86, 549 (1829: Timor, Sumatra); *E. Geoffroy, Hist. Nat. Mamm.* leg. 13, p. 25 (1829); *Wagler, Syst. d. Amphibien*, p. 9 (1830); *Lesson, Hist. Nat. Mamm. (Compl. Buffon)* v. p. 55 (pt.) (1836: Timor, Sumatra); *Temminck, Mon. Mamm.* ii. p. 90, pl. xxxvi. figs. 18, 19 (skull) (1837); *S. Müller, in Temminck's Nat. Gesch. Nederl. overz. bez., Zoogd.* pp. 20, 58, 59 (pt.) (1839-44: Timor, Sumatra); *Wagner, Schreber's Säug., Suppl.* i. p. 359 (pt.) (1840: Timor, Sumatra); *Lesson, N. Tabl. Règne An.* p. 14, no. 193 (pt.) (1842: Timor, Sumatra); *Schinz, Syst. Verz. Säug.* i. p. 131 (pt.) (1844: Timor, Sumatra); *Wagner, Schreber's Säug., Suppl.* v. p. 604 (pt.) (1853-55: Timor, Sumatra); *Giebel, Säug.* p. 1000 (pt.) (1855: Timor, Sumatra); *Schlegel, Dierkunde*, i. p. 53 (1857: Sumatra); *Fensch, Neu-Guinea*, p. 150 (pt.) (1865: Timor).

*Pachysoma amplexicaudatum*, Waterhouse, *P. Z. S.* 1843, p. 67 (Philippines).

*Pteropus (Cynonycteris) amplexicaudatus*, Peters, *MB. Akad. Berlin*, 1861, p. 707 (Luzon, Samar).

*Xantharpyia amplexicaudata*, Gerrard, *Cat. Bones Mamm. B. M.* p. 58 (1862); *Fitzinger, SB. Akad. Wien*, ix. Abth. i. Heft 8, p. 470 (pt.) (1869: Timor, Sumatra); *Thomas, Ann. Mus. Civ. Genova*, (2) xiv. p. 108 (1894: Engano); *id., Nov. Zool.* iv. p. 263 (1897: Savu I.); *id., Trans. Zool. Soc.* xiv. pt. vi. p. 383 (1898: Luzon); *Hartert, Nov. Zool.* v. p. 456 (1898: Alor I.); *Matschie, Megachiroptera*, p. 67 (pt.) (1899).

*Cynonycteris amplexicaudata*, Peters, *MB. Akad. Berlin*, 1867, p. 865 (pt.) (Timor, Philippines); *Dobson, J. A. S. B.* xlii. pt. ii. p. 202 (pt.) (1873); *Peters, MB. Akad. Berlin*, 1873, p. 485 (type of species re-examined); *Dobson, Mon. As. Chir.* pp. 29, 190 (pt.) (1876: Philippines); *id., P. Z. S.* 1878, p. 877 (Cambodja); *id., Rep. Brit. Assoc.* 1880, p. 173 (Cambodja); *Robin, C. R. Acad. Sci.* xc. p. 1369 (1880: anatomy); *id., Ann. Sci. Nat., Zool.* (6) xii. art. 2, pp. 4 & seq., pl. v. fig. 30, vii. fig. 47 (organs of reproduction) (1881); *J. Anderson, Cat. Mamm. Ind. Mus.* i. p. 103 (pt.) (1881: Philippines); *Jentink, Cat. Ostell. Mamm.* p. 263 (pt.) (1887: Timor, Sumatra); *id., Cat. Syst. Mamm.* p. 150 (pt.) (1886: Timor); *D. G. Elliot, Field Columb. Mus. Publ., Zool.* i. no. 3, p. 79 (1896: Negros I.); *Trouessart, Cat. Mamm.* i. p. 84 (pt.) (1897); *Seabra, J. Sci. Math. Lisboa*, (2) v. no. 19, pp. 161, 168, pl. i. fig. 10 (palate-ridges) (1898: Timor).

- Cynonycteris* (*Pteropus*) *amplexicaudatus*, *Marchi, Atti Sc. Ital. Sci. Nat.* xv. p. 517 (1872-73: structure of hairs).  
*Cynopterus* (*Cynonycteris*) *amplexicaudatus*, *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 206 (pt.) (1878).  
*Rousettus amplexicaudatus*, *Trouessart, Cat. Mamm., Suppl.* p. 60 (pt.) (1904); *Miller, Proc. U.S. Nat. Mus.* xxx. p. 824 (1906: Engano); *K. Andersen, Ann. & Mag. N. H.* (7) xix. p. 508 (1907); *Miller, Fam. & Gen. Bats.* p. 54 (pt.) (1907).  
*Eleutherura infumata*, *Gray, Cat. Monk. &c.* p. 118 (1870: Flores).  
*Eleutherura philippinensis*, *Gray, Cat. Monk. &c.* p. 119 (1870: Manila).  
*Pteropus philippineasis*, *Elera, Cat. Sist. Fauna Filipinas*, i. p. 6 (1895: Luzon; Samar; Mindanao; Palawan).  
*Rousettus philippinensis*, *Miller, Fam. & Gen. Bats.* p. 54 \* (1907).  
*Cynonycteris bocagei*, *Seabra, J. Sci. Math. Lisboa*, (2) v. no. 19, pp. 160, 169, pl. i. fig. 11 (palate-ridges) (1898: Timor).  
*Rousettus bocagei*, *Trouessart, Cat. Mamm., Suppl.* p. 60 (1904).

*Diagnosis*.—Similar to *R. leschenaulti*, but  $m_3$  subcircular in outline, ears narrower. Forearm 77-87.2 mm.

*Skull and teeth*.—Skull essentially as in *R. leschenaulti*, but averaging smaller; rostrum proportionally slenderer. —Teeth smaller: maxillary row 12.8-14.2 mm., against 14-15.7 in *R. leschenaulti*.  $m_3$  subcircular in outline, not elliptical as in *R. leschenaulti*. In *R. amplexicaudatus* there is a distinct tendency to a reduction of the interspace between the upper canine and  $p^3$ ,  $p^1$  being in some individuals rather closely wedged in between those two teeth; but the character is not fixed, many examples (independent of geographical habitat) having the interspace  $c-p^3$  as broad, and  $p^1$  as distinctly separated from either of these teeth, as *R. leschenaulti*; *R. amplexicaudatus* forms in this respect a transition between *R. leschenaulti* and *brachyotis*, in which latter  $p^1$  is deciduous,  $c$  and  $p^3$  occasionally in contact.

*Palate-ridges*.—4+3+1, as in *R. leschenaulti*, rarely 4+4+1 (specimen "b" in the list below).

*External characters*.—Muzzle averaging shorter and slenderer than in *R. leschenaulti*: length from front of eye to tip of nostrils 13.5-15.5 mm., against 14.8-16 in *R. leschenaulti*. Ears much narrower: greatest width 12-13, against 14.5-15.5 in *R. leschenaulti*; tip of ear not attenuated; antitragal lobe small, rounded. Tail averaging longer, tibia markedly shorter than in *R. leschenaulti*.

Quality and distribution of fur as in *R. leschenaulti*: upperside of tibia almost naked. Colour of fur as a rule distinctly darker than in *R. leschenaulti*: head, back, and rump varying from dark Prout's brown to dark olive or sepia-brown; nape from wood-brown to broccoli-brown; sides of neck and foreneck more or less suffused with wood-brown or tawny olive in males, broccoli-brown in females; chest, breast, and belly dark greyish drab, sometimes inclining to wood-brown.

*Measurements*. On p. 48.

\* Spelt *Rousettus philippensis* in the index (p. 276).

*Range.* Cambodja, Philippines, Borneo, Sumatra, Engano, Flores, Savu, Alor, Timor.

*Type* in the Paris Museum.

*Pteropus amplexicaudatus*, Geoff. ; 1810.—Based by Geoffroy on "plusieurs individus" obtained in Timor during Péron and Lesueur's voyage (Capt. Baudin); only one of these appears now to be in the Paris Museum, a young individual, mounted, much faded, skull extracted, labelled "Timor, Exp. Baudin"; Reg. no. A. 79.

*Eleutherura infumata*, Gray ; 1870.—Type locality: Flores (A. R. Wallace); type in collection.—The name would seem to indicate that Gray separated the Flores specimen on account of its "blackish brown" colour; it differs, however, neither in this nor in other respects from a majority of examples of *R. amplexicaudatus*.

*Eleutherura philippinensis*, Gray ; 1870.—Type locality: Manila (Hugh Cuming); type in collection.—Gray gives a brief description of the colour of the specimen, without pointing out his reasons for separating it from *Pteropus amplexicaudatus*, Geoff. The type, as well as more recently acquired specimens from the Philippines, differ in no respect from *R. amplexicaudatus*.

*Cynonycteris bocagei*, Seabra ; 1898.—Type locality: Dyli, Timor (Fr. Newton); type in the Lisbon Museum.—Separated by Seabra from *R. amplexicaudatus* on account of the supposed greater zygomatic width of the skull (and a trivial difference in the form and position of the sixth and eighth palate-ridges). Zygomatic width of the type skull (♂) not given; in the figure (*l. s. c. pl. i. fig. 11*) it measures scarcely 23 mm.; in a British Museum specimen (♂) from Alor I., north of Timor, 24 mm., in another (♀) from the same island 21.2: similar variations are found in *R. amplexicaudatus* and allied species from any locality.

*Remarks.*—*R. amplexicaudatus* is readily distinguished from *R. leschenaulti* by its much narrower ears and the different shape of  $m_3$ . *R. leschenaulti* is continental in range, *R. amplexicaudatus* chiefly Indo-Malayan (insular); their areas probably touch each other somewhere in S.E. Asia; *R. leschenaulti* is represented in the collection from Burma and Siam, *R. amplexicaudatus* from Cambodja.—Some authors (Peters, Anderson and de Winton) have laid stress on the greater length of the tail in Indo-Malayan specimens (*amplexicaudatus*) as compared with examples from the Himalayas and the Indian Peninsula (*leschenaulti*); the tail averages, in fact, decidedly longer in *amplexicaudatus*, but the character, as being subject to a good deal of individual variation, is practically not of much use for a discrimination of the two species.

a. Ad. sk.; skull.	Cambodja ( <i>Mouton Coll.</i> ).	Tomes Coll.	7.1.1.263.
b. ♀ imm. al.; skull.	Philippines.	Zool. Soc. Coll.	Not reg.
c. ♂ ad. sk.; skull.	Manila, Luzon.	Hugh Cuming, Esq. [C.].	58.3.29.1.
(Type of <i>Eleutherura philippinensis</i> , Gray.)			

<i>d-e.</i> ♂ ad., ♀ ad. sks.; skulls.	Benguet, N. Luzon, 5000'; 14 Febr. 1894.	J. Whitehead, Esq. [C.].	97.5.2.5-6.
<i>f-g.</i> ♂ ad., ♂ pull. al.; skull off.	Baram, Sarawak.	Dr. Chas. Hose [P.].	0.7.29.2-3.
<i>h.</i> ♀ ad. sk.; skull.	Sumatra.	Purchased (J. Turner).	33.3.13.36.
<i>i.</i> ♀ ad.al.; skull.	Bua-Bua, Engano (Dr. E. Modigliani).	Marquis G. Doria [P.].	94.1.7.2.
<i>j.</i> ♂ ad.sk.; skull.	Flores.	Dr. A. R. Wallace [C.].	63.12.26.12.
	(Type of <i>Eleutherura infumata</i> , Gray.)		
<i>k.</i> ♀ im.al.; skull.	Savu I., W. of Timor; Aug. 1896.	A. Everett [C.].	97.4.18.10.
<i>l m.</i> ♂ ad., ♀ ad. sks.; skulls.	Alor I., N. of Timor; Mar. 1897.	A. Everett [C.].	98.11.3.20-21.
<i>n.</i> Imm. st.	Timor.	Purchased (Frank).	44.4.4.6.

## 7. *Rousettus minor*, Dobson.

*Cynonycteris minor*, Dobson, Cat. Chir. B. M. p. 73.

*Pteropus amplexicaudatus* (pt., nec Geoff.), Desmarest, Dict. Sci. Nat. xlv. p. 367 (1827: Java); Lesson, Hist. Nat. Mamm. (Compl. Buffon) v. p. 55 (1836: Java); S. Müller, in Temminck's Nat. Gesch. Nederl. overz. bez., Zoogd. pp. 20, 58 (1839-44: Java); Lesson, N. Tabl. Règne An. p. 14, no. 193 (1842: Java); Schinz, Syst. Verz. Säug. i. p. 131 (1844: Java); Wagner, Schreiber's Säug., Suppl. v. p. 604 (1853-55: Java).

*Cynonycteris amplexicaudata*, Jentink, Weber's Zool. Ergebn. Niederl. Ost-Ind. Heft i. p. 126 (1890: Java).

*Xantharpyia amplexicaudata* (pt.), Blyth, Cat. Mamm. Mus. As. Soc. p. 21, no. 55 (1863: Java); Matschie, Megachiroptera, p. 67 (1899: Java).

*Rousettus amplexicaudatus* (pt.), Trouessart, Cat. Mamm., Suppl. p. 60 (1904: Java).

*Cynonycteris minor*, Dobson, J. A. S. B. xlii. pt. ii. p. 203, pl. xiv. fig. 9 (ear) (1873: Java); id., Cat. Chir. Ind. Mus. p. 2 (1874: "Malay Countries"); id., Mon. Asiat. Chir. pp. 32, 190 (1876: Java); J. Anderson, Cat. Mamm. Ind. Mus. i. p. 104 (1881: Java); Trouessart, Cat. Mamm. i. p. 84 (1897: Java).

*Cynopterus* (*Cynonycteris*) *minor*, Trouessart, Rev. & Mag. Zool. (3) vi. p. 206 (1878: Java).

*Rousettus minor*, K. Andersen, Ann. & Mag. N. H. (7) xix. p. 509 (1907).

The only specimen I have seen is the type in the Calcutta Museum, a dried skin (perfectly adult, teeth almost unworn), in bad state of preservation; colour faded to pale russet; basioccipital and sphenoid portion of skull wanting. The precise characters of the species cannot be given from this material.

*Skull and teeth*.—Skull not differing appreciably from that of *R. brachyotis*, except perhaps in the slightly larger size of the orbits

(only one quite full-sized skull of *brachyotis* available for comparison). The only tangible difference in the teeth would seem to be the slightly smaller width of the premolars and molars in *R. minor*, but the character must be taken with caution, inasmuch as there is some individual variation in this respect in *R. brachyotis*.  $p^1$  a little smaller in bulk than an inner upper incisor, separated by minute spaces from the canine and  $p^3$ .  $m_3$  subcircular in outline (a little longer than broad).

*External characters.*—According to Dobson the ears in *R. minor* are much longer than in *R. brachyotis* (see his description of *R. brachyotis*, Cat. Chir. p. 74). This statement is erroneous; the ears in the type of *R. minor* (the left ear-conch is well preserved, the right much damaged) are of the same length as in dried skins of *R. brachyotis*, or if there is any difference, they are perhaps a trifle shorter; the width of the ears cannot be estimated with certainty, but would seem to be slightly smaller than in *brachyotis*. In the relative length of the muzzle (wrongly stated by Dobson to be shorter than in *brachyotis*), the distribution of the fur, and the measurements of the forearm, metacarpals, phalanges, and tibia, there is no difference from *R. brachyotis*.

*Measurements.* On p. 48.

*Range.* Java.

*Type* in the Calcutta Museum.

*Remarks.*—Judging from the single specimen examined, *R. minor* appears to be more closely allied to *R. brachyotis* than to *R. amplexicaudatus*. From the latter species it is readily distinguished by its smaller size and relatively smaller ears. Its differences from *R. brachyotis* remain to be determined\*.

### 8. *Rousettus brachyotis*, Dobs.

*Cynonycteris brachyotis*, Dobson, Cat. Chir. B. M. p. 74.

*Pteropus amplexicaudatus* (pt., *nec Geoff.*), Desmarest, Dict. Sci. Nat. xvi. p. 367 (1827: Amboina); Is. Geoffroy, Dict. Class. d'Hist. Nat. xiv. p. 703 (1828: Amboina); J. B. Fischer, Syn. Mamm. p. 86 (1829: Amboina); Lesson, Hist. Nat. Mamm. (Compl. Buffon) v. p. 55 (1836: Amboina); S. Müller, in Temminck's Nat. Gesch. Nederl. overz. bez., Zoogd. pp. 20, 59 (1839-44: Amboina); Wagner, Schreber's Säug., Suppl. i. p. 359 (1840: Amboina); Lesson, N. Tabl. Règne An. p. 14, no. 193 (1842: Amboina); Schinz, Syst. Verz. Säug. i. p. 131 (1844: Amboina); Wagner, Schreber's Säug., Suppl. v. p. 604 (1853-55: Amboina); Giebel, Säug. p. 1000 (1855: Amboina); Finsch, Neu-Guinea, p. 150 (1865: Amboina).

---

\* While these pages were going through the press, a fine series of skins and alcoholic specimens of *Rousettus minor* obtained in Java by Mr. Guy C. Shortridge were presented to the Museum by Mr. W. E. Balston. Full description of the species based on this material will be given in the 'Addenda' to this volume.



- Cynonycteris amplexicaudata* (pt.), *Peters, M.B. Akad. Berlin*, 1867, p. 865 (Amboina); *Jentink, Cat. Syst. Mamm.* p. 151 (1888: Amboina).
- Xantharpyia amplexicaudata* (pt.), *Fitzinger, SB. Akad. Wien*, lx. Abth. i. Heft 8, p. 470 (1869: Amboina).
- Cynopterus (Cynonycteris) amplexicaudatus, Trouessart, Rev. & Mag. Zool.* (3) vi. p. 206 (pt.) (1878: Amboina).
- Cynonycteris brachyotis, Dobson, P. Z. S.* 1877, p. 116 (Duke of York I.); *id.*, *P. Z. S.* 1878, p. 316 (Duke of York I.); *Thomas, P. Z. S.* 1887, pp. 323, 327 (Solomon Is.); *id.*, *P. Z. S.* 1888, pp. 475, 483, 484 (Solomon Is.); *Jentink, Cat. Syst. Mamm.* p. 151 (1888: Duke of York I.); *Trouessart, Cat. Mamm.* i. p. 84 (pt.) (1897).
- Cynopterus (Cynonycteris) brachyotis, Trouessart, Rev. & Mag. Zool.* (3) vi. p. 206 (1878).
- Xantharpyia brachyotis, Matschie, Megachiroptera*, p. 68 (pt.) (1899: New Guinea, New Ireland, Solomon Is.).
- Rousettus brachyotis, Trouessart, Cat. Mamm., Suppl.* p. 60 (pt.) (1904); *K. Andersen, Ann. & Mag. N. H.* (7) xix. p. 309 (1907); *Müller, Fam. & Gen. Bats*, p. 54 (1907).

*Diagnosis*.—Similar to *R. amplexicaudatus*, but smaller, with shorter and narrower ears:  $p^1$  deciduous; tooth-rows shorter. Forearm 70–75 mm.

*Skull and teeth*.—Skull averaging smaller than in *R. amplexicaudatus*, and with noticeably slenderer rostrum, but otherwise not differing in shape.— $p^1$  deciduous\*; if present, as a rule closely wedged in between the canine and  $p^3$ ; interspace  $c-p^3$  as a rule narrower than in any of the foregoing species, the two teeth being occasionally in contact. Cheek-teeth more crowded;  $p^4$  and molars proportionally quite as heavy as (if not heavier than) in *R. amplexicaudatus*;  $m_2$  markedly shorter than  $m_1$ ;  $m_3$  subcircular in outline, as in *R. amplexicaudatus*.

*Palate-ridges*.—3+4+1; one specimen only examined; some slight individual variation may occur.

*External characters*.—General size smaller (at least on an average) than in *R. amplexicaudatus*; see table of measurements. Ears short and narrow, but scarcely differing in form from those of *R. amplexicaudatus*; not attenuated below the tip, the tip itself broadly rounded off; antitragal lobe small, rounded.

Quality and distribution of fur as in *R. amplexicaudatus*; tibiæ practically naked above; proximal portion of forearm thinly covered with short hairs. Coloration as in the darkest specimens of *R. amplexicaudatus*.

*Measurements*. On p. 48.

*Range*. Amboina (Genoa Mus.), New Guinea (Berlin Mus.), Bismarck Archipelago, Solomon Islands.

*Type* in collection.

*Remarks*.—This, the most eastern representative of the genus, is

\* Details from six skulls:—one juv. (not quite full-grown), two young adults:  $p^1$  present on both sides; one young adult:  $p^1$  present on one side only; two adults (teeth slightly worn):  $p^1$  absent on both sides.

very closely allied to *R. amplexicaudatus*, differing only in its smaller size, proportionally smaller ears, slenderer rostrum, deciduous p<sup>1</sup>, and (as a rule) narrower interspace between c and p<sup>3</sup>. The western limits of its range (islands W. and S.W. of New Guinea) remain to be determined; a specimen in the Geneva Museum from Amboina (collected by O. Beccari, and examined by the present writer) is *R. brachyotis*, but its alleged occurrence in Celebes (Jentink, Notes Leyden Mus. v. p. 173, 1883) probably rests on confusion with a distinct species (*R. celebensis*, infra).

a.	♀ ad. sk.; skull.	Duke of York I.	Rev. J. Brown	77.7.18.3.
			[C.]	(Type of species.)
b.	Juven. sk.; skull.	Duke of York I.	Rev. J. Brown	77.7.18.4.
			[C.]	
c.	♂ ad. sk; skull.	Duke of York I.	Rev. J. Brown	78.2.5.5.
			[C.]	
d-e.	2 jun. sks.; skulls.	Fauro, Solomons; May 1886.	C. M. Woodford, Esq. [C.]	87.1.18.4-5.
f.	Jun. sk.	Guadalcanar, Solomons; 12 May, 1901.	J. Meek, Esq. [C.]	1.11.5.4.

### 9. *Rousettus celebensis*, K. And.

*Cynonycteris amplexicaudata* (pt.), Dobson, Cat.  
Chir. B. M. p. 73.

*Cynonycteris amplexicaudata* (pt., *nee* Geoff.), Dobson, *J. A. S. B.* xlii. pt. ii. p. 202 (1873: Celebes); Jentink, *Cat. Ostéol. Mamm.* p. 263 (1887: Celebes); *id.*, *Cat. Syst. Mamm.* p. 150 (1888: Celebes); Trouessart, *Cat. Mamm.* i. p. 84 (1897: Celebes).

*Rousettus amplexicaudatus* (pt.), Trouessart, *Cat. Mamm., Suppl.* p. 60 (1904: Celebes).

*Cynopterus* (*Cynonycteris*) *amplexicaudatus* (pt.), Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 206 (1878: Celebes).

*Cynonycteris brachyotis* (*nee* Dobs.), Jentink, *Notes Leyden Mus.* v. p. 173 (1883: N. Celebes); Trouessart, *Cat. Mamm.* i. p. 84 (pt.) (1897: Celebes).

*Xanthopyia brachyotis* (pt.), Matschie, *Megachiroptera*, p. 68 (1899: Celebes).

*Rousettus brachyotis* (pt.), Trouessart, *Cat. Mamm., Suppl.* p. 60 (1904: Celebes).

*Cynonycteris minor* (*nee* Dobs.), Hickson, *A Naturalist in N. Celebes*, p. 84 (1889: Talisse I.).

*Xanthopyia minor*, A. B. Meyer, *Abh. Mus. Dresden*, vii. no. 7, p. 6 (1899: N. Celebes, Sanghir).

*Rousettus celebensis*, K. Andersen, *Ann. & Mag. N. H.* (7) xix. p. 509 (June 1, 1907: Mt. Masarang, Celebes).

*Diagnosis*.—Bony palate narrower than in any of the foregoing species; last premolar and molars, above and below, unusually narrow. Fur longer and richer; notopatagium partly (or wholly) hairy; general size small. Forearm 72.5-75 mm.

*Skull*.—General size as in *R. amplexicaudatus*; rostrum very low and slender; premaxillaries in simple contact in front; bony

palate unusually narrow posteriorly: width externally across  $m^2$ - $m^2$  9.7 mm. (two adults), against 10.2-11.8 in *amplexicaudatus* (ten adults); frontal region between postorbital processes flat; temporal fossa narrow; temporal ridges forming a low sagittal crest in fully mature individuals.

*Teeth*.—Upper canine and  $p^3$  widely separated;  $p^1$  in the centre of the interspace between these two teeth, not deciduous; last premolar and molars above and below very narrow:  $m_1$  at least twice as long as broad:  $m^2$  small, less than half the size of  $m^1$ ;  $p_1$  three or four times the size of a lower incisor;  $m_2$  about half the length (or less) of  $m_1$ ;  $m_3$  subcircular in outline.

*Palate-ridges*.—4+3+1; arrangement as in *R. amplexicaudatus*.

*Ears, wings, tail*.—Ears essentially as in *R. amplexicaudatus*: narrow, not attenuated below the tip, the tip itself broadly rounded off; antitragal lobe small, rounded. General size of the animal as in *R. brachyotis* (smaller than *R. amplexicaudatus*), but digits proportionally longer than in any other eastern species of the genus (index of pollex 39.2, of third digit 16.46, against 33.5-41 and 15.29-41 respectively in all other eastern species); for details see wing-indices, above p. 20. Tail long, probably about 20 mm. (only dried skins examined).

*Fur*.—Longer, richer, and more velvet than in *R. amplexicaudatus* and allied eastern species; notopatagium clothed with dense fur: hairing on forearms, tibiae, interfemoral, and underside of lateral membrane longer and richer; face more densely haired.

*Colour*.—Brighter than in *R. amplexicaudatus*. Back light. Prout's brown, rump more inclining to mars-brown tinged with russet; sides of back and tibiae next to membranes almost vandyck-brown; crown and occiput dark brown, approaching bistre; nape of neck broccoli-brown; a glandular tuft of mummy-brown hairs on each side of the neck in both sexes; entire underside of body dark greyish drab.—Immature individuals are similar in colour to adults, but without the mummy-brown neck-tuft.

*Measurements*. See table, p. 48.

*Range*. Celebes; Sanghir Islands (Dresden Mus.).

*Type* in collection.

*Remarks*.—Without close inspection this species, owing to its small size, may be easily (and has in fact repeatedly been) confused with *R. brachyotis*. The larger skull, very narrow palate, narrow molars, non-deciduous  $p^1$ , much longer pollex (28-30 mm., against 24-26 in *brachyotis*), longer wings (chiefly owing to the longer metacarpals), much longer fur, hairy notopatagium, and much more densely haired tibia readily distinguish it from *R. brachyotis*.

- a. ♂ ad. sk.; skull. Rurukan, N. Celebes; Dr. Chas. Hose [C.]. 97.1.2.6.  
Oct. 1895.  
b. Imm. sk.; skull. Mt. Masarang, N. Celebes. Dr. Chas. Hose [C.]. 97.1.2.7.  
4000'; Oct. 1895.  
c. ♀ ad. sk.; skull. Mt. Masarang, N. Celebes, Dr. Chas. Hose [C.]. 97.1.2.8.  
3500'; Oct. 1895. (Type of species.)

## Measurements of Eastern Species of Roussettus.

	<i>R. leschenaulti.</i>		<i>R. seminioides.</i>		<i>R. amplexicaulatus.</i>		<i>R. minor.</i> Type.	<i>R. brachyotis.</i>		<i>R. celebensis.</i>	
	Min.	Max.	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
Forearm .....	80.5	87.5	79	85.5	77	87.2	mm.	mm.	mm.	mm.	mm.
Pollex, c. u. ....	26.7	29.5	26	26.5	25.5	30	70.5	69.8	75	72.7	75
2nd digit, metacarpal .....	31.8	37.5	33.5	35.5	31	35.2	...	24	26	30.8	30
" " 1st phalanx.....	7.8	8.7	7.8	8	6	8.2	29.2	28.2	31.5	33.5	33.5
" " 2nd-3rd phalanx, c. u. ....	7.8	9	7.8	8.5	7.5	9	6.2	6	7.5	7	7.5
3rd digit, metacarpal .....	48.8	54	49	51	46.7	52	8	7	8.8	8.7	8.8
" " 1st phalanx.....	33.8	36.8	33.7	33.7	30.2	35.7	45.8	42	44.8	46	48.5
" " 2nd phalanx .....	41	46.2	40.7	42	39.2	47.2	30	29	31.5	32	35
4th digit, metacarpal .....	47.3	52.8	49	50.5	44.7	51.2	? 35	36	40.8	40.8	41
" " 1st phalanx .....	25.8	28.5	...	27	23	26.5	43.8	40.8	44	45	46.5
" " 2nd phalanx .....	29	31.5	...	28.8	25.8	32	22.5	21	22	23.5	24.7
5th digit, metacarpal ..	47	52	47	50	43	51	26.5	23.7	24	25.7	28.5
" " 1st phalanx.....	24	26.8	24.5	25	21.2	24	42	40	42.5	45	46.5
" " 2nd phalanx .....	25.5	29.5	...	26	23.8	29.5	19.8	19	20	20	22.5
Ear, length fr. m. notch .....	19	20.5	...	19.7	18.5	19.7	24.5	21.5	25	24	25.5
" greatest width, flattened .....	14.5	15.5	...	15.8	12.2	13	? 15	16	16	16.8	17.5
Eye to tip of muzzle .....	14.8	16	...	15.5	14	15.5	? 8.3	10	11	12.2	12.5
Tail .....	13	17.5	...	14.5	14	15.5	...	...	...	...	...
Lower leg .....	36	41.5	...	40	34.7	38.8	? 12	...	...	...	...
Foot, c. u. ....	20	23.5	...	21	20	22.8	30.2	...	...	31.5	34
Skull, total length to front of premaxillaries ..	37.5	41.5	38.2	41.5	35	39.7	...	18	20.5	22.5	23
" " width of brain-case at zygomata .....	15	16.5	16	16.2	14	16.2	35	33	36.2	37.3	38
" " zygomatic width .....	22.8	23.7	23	23.8	21	24.5	14.7	13.8	14.8	15	15
" " postorbital constriction.....	8	9.5	8.2	9	7.2	9.3	22.8	20	23.7	21	21.7
" " interorbital constriction.....	7.2	9	7.5	8.2	7.2	8.6	7.8	7.2	8.2	7.3	7.3
" " width across m <sup>2</sup> , externally.....	11	12	11.7	11.9	10.2	11.8	8	7	8.5	7.5	8
" " width across c, externally.....	7	8.5	7.5	8.7	6.7	8.7	10.7	9.7	10.7	9.7	9.7
" " palation to incisive foramina .....	18	18.7	17.8	...	16	17.7	7	6.5	6.8	7.6	7.8
" " front of orbit to tip of nasals .....	12.8	13.5	12.8	...	11.7	13.2	16	14.3	16	...	17.5
Mandible, length .....	28.8	32.7	30.2	32.7	27	31.2	11.8	10.5	12.8	12.5	13.2
Upper teeth, c-m <sup>2</sup> .....	14	15.7	14.5	15.2	12.8	14.2	27.8	26	28.5	28	29.8
Lower teeth, c-m <sub>3</sub> .....	15.2	17	16.2	17	14	15.8	15	11.8	13	14	14.3
							14.5	13.2	14.8	15	15.5

10. *Rousettus (Stenonycteris) lanosus*, *Thos.*

*Xantharpyia ægyptiaca* (*nec Geoff.*), *Horsfield, Cat. Mamm. Mus. E. Ind. Co.* p. 29 (1851: Abyssinia).

*Eleutherura ægyptiaca* (pt.), *Gray, Cat. Monk. Sc.* p. 117 (1870: Abyssinia).

*Cynonycteris ægyptiaca*, *Dobson, Cat. Chir. B. M.* p. 75, specimen *e* (1878: Abyssinia).

*Cynopterus (Cynonycteris) ægyptiaca* (pt.), *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 206 (1878: Abyssinia).

*Rousettus ægyptiacus* (pt.), *Trouessart, Cat. Mamm., Suppl.* p. 60 (1904: Abyssinia).

*Rousettus lanosus*, *Thomas, Ann. & Mag. N. H.* (7) xviii. p. 137 (Aug. 1. 1906: Ruwenzori East); *K. Andersen, op. cit.* (7) xix. p. 511 (1907).

*Diagnosis.*—Basicranial axis strongly deflected; molars excessively narrow. Antitragal lobe obsolete; wings from back of second toe; second phalanx of fifth digit longer than first phalanx; fur long and coarse; notopatagium hairy. Forearm 88.5–90 mm.

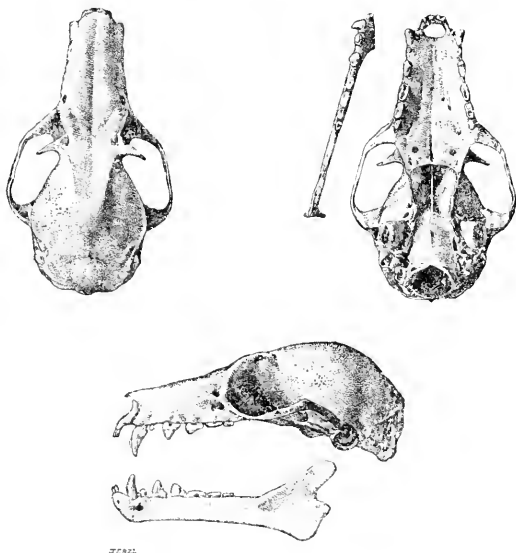


Fig. 3.—*Rousettus (Stenonycteris) lanosus*, ♂. Ruwenzori East. No. 6.7.1.2.  
Type. }.

*Skull* (fig. 3).—General size as in *R. leachi* and *angolensis*, but more delicately built, the bones thinner and lighter. Brain-case so strongly deflected that the alveolar margin projected backward passes through middle or upper half of supraoccipital. Rostrum

slender; premaxillaries in simple contact (not co-ossified), and produced distinctly more forward than in *R. leachi*; incisive foramina, therefore, longer and broader than usual in the genus. Owing to the strong reduction in the size of the cheek-teeth, the temporal muscle is weaker, the temporal fossa markedly shorter and narrower than in *R. leachi* and *angolensis*, the rami of the mandible slenderer, the coronoid process somewhat lower, much slenderer, and directed considerably more obliquely backward, the condyles smaller, the angular process less projecting.

*Teeth* (fig. 3).—Chief character: the extremely narrow cheek-teeth. Upper incisors smaller than in *R. leachi* and *angolensis*;  $i^1-i^1$  rather more separated than  $i^1-i^2$ ; owing to the projection of the premaxillaries, the distance  $i^2-c$  is as great as between  $c$  and  $p^3$ .  $p^1$  as small as an upper incisor, situated nearer to the canine than to  $p^3$ .  $p^3-m^2$  and  $p_3-m_3$  lower, shorter, and very much narrower than in *R. leachi* and *angolensis*: width of  $p^4$  only about one fifth (in all other species about one third) the distance between inner sides of  $p^4-p^4$ .  $m^1$  equalling or slightly exceeding  $p^4$  in length.  $m^2$  about one third the bulk of  $m^1$ .  $i_2$  in cross-section distinctly larger than  $i_1$ .  $p_1$  twice or three times the bulk of an outer lower incisor.  $m_2$  comparatively smaller than in *R. leachi* and *angolensis*: length about half that of  $m_1$ .  $m_3$  elliptical in outline, about two thirds of  $m_2$ .

*Palate-ridges*.—Examined in one specimen only: 3+4+1; arrangement as usual (see p. 19), except that the 5th ridge terminates closely behind  $m^2$  (not at  $m^2$  or between  $m^1$  and  $m^2$ ), and the 6th ridge is incomplete, not reaching the lateral margins of the palate.

*Ears*.—Similar in length to those of *R. leachi*, but rather narrower; outer margin slightly, but distinctly, concave below tip, the tip itself narrow, rounded. Antitragal lobe obsolete.

*Wings*.—Inserted on base of second toe. 9-10 long vertical fasciæ in the lateral membrane, viz. 2 postaneal, 7-8 preaneal (two alcoholic specimens examined). Wing-structure essentially as in *R. leachi*, except that the pollex is longer (index 400, against 361 in *leachi*), and the second phalanx of the fifth digit considerably longer than the first phalanx. See wing-indices, *suprà*, p. 20.

*Fur*.—Face short-haired. Fur on body unusually long and coarse. Above, proximal two thirds of forearm densely haired; notopatagium and plagiopatagium next to body, the whole of the tibia and the interfemoral, a narrow inner line excepted, furred, the hair being particularly long and coarse on the proximal half of the tibia and the interfemoral; upperside of feet covered with short hairs. Below, proximal two thirds of forearm, plagiopatagium next to body, tibia almost to the ankle-joint, and interfemoral, a narrow inner border excepted, clothed with long woolly hair.

*Colour*.—Back and rump dark brown, approaching seal-brown, inclining to bistre on the posterior part of the rump, interfemoral, and tibia; crown rather darker than back; nape of neck between broccoli-brown and hair-brown; the whole of the underparts dark greyish drab.

*Measurements.* On p. 54.

*Range.* Shoa; Ruwenzori East (5000–13,000').

*Type* in collection.

*Remarks.*—This peculiar species, the type of the subgenus *Stenonycteris*, is chiefly characterized by the thin, almost papery condition of the bones of the skull, the unusually strong deflection of the brain-case, the extremely narrow cheek-teeth, the practically complete obliteration of the antitragal lobe, the insertion of the wings on the second instead of the first toe, and the long and coarse fur. Though much reduced in size the molars do not differ in structure from those of other species of the genus. In the quality of the fur *R. lanosus* is unlike any species of *Rousettus*, but closely similar to the coarse-haired species of *Pteropus*.

a. Imm. sk.; skull.	Shoa.	Sir W. Cornwallis Harris [C.].	61.2 30.6.
b. ♂ ad. al.; skull.	Ruwenzori East, 13,000' ( <i>R. B. Woosnam</i> ).	Ruwenzori [P.].	Ex- 6.7.1.2. ploration Comm.
c-d. ♀ ad., ♀ juv. al.	Ruwenzori East, 12,500–13,000' ( <i>R. B. Woosnam</i> ).	(Type of species.) Ruwenzori [P.].	Ex- 6.7.1.3–4. ploration Comm.
e. ♀ imm. sk.; skull.	Ruwenzori East, 5000'; 13 March, 1906 ( <i>R. E. Dent</i> ).	Ruwenzori [P.].	Ex- 6.12.4.11. ploration Comm.

## 11. *Rousettus (Lissonycteris) angolensis*, Bocage.

*Cynonycteris ægyptiaca*, Bocage, *Journ. Sci. Math. Lisboa*, (2) i. no. 1, p. 15 (1889: Pungo Andongo).

? *Cynonycteris unicolor* (nec Gray), Matschie, *Arch. Naturg.* i. 3, p. 351 (1891: Cameroon).

*Cynonycteris* sp., Bocage, *Journ. Sci. Math. Lisboa*, (2) ii. no. 7, p. 174, fig. 2 (palate-ridges) (1892: Pungo Andongo, Cahata, Quibula).

*Xantharpyia collaris* (nec Ill.), Matschie, *Säug. D. Ost-Afrika*, p. 17 (1895: Tanga, Bukoba).

*Cynonycteris collaris*, Sjöstedt, *Bih. K. Sv. Vet.-Akad. Handl.* xxiii. Afd. iv. no. 1, pp. 13, 15–16. 46 (1897: Cameroon); *id.*, *Mitth. Deutsch. Schutzgeb.* x. Heft 1, p. 7 (1897: Cameroon).

*Rousettus collaris*, Thomas, in H. H. Johnston's 'The Uganda Protectorate,' i. p. 422 (1902).

*Cynonycteris angolensis*, Bocage, *Journ. Sci. Math. Lisboa*, (2) v. no. 19, p. 133, 138, text-fig. (palate-ridges) (1898: Pungo Andongo, Cahata, Quibula); Scabra, *ibid.* pp. 159, 169, pl. i. fig. 9 (palate-ridges) (1898).

*Xantharpyia (Myonycteris) angolensis*, Matschie, *Megachiroptera*, p. 64 (1899: Angola, Togo, Bukoba).

*Rousettus angolensis*, Trouessart, *Cat. Mamm., Suppl.* p. 59 (1904) K. Andersen, *Ann. & Mag. N. H.* (7) xix. p. 510 (1907).

*Diagnosis.*—Basiscranial axis very slightly deflected; frontal region between postorbital processes distinctly concave; premaxillaries co ossified in front; molariform teeth short and broad

$p_1$  subequal in bulk to a lower incisor. Antitragal lobe distinct; wings from back of second toe; lower leg very short (29–31 mm.); fur long and silky; notopatagium hairy. Smaller than *R. leachi*: forearm 78–83.5 mm.

*Skull* (fig. 4).—Brain-case only very slightly deflected, the alveolar line if continued backward passing below, or through, the lower margin of the occipital condyle. Occipital and hinder parietal region considerably more flattened than in any other species of the genus, supraoccipital much lower, outline of lambdoid crest, in back view, therefore more flatly convex. Owing to the combined effect of the slight deflection of the basiscranial axis and the flattening of the

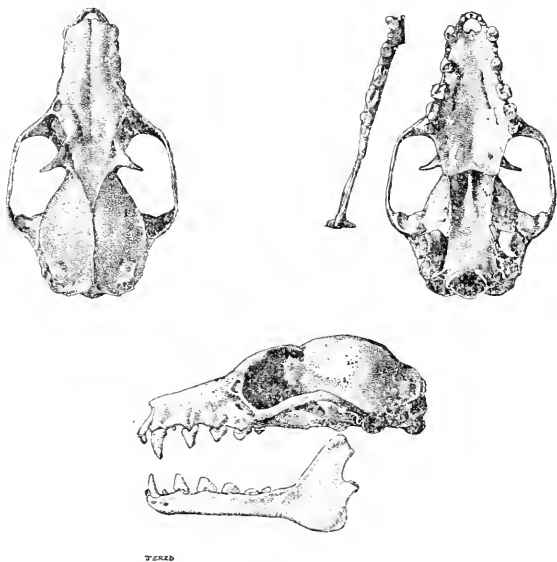


Fig. 4.—*Rousettus (Lissonycteris) angolensis*, ♀. Ruwenzori East. No. 6.12.4.5.  
 †. (A supernumerary upper molar present on one side in the skull figured has been omitted in the drawing; cf. *antea*, p. 18.)

occiput, this latter portion of the skull is directed more backward, less obliquely downward, than in other species. Premaxillaries firmly co-ossified in front, forming an unbroken bar without any trace of a median suture, even in slightly immature individuals; ascending rami of premaxillaries slenderer than in other species, particularly in their upper half. Supraorbital margin and bases of postorbital processes more raised above the level of the upper surface of the skull, making the frontal plateau between the processes very distinctly concave from side to side. Palation border and mesopterygoid fossa rather narrower than usual.



*Teeth* (fig. 4).— $c-p^3$  and  $p^3-p^4$ , as well as  $c-p_3$  and  $p_1-p_4$  more broadly separated than in *R. leachi*.  $p^1$  and  $p_1$  more reduced in size,  $p_1$  in cross-section only equalling or slightly exceeding a lower incisor. Molariform teeth, above and below, peculiarly short and broad, in the upper jaw almost squarish.

*Palate-ridges*.— $3+4+2$  (three of four alcoholic specimens) or, the fourth ridge being not interrupted in the median line,  $4+3+2$  (one specimen).

*Ears*.—Outer margin of ear-conch very slightly attenuated below the tip, the tip itself broadly rounded off; antitragal lobe well developed, triangular, subacute.

*Wings*.—Inserted on back of second toe. 12–15 long vertical fasciæ in the lateral membrane, viz. 3–5 postaneoneal, 8–11 preaneoneal (five alcoholic specimens examined). Forearm shorter than in *R. leachi*: 78–83.5 mm., against 89–99. All digits proportionally considerably longer than in *R. leachi*: index of pollex 440 (361 in *leachi*); second digit (index 786) decidedly longer than third metacarpal (index 705; in *leachi* respectively 652 and 644); second phalanx of fifth digit as a rule longer than first phalanx. For further details see wing-indices, *suprà*, p. 20.

*Tail and hind limb*.—Tail shorter than in *R. leachi*: 8.5–13 mm., against 15–19. Lower leg much shorter: 29–33 mm., against 40–42 in *R. leachi*.

*Fur*.—Ears naked posteriorly, except at base. Face in front of and below eyes much more strongly haired than in *R. leachi*. Fur of body much longer, softer, more silky. Distribution of fur on humerus and forearm, above and below, as in *R. leachi*. Notopatagium densely haired. Upperside of femur, tibia, and interfemoral (a narrow portion next to calcar excepted) long-haired.

*Colour*.—Different from that of *R. leachi*: general aspect, chestnut above, dark wood-brown below.

*Adult male*.—Back and rump rich brown, approaching chestnut or burnt-umber, base of hairs light drab or wood-brown, sometimes with a tinge of fawn: crown dark grizzled brown; fur on forearm, sides of back next to membranes, interfemoral and tibia usually of a brighter tinge, approaching mars-brown or russet. Breast and belly wood-brown; throat and foreneck dark mars-brown tinged with fawn.—The bleached coat ( $\sigma$  ad., Ruwenzori East, March 13, no. 6.12.4.3) presents a very different aspect: back and rump rich tawny olive: crown and occiput dark raw umber; breast and belly as above; throat and foreneck cinnamon.

*Adult female*.—Similar to the male, but throat and foreneck scarcely differing in colour from the rest of the underparts.

*Measurements*. On p. 54.

*Range*. Angola, north-westward to Cameroon and Togo, eastward through the Congo Basin to Ruwenzori, and German East Africa.

*Cotypes* in the Lisbon and British Museums.

*Remarks*.—*R. angolensis*, the type of the subgenus *Lissonycteris*, is the most aberrant species of *Rousettus*; in none of its peculiar characters is it approached by any other species of the genus. In

the slight deflection of the brain-case and the shape of the occipital and hinder parietal region it shows distinct leanings towards the genus *Epomophorus*.

a. ♀ imm. al.; skull.	Quibula, Benguela.	Lisbon Museum [P.].	97.8.6.1. ( <i>Cotype</i> of species.)
b-c. 3 ♂ ad., ♀ ad. sks.; skulls.	Ruwenzori East, 5000-5500'; March, 1906 ( <i>R. E. Dent</i> ).	Ruwenzori Exploration Comm. [P.].	6.12.4.1-4.
f-g. 2 ♀ ad. sks.; skulls.	Ruwenzori East, 5500'; March, 1906 ( <i>D. Carruthers</i> ).	Ruwenzori Exploration Comm. [P.].	6.12.4.5-6.
h-l. ♂ ad., ♂ imm., 2 ♀ imm., ♂ pull. al.	Ruwenzori East ( <i>R. E. Dent</i> ).	Ruwenzori Exploration Comm. [P.].	6.12.4.111-114.
m. ♀ imm. sk.; skull.	Kodja, Gaima Range, N.E. Congo, 3° 30' N., 29° E.; 26 Aug. 1906.	Alexander-Gosling Expedition [P.].	7.7.8.24.

*Measurements of Rousettus lanosus and angolensis.*

	<i>R. lanosus.</i>		<i>R. angolensis.</i>	
	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Forearm .....	88.5	90	78.2	83.2
Pollex, c. u. ....	34	37.2	32.7	37.7
2nd digit, metacarpal .....	37.5	38.5	40	47
" 1st phalanx .....	8.8	10.5	8.5	11.5
" 2nd-3rd phalanx, c. u. ....	10.8	12	9	11.5
3rd digit, metacarpal .....	59.2	60	54.7	60.8
" 1st phalanx .....	40.2	40.7	38	43.5
" 2nd phalanx .....	57	59	48.2	55
4th digit, metacarpal .....	58.2	59.7	53.5	58.8
" 1st phalanx .....	30.2	30.8	29	33
" 2nd phalanx .....	35.5	37	29	33.7
5th digit, metacarpal .....	54.5	56.8	53	58.8
" 1st phalanx .....	26.2	27	25.8	29.8
" 2nd phalanx .....	33.8	34.5	26	30.5
Ear, length from notch .....	20.2	22	22	24
" greatest width, flattened .....	14	14.2	15.2	16.7
Eye to tip of muzzle .....	...	18.5	17.8	18.7
Tail .....	15.5	21.2	8.5	12.8
Lower leg .....	39	39.7	29	33
Foot, c. u. ....	23.5	24.5	21.8	24.8
Skull, total length to front of premax. ....	43.7	...	42.5	44
" width of brain-case at zygomata .....	17.1	17.3	16.8	17.2
" zygomatic width .....	24.8	...	24.8	27.5
" postorbital constriction .....	9.3	9.8	7.7	8.5
" interorbital constriction .....	7.7	8	6.8	8
" width across m <sup>2</sup> , externally .....	11.2	11.7	12.7	14.5
" width across canines, externally .....	8.7	9	8.2	9.6
" palation to incisive foramina .....	19.2	...	20.6	22.2
" front of orbit to tip of nasals .....	15.7	...	13.8	14.8
Mandible, length .....	32	33	33.2	34.8
Upper teeth, c-m <sup>2</sup> .....	14.3	14.8	16	17
Lower teeth, c-m <sub>3</sub> .....	16.2	16.7	18	19.2

3. BONEIA, *Jentink*.

Type.

1879. Boneia, *Jentink*, *Notes Leyden Mus.* i. p. 117 (April,  
1879) ..... B. bidens.

*Diagnosis*.—Closely allied to *Rousettus*, with which it accords in most of its cranial and dental and practically all external characters (second digit clawed, a short tail, membranes from sides of back), but differing in the following particulars: palate much broader anteriorly, premaxillæ separated in front, upper and lower canines excessively heavy at base, lower canines directed strongly outward, inner pair of upper incisors lost (at least in adults), outer pair of lower incisors larger than inner, crowns of molariform teeth flatter. General size (of the single species known) as the larger species of *Rousettus*: forearm about 95 mm.

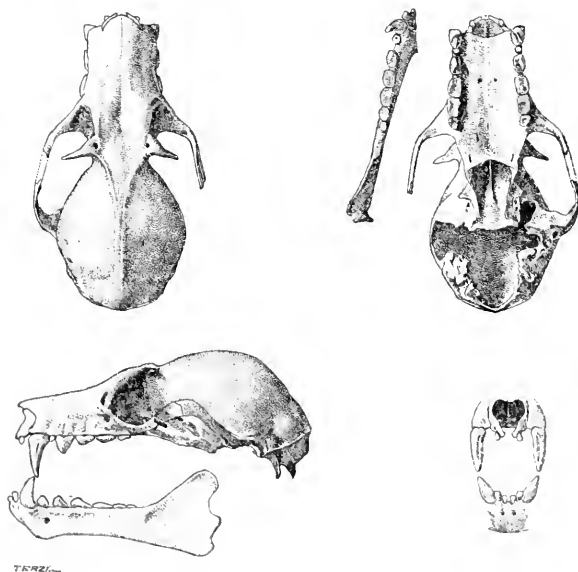


Fig. 5.—*Boneia bidens*, ♂. Menado. No. 97.1.2.5 (type of  
*B. menadensis*). ♀.

*Skull* (fig. 5).—Differing from that of *Rousettus* in the two characters referred to in the diagnosis above; in all other respects

perfectly Roussettine. In *Roussettus* the breadth of the palate (palatal plates of maxillæ) anteriorly between the cingula of the canines is less than, or at most equal to, half the breadth between  $m^2$ - $m^2$ , the maxillary tooth-rows therefore very conspicuously converging in postero-anterior direction, and the rostrum, in upper view, distinctly tapering anteriorly, the breadth across the outer surfaces of the canines being much less than the lachrymal breadth. In *Boneia* the palatal breadth between the cingula of the canines is about two-thirds the breadth between  $m^2$ - $m^2$ , the maxillary tooth-rows not conspicuously converging postero-anteriorly, the rostrum in upper view, owing both to the greater distance between the canines and to the unusually heavy sockets of these teeth, not distinctly tapering anteriorly, the breadth across the outer surfaces of the canines subequal to the lachrymal breadth. Premaxillæ separated anteriorly by a space of about 1 mm.

Deflection of brain-case greater than in typical *Roussettus*, nearly as in *Stenonycteris* (*Roussettus lanosus*, p. 49, fig. 3), alveolar line if projected backward passing through supraoccipital near upper margin of foramen magnum. Occiput not tubular (compare *Pteropus*). Length of rostrum much greater than lachrymal breadth; front of orbit above middle of  $m^1$ . Palate, apart from greater breadth in front, quite as in *Roussettus*, postdental portion not long as in *Pteropus*. Premaxillæ perfectly similar in shape to those of *Eidolon* and *Roussettus*, narrow, upper extremity curved forward and tapering to a point. Tympanic unknown. Sagittal crest low, scarcely raised above level of brain-case; postorbital processes as in *Roussettus*. Coronoid low, much sloping, rather similar to that of *Stenonycteris*, though still lower and somewhat broader antero-posteriorly; condyle of mandible below level of alveolar line.

Dentition (fig. 5).—
$$\frac{i^2 c p^1 p^3 p^4 m^1 m^2}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2 m_3} \times 2 = 32. \quad p^1 \text{ and } m^2,$$
  
 $p_1$  and  $m_3$  reduced. Differential characters, as compared with dentition of *Roussettus*, see diagnosis of genus, *suprà*.

$i^2$  small, subterete, crown very slightly differentiated from shaft, cutting-edge rounded off; premaxilla projecting on inner side of  $i^2$  (see fig. 5), suggesting the possibility that a rudimentary  $i^1$  may be present in young individuals.  $i_1$  similar in size and shape to  $i^2$ ;  $i_2$  scarcely differing in general shape, but higher and considerably larger, crown area twice or twice and a half that of  $i_1$ . Upper canine long, very broad (antero-posteriorly) at base, compressed from side to side, its socket conspicuously projecting on side of rostrum; antero-posterior basal diameter subequal to length of  $p^1$  (in *Roussettus* about two-thirds the length of  $p^1$ ); profile of front margin of crown straight; anterior surface of crown marked with a broad and deep vertical groove: a similar deep but narrow vertical groove on hinder surface of crown: cingulum narrow. Lower canine very heavy at base, crown slanted strongly outward.

$p^1$  slightly larger in crown area than  $i^2$ ,  $p_1$  about twice the bulk of  $i_1$ ,  $p^3-m^2$  and  $p_3-m_3$  similar to corresponding teeth of *Roussettus*, but crowns flatter, longitudinal ridges lower; outer and inner ridge of  $p^3$  and  $p_3$  less completely united anteriorly than in *Roussettus*;  $m^2$  smaller, scarcely one half the area of  $m^1$ ;  $m_1$  little more than half the bulk of  $m_1$ ;  $m_3$  similar in size to  $p_1$ .

*Palate-ridges*.— $4+3+?$  (formula derived from Jentink's description, *l. s. c.*).

*Wings*.—Second digit clawed. Lateral membranes arising from sides of back, separated by a space about 15–17 mm. in width, and inserted posteriorly on back of first (or junction between first and second) metatarsal. Relative lengths of metacarpals and phalanges essentially as in *Stenonycteris* (*Roussettus lanosus*, see p. 20). The subjoined wing-indices are calculated from measurements of only two specimens:—

Forearm.	Pollex. c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph. c. u.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	420	436	121	126	671	461	666	659	357	441	648	276	314

*Tail*.—As in *Roussettus*. Shorter than hind-foot; basal portion connected with underside of interfemoral by its dorsal integument, tip freely projecting.

*Range*.—Celebes; as yet only known from the northern portion of the island.

*Affinities*.—*Boneia* is closely related to *Roussettus*, but decidedly more specialized. It differs chiefly (and almost only) in certain characters of the canines and incisors, which again have effected some modification of the front of the rostrum and mandible. As pointed out in the description of the genus, both the upper and lower canines are unusually heavy, and the lower canines slanted strongly outward (see front view of rostrum and mandible, fig. 5, p. 55); the latter character necessitates a greater distance (broader palate) between the upper canines; the breadth of the rostrum anteriorly is further increased by the laterally projecting sockets of the upper canines. The widening of the space between the upper canines has forced the rami of the premaxillæ from each other anteriorly (in all typical species of *Roussettus*, as in most genera of Megachiroptera, the premaxillæ are much more firmly united with the maxillæ and nasals than anteriorly with each other). It appears unlikely that the degeneration, or at least in adults complete suppression, of the inner upper incisor has had anything to do with the separation of the premaxillæ; though  $i^1$  is missing, its portion of the premaxillæ is preserved. The heavy

lower canines and somewhat enlarged outer lower incisors make the symphysis of the mandible distinctly broader and longer (antero-posteriorly) than in *Rousettus*. The tip and trenchant hinder edge of the lower canines has carved a deep vertical groove in the front face of the crown of the upper canines. The heavy canines and anteriorly protruding lower jaw render this portion of the skull and dentition somewhat bulldog-like in appearance. The cheek-teeth are relatively weak (longitudinal ridges unusually low), and, in accordance with this, the coronoid process low and much sloping, the deflection of the brain-case greater than in any species of *Rousettus*, except the weak-toothed *R. lanosus*.—The separation of the premaxillæ might suggest affinities with *Eidolon*, the somewhat enlarged  $i_2$  with *Pteropus*; but in no other characters does *Boneia* show any leanings whatever to these genera.

*History of genus in literature*.—Secondary references: Dobson, Rep. Brit. Assoc. for 1880, p. 174 (near *Rousettus*); Winge, E. Mus. Lundii, ii. pt. 1, p. 59 (1892: near *Rousettus*); Matschie, Megachiroptera, p. 69 (1899: near *Rousettus*); Miller, Fam. & Gen. Bats, p. 61 (1907: near *Pteropus*).

### 1. *Boneia bidens*, Jentink.

*Boneia bidens*, Jentink, Notes Leyden Mus. i. p. 117 (April, 1879: Boné, N. Celebes): Dobson, Rep. Brit. Assoc. for 1880, p. 174 (1880); Jentink, Cat. Ost. Mamm. p. 264 (1887: Gorontalo); *id.*, Cat. Syst. Mamm. p. 152 (1888: Gorontalo: Boné); Flower & Lydekker, Mamm. p. 653 (1891); Trouessart, Cat. Mamm. i. p. 85 (1897: Boné); Matschie, Megachir. p. 69 (1899: Boné); Trouessart, Cat. Mamm., Suppl. p. 60 (1904: Boné); Willink, Nat. Tijds. Nederl. Ind. lxxv. p. 275 (1905: Celebes); Miller, Fam. & Gen. Bats, p. 62 (1907).

*Boneia menadensis*, Thomas, Ann. & Mag. N. H. (6) xviii. p. 242 (1 Sept. 1896: Menado); Trouessart, Cat. Mamm. i. p. 85 (1897: Menado); Matschie, Megachir. p. 69 (1899: Menado); Trouessart, Cat. Mamm., Suppl. p. 60 (1904: Menado); Willink, Nat. Tijds. Nederl. Ind. lxxv. p. 275 (1905: Menado); Miller, Fam. & Gen. Bats, p. 62 (1907).

Forearm about 95 mm.

*Ears*.—Similar in size to those of *Rousettus leachi*, but much more distinctly attenuated above, tip narrowly rounded off; antitragal lobe small.

*Fur*.—Short; somewhat adpressed on back and underside of body, spreading round neck. Upperside of forearm thinly clothed with short adpressed hairs for proximal half; femur and adjoining interfemoral furred above; tibia naked. Approximate length of hairs, back 8, nape of neck and belly 9–10 mm. Least breadth of furred area of back 15–17 mm.

*Colour*.—♂ ad. (skin), type of *B. menadensis*: Back deep Prout's

brown, tinged with russet on rump. Entire underside, from throat to interfemoral, including flanks, drab with a slight tinge of brownish, rather darker on throat and foreneck than on breast and belly. Nape and sides of neck golden buffy. A tuft of rigid unctuous hairs on each side of neck, deep ochraceous at base, golden buffy at tip; colour of tufts, in arranged fur, not conspicuously differing from that of surrounding hair. Occiput, crown, sides of head, and face darker brown than back.

*Sexual differentiation*.—Females of this species are unknown. They probably differ in having the neck tufts undeveloped or less developed than males.

*Measurements*. On p. 60.

*Specimens examined*. Three males (two skulls), in the collections of the Leyden and British Museums, including the type of the species and of *B. menadensis*. So far, these appear to be the only specimens known (December, 1908).

*Range*. North Celebes: Menado, Boné, Gorontalo. ("Boné," the type locality of the species, is not, as naturally presumed by Thomas and all later writers, the well-known Bone or Boni in S. Celebes, but a mountain range and river in N. Celebes, very near Gorontalo; see Rosenberg, Malay. Arch. p. 257, 1878, and P. & F. Sarasin, Reisen in Celebes, i. map iii, 1905.)

*Type* in the Leyden Museum.

*Boneia bidens*, Jentink; 1879.—Type locality, Boné, N. Celebes (*Rosenberg*); type, an adult male, preserved in alcohol, skull *in situ*. The second Leyden specimen, also a male, is mounted, and ticketed Gorontalo (*Rosenberg*); skull extracted, very incomplete.

*Boneia menadensis*, Thomas; 1896.—Type locality, Menado, N. Celebes; type in collection. In this specimen the golden buffy colour is restricted to the nape and sides of the neck, whereas in the type of *B. bidens* it extends to the occiput; in all other characters the two specimens are identical. In view of the fact (which was not known to Thomas) that *B. menadensis* is very nearly a topotype of *B. bidens*, there can be no doubt that the difference referred to is only individual.

a. ♂ ad. sk.; skull. Menado, N. Celebes, Dr. Chas. Hose [C.]. 97.1.2.5.  
3500'; Oct. 1895. (*Type of B. menadensis.*)

*Measurements of Boneia bidens.*

	♂ ad. Boné. Type of species.	♂ ad. Menado. Type of <i>B. menadensis</i> .
	mm.	mm.
Forearm .....	95.5	95
Pollex, c. u. ....	41	39
2nd digit, metacarpal .....	42	41
" 1st phalanx .....	12.5	10.5
" 2nd-3rd phalanx, c. u. ....	12	12
3rd digit, metacarpal .....	65	63
" 1st phalanx .....	45	43
" 2nd phalanx .....	65	62
4th digit, metacarpal .....	63.5	62
" 1st phalanx .....	34	34
" 2nd phalanx .....	41	43
5th digit, metacarpal .....	63.5	61
" 1st phalanx .....	26.5	26
" 2nd phalanx .....	32	33.5
Ear, length from notch .....	23.5	...
" greatest width, flattened .....	14.5	...
Tail .....	24.5	...
Lower leg .....	50.5	50.5
Foot, c. u. ....	31	...
Calcar .....	8	...
Skull, total length to gnathion .....	...	44
" palation to incisive foramina .....	...	18.2
" front of orbit to tip of nasals .....	...	14.2
" zygomatic width .....	...	25.5 *
" width across m <sup>1</sup> , externally .....	...	13
" lachrymal width .....	...	10.8
" width across canines, externally .....	...	10.8
" postorbital constriction .....	...	8.2
" interorbital constriction .....	...	7.8
" width of mesopterygoid fossa .....	...	6
" between p <sup>4</sup> -p <sup>4</sup> , internally .....	...	7.8
" between cingula of canines .....	...	6.2
" orbital diameter .....	...	10.2
Mandible, length .....	...	33
" coronoid height .....	...	11.8
Upper teeth, c-m <sup>2</sup> .....	...	15.2
Lower teeth, c-m <sub>3</sub> .....	...	17.3

\* Estimate.



4. PTEROPUS, *Brisson*.*Pteropus* (pt.), Dobson, Cat. Chir. B. M. p. 15.

1762. <i>Pteropus</i> , <i>Brisson</i> , <i>Regn. Anim.</i> , 2 ed. pp. 13, 153-155 .....	Type. Pt. niger.
1799. <i>Spectrum</i> , <i>Lacépède</i> , <i>Tabl. Mamm.</i> p. 15 [ <i>nec</i> <i>Spectrum</i> , <i>Scopoli</i> , 1777, a genus of Lepi- doptera] .....	Pt. niger.
1866. <i>Eumycteris</i> , <i>Gray</i> , <i>P. Z. S.</i> p. 64 .....	Pt. melanopogon.
1870. <i>Spectrum</i> , <i>Gray</i> , <i>Cat. Monk. &amp;c.</i> pp. 99, 100.	Pt. niger.
1870. <i>Pselaphon</i> , <i>Gray</i> , <i>Cat. Monk. &amp;c.</i> p. 110 [ <i>nec</i> <i>Pselaphus</i> , <i>Herbst</i> , 1792, a genus of Coleo- ptera] .....	Pt. pselaphon.
1899. <i>Serieonycteris</i> , <i>Matschie</i> , <i>Megachir.</i> pp. 6, 30.	Pt. subniger.
1907. <i>Desmalopex</i> , <i>Miller</i> , <i>Fam. &amp; Gen. Bats</i> , p. 60 (29 June, 1907) .....	Pt. leucopterus.

*Diagnosis*.—Basiscranial axis distinctly deflected; occiput tubular; length of rostrum much greater than lachrymal breadth; breadth of palate posteriorly subequal to breadth between canines. Incisors  $\frac{2}{2} - \frac{2}{2}$ ; cheek-teeth  $\frac{5}{6}$ :  $p^1$  rudimentary, deciduous,  $p_1$ ,  $m_3$ , and  $m^2$  much reduced; outer cusp of lower cheek-teeth never deeply bifid; no inner basal ledge in lower cheek-teeth (except in *Pt. anetianus*), and no well developed antero-internal basal cusp in any cheek-tooth. Second digit clawed; membranes from sides of dorsum and back of second toe; calcar well developed; no tail. Forearm 86-220 mm.

*Skull* (figs. 6-8).—(1) Differential characters, as compared with skulls of *Eidolon* (fig. 1, p. 3) and *Rousettus* (figs. 2-4, pp. 17, 49, 52).—Occiput produced backward and downward, as a short tube. Tympanic annular, much narrower than in *Rousettus*. Maxillary tooth-rows less diverging in antero-posterior direction; palate relatively narrower, particularly in its postdental portion: breadth at extreme hinder border subequal to breadth between canines, much less than breadth between  $p^1$ - $p^4$ . Rostrum more conspicuously constricted at diastema  $c$ - $p^3$ . Premaxillæ heavier, zygomatic arches, ectopterygoid, posttympanic, and paroccipital processes stronger, angular portion of mandible more broadly rounded off.

(2) The typical Pteropine skull (fig. 6).—The skull of *Pt. hypomelanus*, as showing no appreciable specialization in any respect, may serve as a paradigm of a "typical Pteropine" skull, and as a basis for a brief summary of the principal aberrations from this fundamental type:—Deflection of brain-case moderate, alveolar line if projected backward passing through middle or upper half of occipital condyles. Rostrum not shortened: front of orbit vertically above front (or some point of front half) of  $m^1$ . Sagittal crest perfectly developed throughout its whole length, extending anteriorly very nearly to base of postorbital processes; brain-case much constricted in front, breadth of postorbital much less than of inter-orbital constriction. Postorbital processes moderate, reaching

within short distance of corresponding small processes on zygoma. Coronoid process moderately strong, somewhat sloping; coronoid height of mandible less than length of lower tooth-row,  $c-m_3$ , subequal to  $c-m^2$ ; condyle of mandible considerably above level of alveolar line.

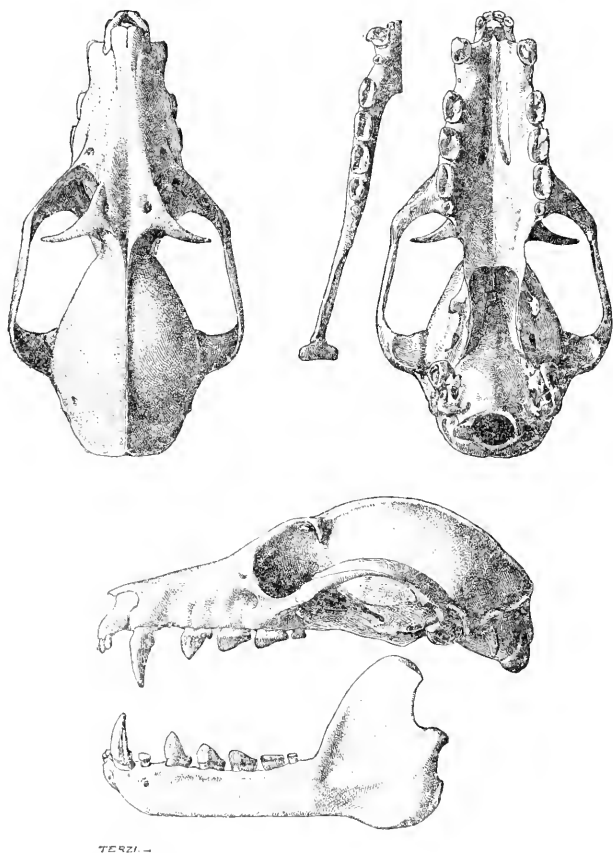


Fig. 6.—*Pteropus hypomelanus tomesi*, ♂. Darvel Bay, N.E. Borneo.  
No. 94.7.14.2. ♀.

The typical Pteropine skull (without, or with only slight, modifications) is found in the large majority of species of the genus, viz. in all species of the *Pt. hypomelanus* (except *Pt. subniger*), *maritimus*,

*caniceps*, *rufus*, *melanotus*, *melanopogon* (rostrum somewhat shortened in *Pt. keyensis*), *vampyrus*, *alcto*, *conspicillatus*, and *neohibernicus* groups. Leaving all minor differences out of consideration, the principal aberrations from this general type may be classed under the following headings [(3) and (4)]:—

(3) Modifications of skull in species with weak dentition (figs. 7 C, S C).—Species with small or excessively narrow premolars and molars show invariably all, or most of, the following modifications of the skull:—Deflection of brain-case conspicuously greater than usual: alveolar margin if projected backward passing through middle or upper half, or even through upper margin, of supraoccipital; coronoid process of mandible weak and much sloping; condyle of mandible situated lower than usual, at level of or only slightly above alveolar line; temporal ridges more or less closely approximated, but not fused to form a sagittal crest, or not fused throughout their whole length; brain-case much less constricted in front than usual, making postorbital broader than interorbital constriction. Extremes of these modifications of the skull are seen in *Pt. scapulatus*, *woodfordi*, and *personatus* (cheek-teeth excessively narrow), *Pt. subniger*, *molossinus*, *insularis*, *phoecephalus*, *temminckii*, *epularius*, and *macrotis* (teeth smaller than usual). A similar adaptation of the skull is shown by the extremely narrow-toothed *Rousettus lanosus* (fig. 3, p. 49) compared with the normal-toothed species of *Rousettus* (cf. also *Macroglossinae*).

Some species with weak dentition show no appreciable, or at least no considerable, reduction of the length of the rostrum: in these, the teeth are normally spaced or may even be more spaced than usual (*Pt. scapulatus*, *woodfordi*). Generally, however, weak dentition is combined with a conspicuous shortening of the rostrum and consequently rather more crowded arrangement of the teeth. In a few species the shortening of the rostrum seems to be due chiefly to enlargement of the orbits (*Pt. temminckii*, *personatus*, *epularius*, *macrotis*).

(4) Short rostrum combined with heavy coronoid process (figs. 7 B, S B).—In the typical Pteropine skull (as shown in figs. 6, 7 A, and 8 A, *Pt. hypomelanus*) the rostrum is rather long, the front of the orbital cavity approximately vertically above the front of  $m^1$ , the coronoid process moderately strong and somewhat sloping, the coronoid height of the mandible less than the length of the lower tooth-row, exclusive of incisors. In a small number of species, viz. the typical forms of the *Pt. pselaphon* group (*Pt. pselaphon* (fig. 8 B), *pilosus*, *tuberculatus*), all forms of the *Pt. samoënsis* type (*Pt. navaïensis*, *samoënsis*, *antianus*, fig. 7 B), and the typical forms of the *Pt. lombocensis* group (*Pt. lombocensis*, *solitarius*), these characters are modified as follows: rostrum considerably shortened, front of orbit above back, or posterior third, or even middle of  $p^1$ , coronoid process unusually high, broad (antero-posteriorly), and steeply ascending, coronoid height of mandible more than length of lower tooth-row, exclusive of incisors. In all of these species the dentition is heavier than usual, and in nearly all peculiarly modified

in one or other direction (either by enlargement of the posterior basal ledges of the molariform teeth, or development of an inner basal ledge in the lower cheek-teeth, or tendency to splitting of inner ridges of certain lower cheek-teeth, or reduction of  $m_3$  and  $m^2$ , or excessive development of cingulum of canines and incisors, or by several of these modifications combined). Compare skull and mandible of *Pteralopex*.

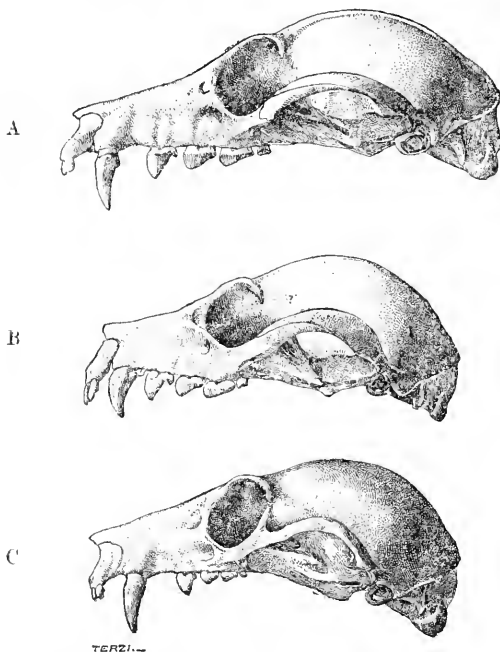


Fig. 7. —A, typical Pteropine skull (*Pt. hyponelaus tomesi*, 94.7.14.2); see text p. 61. B, skull of a species with short rostrum and heavy dentition (*Pt. aetianus*, 7.1.1.255); text p. 63. C, skull as modified in species with excessively weak cheek-teeth (*Pt. scopulatus*, 62.6.4.2); text p. 63. All figures  $\frac{1}{4}$ .

The three principal types of Pteropine skulls described above as (2), (3), and (4) must not be considered sharply separated. There is, on the contrary, a perfectly gradual transition from (2) to (3) (viz. by species showing various stages of reduction in the sizes of the teeth, and therefore also more or less pronounced leanings towards the cranial characters of weak-toothed species), and several transitional stages between (2) and (4) (some of the most instructive examples are found in the *Pt. pselaphen* group; certain peripheral

species of this group, viz. *Pt. insularis* and *phorocephalus*, Caroline Islands, and *Pt. leucopterus*, Philippines, while preserving most of the *pselaphon* characters in skull and dentition, show a remarkable decrease in the size of the teeth, and in these species the short and heavy rostrum of a *Pt. pselaphon* is combined with a normal or even rather weak coronoid process: similarly in certain peripheral forms

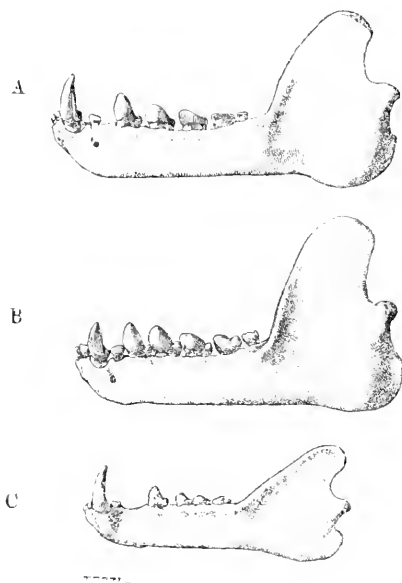


Fig. 8.—A, typical Pteropine mandible (*Pt. hypomelanus tomesi* 94.7.14.2); see text p. 62. B, mandible of a species with short rostrum, heavy dentition, high and steeply ascending coronoid process (*Pt. pselaphon*, 92.2.4.1); text p. 63. C, mandible of a species with excessively weak cheek-teeth (*Pt. scapulatus*, 62.6.4.2); text p. 63.

All figures  $\frac{1}{2}$ .

of the *lombocensis* group, viz. *Pt. rodricensis*, Rodriguez, and *molossinus*, Caroline Islands). But any essential modifications of the skull, other than those briefly referred to above, do not occur in this genus.

**Dentition** (figs. 6, 9, 10).— $i^1 i^2 c p^1 p^3 p^4 m^1 m^2$   
 $i_1 i_2 c p_1 p_3 p_4 m_1 m_2 m_3 \times 2 = 34^*$ . *p*, rudimentary, deciduous; *p*, *m*, and *m*<sup>2</sup> much reduced in size.

\* Individual abnormalities in the tooth formula appear to be exceedingly rare in all species of *Pteropus*, except *Pt. scapulatus* (a species characterized by strong degeneration of the dentition), *giganteus* (posterior basal ledges of cheek-teeth obliterated), and *campylus* (closely allied to *giganteus*). Of about

(1) Differential characters, as compared with dentition of *Eidolon* (fig. 1, p. 3) and *Rousettus* (fig. 2, p. 17).—Dentition on the whole considerably heavier. Upper incisors relatively much larger, with crown distinctly differentiated from shaft.  $i_2$  always conspicuously larger than, generally about twice, sometimes three, rarely four, five, or six times the bulk of  $i_1$ .  $p^1$  rudimentary, styliiform, generally early deciduous. A pronounced tendency throughout the genus to enlargement of the cingulum of the canines and development of posterior basal ledges in  $p^3$ ,  $p^1$ ,  $p_3$ ,  $p_1$ , and  $m_3$ , these characters being obscured only in certain species with peculiarly weakened or degenerated dentition. Other characters essentially as in *Eidolon* and *Rousettus*.

(2) The typical Pteropine dentition (figs. 6, 9 A, A', 10 A, A').—Upper incisors nearly equal in bulk and height ( $i^2$  generally slightly smaller and lower), crowded or very narrowly spaced; crown distinctly differentiated. posterior basal ledge (cingulum) generally obsolescent in  $i^1$ , narrow but distinct in  $i^2$ . Diastema  $i^2$ -c wide, subequal to transverse diameter of lower canine at middle, and to diastema c- $p^3$ . Upper canines long, subequal to ascending branch of premaxillæ, slender, gently recurved, in certain species practically straight; cingulum always distinct, as a rule prominently developed and forming a conspicuous rim or ledge at inner and posterior base of tooth: front face of crown marked by a broad and deep vertical groove terminating a short distance above tip of tooth, inner face by a sharp median keel from cingulum to tip.  $p^1$  a minute spicule, deciduous.  $p^3$  slightly shorter (antero-posterior extent) than, but nearly as broad as,  $p^1$ ;  $p^1$  subrectangular in basal outline, distinctly longer than broad;  $m^1$  longer and slightly narrower than  $p^1$ ;  $m^2$  much reduced, subequal in cross-section to  $i^1$ , outline of crown circular or elongate. Posterior basal ledge of  $p^3$  and  $p^1$  distinct but short, marked off postero-externally by shallow notch from base of outer main cusp of teeth.

Lower incisors crowded or very narrowly spaced, in contact with or separated by minute space from canines; crown distinctly differ-

600 skulls examined by the writer, and representing all species and subspecies, only 10 show deviations from the normal condition; no less than five of these skulls are of *Pt. scapulatus* (total number of skulls examined, 21), three of *Pt. giganteus* (of a total number of 29 skulls), two of *Pt. vampyrus* (75 skulls), none of other species. The aberrations found in *Pt. giganteus* and *vampyrus* are as follows (on those of *Pt. scapulatus* see this species, p. 495):—(1) a well developed " $i_3$ " is present on both sides in one skull of *Pt. vampyrus* (B. M. 55.12.26.90, locality unknown); the right and left  $i_3$  are perfectly alike in size, larger than but essentially similar in form to  $i_2$ , and situated on inner side of tooth-row, at base of canines; (2)  $m_3$  and its alveolus missing on one side: one *Pt. vampyrus vampyrus* (y.g. ad., Java, 9.1.5.867); (3)  $m_3$  and their alveoli missing on both sides: one *Pt. giganteus* (ad., teeth slightly worn, uncertain locality, 79.3.31.3); (4) an " $m_4$ ," similar in bulk to  $i_2$  of the same skull, present on one side: one *Pt. giganteus* (ad., teeth somewhat worn Bengal, no. 106.d);  $m_3$  is in this skull slightly larger than usual; (5) " $m^3$ " present on both sides: one *Pt. giganteus* (ad., teeth somewhat worn, Nepal, 45.5.15.4; mentioned by Dobson, Cat. Chir. B. M. p. 16, footnote); these two " $m^3$ " are very similar in size to  $m^2$  of a normal skull, whereas " $m^2$ " is noticeably larger than usual, about half the bulk of  $m^1$  (the possibility therefore being that " $m^2$ " is supernumerary, and " $m^3$ " homologous with the normal  $m^2$ ).

entiated, at least in  $i_2$ ; usually a faint median notch in front edge of crown of  $i_2$ ;  $i_2$  twice or twice and a half the bulk of, but only slightly higher than,  $i_1$ . Lower canines generally a little shorter and more recurved than upper ones, in front view more conspicuously diverging; cingulum distinct or even strong; usually a well-marked vertical groove on outer face of crown. Diastema c- $p_2$  wide, subequal to antero-posterior basal diameter of upper canine.  $p_1$  much reduced, once and a half or twice the bulk of, but scarcely higher than,  $i_2$ , permanent; crown subcircular or somewhat elongate in outline, crushing surface concave; nearly always situated closer to canine than to  $p_3$ .  $p_3$ ,  $p_4$ , and  $m_1$  subequal in cross-section, longer than broad;  $m_2$  smaller than  $m_1$ ;  $m_3$  much reduced, subequal to  $i_2$ , outline circular or somewhat elongate. Posterior basal ledges of  $p_3$  and  $p_4$  as in corresponding upper premolars.

A typical Pteropine dentition, similar to that described above or differing only in minor details, is found in about half the number of known species, viz. all forms of the *Pt. hypomelanus* (except *Pt. subniger*), *muriannus*, *caniceps*, *rufus*, *melanotus*, and *melanopogon* groups.

(3) The principal modifications of the typical Pteropine dentition may conveniently be epitomized under the following headings:—

Upper incisors.—General size larger and cingulum conspicuously broader than usual, forming a noticeable shelf posteriorly, in all species of the *Pt. pselaphon* group, viz. *Pt. pselaphon*, *pilosus*, *tuberculatus*, *leucopterus*, *insularis*, and *phorocephalus*. (Compare *Pteralopex*.)

Lower incisors.—In most species  $i_2$  is about once and a half, or twice, or twice and a half the bulk of  $i_1$ , but in some species the disproportion in size is considerably greater. This is sometimes due chiefly to a reduction of  $i_1$ , making this tooth only about  $\frac{1}{4}$ – $\frac{1}{6}$  of  $i_2$ : *Pt. lombocensis*, *solitarius*, *rodricensis*, and *molossinus*. More frequently, however, to actual enlargement of  $i_2$ , sometimes combined with a slight reduction of  $i_1$ : *Pt. nawaiensis*, *samoënsis*, *anetiannus*, *pselaphon*, *pilosus*, *tuberculatus*, and *leucopterus*; in some of these species  $i_2$  is about four or five times the bulk of  $i_1$ . (Compare *Pteralopex*.)—In *Pt. scapulatus* and *woodfordi* all incisors are reduced in size.

Canines.—As a general rule, weak cheek-teeth (no posterior basal ledges, or general size of teeth conspicuously reduced) are in this genus combined with longer, slenderer, and straighter canines with narrow or even somewhat ill-defined (but never completely obsolete) cingulum, whereas heavy cheek-teeth (strong basal ledges) are associated with rather shorter, stouter, and more distinctly recurved canines with strong, sharply defined, shelf-like cingulum. In species with very broad cingulum of the canines, the edge of the cingulum sometimes shows a pronounced tendency to subdivide into a row of small, round, more or less incompletely separated tubercles: *Pt. samoënsis*, *anetiannus*, *pselaphon*, *pilosus*, *leucopterus*, *tuberculatus*, *insularis*, *phorocephalus* (compare with this *Pteralopex*). In *Pt. molossinus* the crown of the canines is more strongly compressed from side to side than usual. The vertical groove on the

front face of the upper canines is shallow or sometimes obliterated in *Pt. natalis* and *livingstonei*. *Pt. tuberculatus* is unique in the genus in having a small, but perfectly well-marked, cusp-like projection on posterior trenchant edge of upper canine above middle of tooth (compare *Pteralopex*).

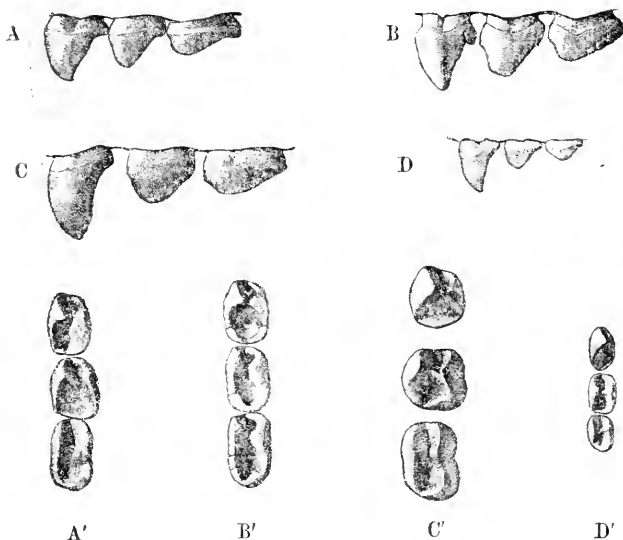


Fig. 9.— $p^3$ ,  $p^4$ ,  $m^1$ , profile of left row, palate view of right row. All figures ♀. A, A', typical Pteropine dentition (*Pt. hypomelanus luteus*, immature, 78.9.14.2). B, B', heavy dentition, strong posterior basal ledges (*Pt. pselaphon*, adult, 92.2.4.1). C, C', teeth short (antero-posteriorly) and broad, posterior basal ledges practically obliterated (*Pt. neohibernicus*, immature, 86.7.9.1, type of *Pt. coronatus*). D, D', degenerate dentition (*Pt. scapulatus*, adult, 7.8.9.4).

$p^1$ .—Rather larger than usual, sometimes equal to or slightly larger than  $i_1$ , and with crown distinctly differentiated in *Pt. pilosus*, *leucopterus*, *nawaiensis*, *samoënsis*, *anetianus*, *lombocensis*, and *solitarius*.

$p_1$ .—Unusually large in *Pt. nawaiensis*, *samoënsis*, *anetianus*, *pselaphon*, *pilosus*, *tuberculatus*, and *leucopterus*. This peculiarity is in all of these species associated with an enlargement of  $i_2$ . (Compare *Pteralopex*.)

Posterior basal ledges of molariform teeth.—Species with typical Pteropine dentition possess short or moderately strong posterior basal ledges in  $p^3$ ,  $p^4$ ,  $p_3$ , and  $p_4$ ; not infrequently the ledges are also more or less distinctly perceptible in  $m^1$  and  $m_1$ . From this general type the modifications go in two opposite directions:—



Either towards complete or nearly complete obliteration of the ledges, as in the species of the *Pt. giganteus* (five species), *alecto* (four), *conspicillatus* (three), *neohibernicus* (two), and *macrotis* groups (three), though in young teeth of some of these species a slight remnant of the ledge is occasionally detectable. Or towards an

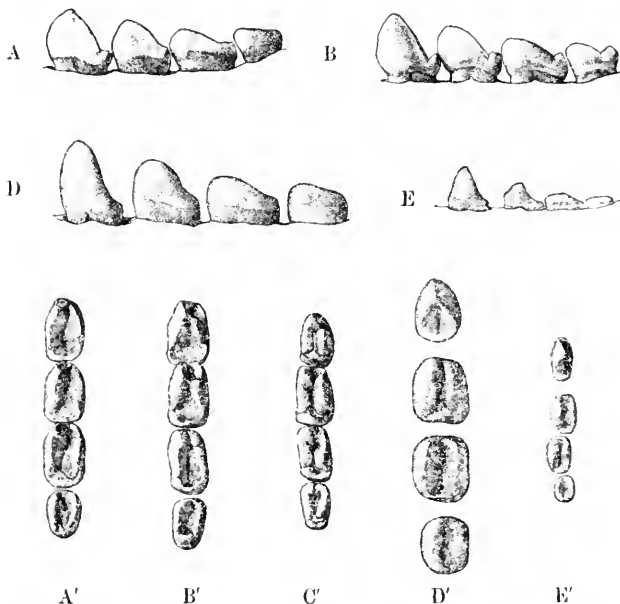


Fig. 10.— $p_1$ ,  $p_4$ ,  $m_1$ ,  $m_2$ , profile and upper view of left row. All figures  $\frac{7}{8}$ . A, A', typical Pteropine dentition; posterior basal ledges moderate (*Pt. hypomelanus luteus*, immature, 78.9.14.2). B, B', posterior basal ledges heavy, separated postero-externally by a deep notch from base of outer main cusp; note in the upper view the deep transverse groove in the inner (in the figure right) longitudinal ridge of  $p_1$  and  $m_1$  in front of middle of ridge (*Pt. pselaphon*, adult, 92.2.4.1). C', strong posterior basal ledge of  $p_1$ ,  $m_1$ , and  $m_2$  continued forward along base of inner (right) side of tooth (*Pt. anetianus*, adult, 7.1.1.255). D, D', teeth short (antero-posteriorly) and broad; posterior basal ledges practically obliterated (*Pt. neohibernicus*, immature, 86.7.9.1, type of *Pt. coronatus*). E, E', degenerate dentition (*Pt. scapularis*, adult, 7.8.9.4).

unusual strengthening of the ledges, as in *Pt. rodricensis*, *nawaiensis*, *samoënsis*, *anetianus*, *insularis*, *pharocephalus*, *pselaphon*, *pilosus*, and *tuberculatus*; in most of these species the ledges are well-marked also in  $m_1$  and  $m_2$ , and not infrequently indicated in  $m_3$ .

Inner basal ledge in lower molariform teeth (fig. 10 C').—*Pt. anetianus* is unique in the genus (but similar to *Acerodon*) in having

a broad, well-defined inner basal ledge in  $p_1$ ,  $m_1$ , and  $m_2$ , this ledge being in reality (quite as in *Acerodon*) a direct continuation of the posterior ledge along the inner side of the teeth. On close examination a very faint trace of an inner ledge in the lower cheek-teeth is sometimes perceptible in the related *Pt. samoënsis* and *pilosus*.

Traces of antero-internal basal tubercles in  $p^3$ ,  $p^4$ ,  $p_3$ , and  $p_4$ .—In a few species the antero-internal cingulum of  $p^3$  and  $p^4$  is somewhat more differentiated than usual, *i. e.* more distinctly projecting as a narrow ledge: *Pt. molossinus* and *rodricensis*; in the latter species the rim of this narrow ledge occasionally develops one or two minute tubercles. Similarly, the antero-internal cingulum of  $p_3$ , or both  $p_3$  and  $p_4$ , shows in certain species a more or less noticeable tendency towards differentiation into a projecting ledge: *Pt. nawaiensis*, *samoënsis*, *anctianus*, *insularis*, and *phurocephalus*; at least in *Pt. anctianus* this ledge develops a minute tubercle. In *Pt. psclaphon* the antero-internal portion of  $p_4$  is rather sharply marked off, by a deep groove, from the inner main cusp of the tooth.—Compare *Acerodon*.

Indications of splitting of ridges of lower molariform teeth.—In the large majority of species the inner and outer longitudinal ridges (cusps) of all molariform teeth are perfectly simple. On close inspection of  $p_4$  of *Pt. samoënsis* and *pilosus* (allied to *Pt. psclaphon*) a faint transverse depression in the inner ridge of that tooth is detectable, at least in some individuals, suggesting an initial stage towards a splitting of the ridge into an anterior and posterior portion. This leads to *Pt. psclaphon*, in which the inner ridge of  $m_1$  is always slightly but quite distinctly subdivided into an anterior and posterior portion. And finally, in *Pt. leucopterus* (allied to *psclaphon*) not only the inner but, at least in some individuals, also the outer ridge of  $m_1$  and  $m_2$  are similarly subdivided.—Compare *Pteralopex*.

$m_3$  and  $m^2$ .— $m_3$  is more reduced than usual in the *Pt. rayneri* group (*Pt. cognatus*, *rayneri*, *rubianus*, *lavellanus*, *grandis*, and *chrysoproctus*). Both  $m_3$  and  $m^2$  are reduced in the *Pt. lombocensis* (*Pt. lombocensis*, *solitarius*, *rodricensis*, and *molossinus*) and *scapulatus* groups (*Pt. scapulatus* and *woodfordi*); in the two latter species these teeth are quite rudimentary, and at least in *Pt. scapulatus*  $m_3$  is sometimes, but  $m^2$  rarely, lost.

Modifications of general shape (basal outline), and noticeable reduction of size, of cheek-teeth.—The typical Pteropine shape and size of the cheek-teeth lead, on the one side, through practically all intermediate stages to the extremely heavy dentition of a *Pt. psclaphon*, and on the other through numerous transitions to the small and excessively narrow cheek-teeth of a *Pt. scapulatus*. Obliteration of the posterior basal ledges of the cheek-teeth (a character which of itself is perhaps indicative of a beginning degeneration of the cheek-teeth) is rather often associated with a distinct reduction of the size of the teeth: *Pt. gouldi*, *epularius*, *macrotis*, *poliocephalus*. The cheek-teeth are small but not much narrower than usual in *Pt. molossinus*; peculiarly shortened, with rounded corners, in *Pt. papuanus* and *neohibernicus* (figs. 9C', 10D'); and so much shortened

as to be nearly squarish in *Pt. leucopterus* (particularly in the upper jaw). All the cheek-teeth are reduced, especially in width, in *Pt. subniger*. And the extreme of degeneration is reached by *Pt. personatus*, *scapulatus* (figs. 9 D, D', 10 E, E'), and *woodfordi*, in which the cheek-teeth are excessively narrow: a perfect parallel to this peculiarity is seen in one species of *Rousettus* (*R. lanosus*) and in the *Macroglossi*; in the general shape of the teeth *Pt. personatus*, *scapulatus*, and *woodfordi* bear in fact no small resemblance to *Eonycteris spelæa*. It should be noticed that a reduction of the general size of the cheek-teeth (in length only, breadth only, or both in length and breadth) is a character developed independently by species of entirely different groups of the genus (*Pt. subniger*, a member of the *hypomelanus* group; *Pt. molossinus*, of the *lombocensis* group; *Pt. personatus*, of the *temminckii* group; *Pt. scapulatus* and *woodfordi*, geminate species forming a small natural group), and therefore far from being indicative of natural relationship. The modification is probably in all cases due to adaptation to a kind of food which requires less mastication than that taken by the majority of species.

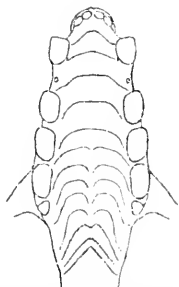


Fig. 11.—Palate-ridges, typical Pteropine number and arrangement, formula  $5+5+3$  (see text, *infra*) (*Pt. hypomelanus tomesi*, 94.7.14.3).  $\frac{1}{2}$ .

*Palate-ridges* (fig. 11).—(1) The apparently commonest formula is  $5+5+3$ , *i. e.* five anterior, undivided, five middle, separated in the median line, and three posterior, approximately wedge-shaped, situated near the hinder border of the palate; this formula has been observed in *Pt. alecto*, *antianus*, *chrysarchen*, *dasymallus*, *formosus*, *giganteus*, *griseus*, *hypomelanus*, *keyensis*, *melanopoigon*, *melanotus*, *nawaiensis*, *pilosus*, *pselaphon*, *rayneri*, *rodricensis*, *rubianus*, *tonganus*, and *vampyrus*. In some of these species there is a more or less incomplete, sometimes nearly fully developed, additional ridge between the normal ninth and tenth ridges (formula approaching  $5+6+3$ : *Pt. tonganus*, *giganteus*, *vampyrus*, but the same will no doubt be found in many of the other species). Such species form a natural transition to those in which the normal formula seems to be  $5+6+3$ , *viz.* *Pt. auratus*, *rufus*, *lombocensis*, *solitarius*. In some individuals of various species the sixth ridge is only slightly, or not at all, separated in the middle line (formula nearly or quite  $6+4+3$ ).

(2)  $5+4+2$  (or 3) palate-ridges have been found in six species: *Pt. molossinus*, *insularis*, *phaecephalus*, *epularius*, *scapularius*, *woolfordi*; in at least two of these (*Pt. insularis* and *phaecephalus*) the formula approaches  $6+3+2$ , owing to the sixth ridge being only very slightly interrupted in the middle. (3) In two species, *Pt. papuanus* and *neohibernicus*, the number of middle divided ridges is noticeably larger than usual, formula  $5+8+3$ .—The palate-ridges have been examined by the present writer only in the thirty-one species referred to above, but inasmuch as these represent practically all groups of the genus, it appears unlikely that any formula essentially different from those given above will be found.

*Ears*.—In most species moderate in length (not reaching eye, when laid forward), subtriangular, exposed; inner margin convex from base to tip, outer margin convex in lower two thirds, straight or very flatly concave in upper third; tip obtusely pointed or somewhat narrowly rounded off. The deviations from this general type go chiefly in two opposite directions:—(1) Ears considerably reduced, half exposed, or so much reduced as to be nearly concealed in the fur; this modification is predominant in two Polynesian groups, the *Pt. samoënsis* and *pselaphon* groups, and occurs also in a few members of other groups, e. g. *Pt. subniger*, *niger*, *rodricensis*, *molossinus*, and *woolfordi*; but the line between normal-eared and small-eared species is in some cases difficult to draw, the difference being one of degree only. (2) Ears long (reaching, or extending beyond, eye), outer margin more distinctly concave in upper third, ear therefore conspicuously attenuated above, tip acutely or subacutely pointed; this modification is characteristic of the *Pt. rufus* group (except the single Mascarene species), the *Pt. vampyrus* group, the *Pt. macrotis* group, and *Pt. caniceps*, *argentatus*, and *scapularius*.—*Pt. livingstonei* is unique in the genus (but compare *Pteralopex*) in having the ears nearly semicircularly rounded off above; it is allied to species (*Pt. melanopogon*, *keyensis*, *aruensis*) which have the ears rather more broadly rounded off than usual.

*Wings*.—Chief characters: second digit clawed, membranes from sides of dorsum and back of second toe.—The line of origin of the membranes from the back varies somewhat in position; generally it is rather nearer the spine than the flanks; in a few species (*Pt. melanopogon*, *papuanus*, *neohibernicus*) the membranes arise very close together, nearly from the sides of the spine.

The wing-structure of *Pteropus* differs from that of the subgenus *Rousettus* (the subgenera *Stenonycteris* and *Lissonycteris* are more specialized in this respect) chiefly in the following four points:—(1) pollex relatively longer, index about 440, in *Rousettus* about 340–390; (2) second digit with claw (index 740) decidedly longer than third metacarpal (index 690), in *Rousettus* subequal to third metacarpal; (3) third metacarpal a trifle longer than fourth, fifth slightly the longest, while *Rousettus* shows the more primitive condition of having the fifth metacarpal the shortest; (4) second phalanx of third digit longer than, rarely subequal to, metacarpal of same digit, in *Rousettus* decidedly shorter than metacarpal.

Within the genus *Pteropus* the wing-structure is rather uniform, the variations chiefly confined to the greater or lesser relative length of the terminal phalanges, and even in this respect the variations are rather inconspicuous. Subjoined the wing-indices of *Pt. hypomelanus*, calculated from measurements of 56 adult specimens representing the eleven known races of the species:—

Forearm.	Pollex, c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	437	510	120	113	689	196	720	670	408	405	718	302	308

*Interfemoral*.—In most species scarcely developed, or only a few millimetres deep, in centre; in the species of the *Pt. rufus* and *melanotus* groups generally distinct (8–16 mm.), in the *Pt. vampyrus* group unusually deep (sometimes 25 mm.) in centre.

*Fur*.—Typical Pteropino pelage: Fur of back short, distinctly adpressed, extending on upperside of lateral membranes somewhat beyond their origin from back, breadth of furred area of back therefore greater than space between lines of origin of membranes; fur of mantle and underparts generally slightly longer, but difference in length often more apparent than real, owing to fur of mantle being less adpressed, more spreading than that of back; femur furred above; upperside of humerus clothed with short adpressed hair; fleshy part of forearm with thinly spread adpressed hairs; tibia naked. Underside of antebrachial membrane, and of lateral membrane along outer side of forearm and near body between humerus and femur, clothed with short woolly fur.—There is every intergradation from this typical style of pelage (characteristic of a majority of species), in one direction to species with the fur of the back excessively short and restricted to the narrow spinal tract between the origin of the lateral membranes (*Pt. melanopogon*, *papuanus*, *neohibernicus*: aged individuals sometimes nearly naked on back), and in the opposite direction species with rather longer fur, extending more or less thickly on the upperside of the tibia (most species of the *Pt. rayneri*, *lombocensis*, *samoensis*, *pselaphon*, and *temmincki* groups, and a few aberrant species of other groups, viz. *Pt. solomonis*, *brunneus*, *ornatus*, *auratus*, *niger*, and *poliocephalus*), to species with very long and spreading fur (*Pt. dasymallus*, *formosus*, *subniger*)\*.

\* It has been stated in literature that species "provided with long woolly hairs extending thickly upon the extremities appear to be confined to the small wind-swept oceanic islands situated towards the extreme northern or southern limit of the distribution of the family" (Dobson, Cat. Chir. B. M. p. 18; see also Temminck, Esq. Zool. p. 64). In so far as this statement might convey the idea that long-furred and hairy-legged species are confined to the extreme northern and southern islands inhabited by the genus, it is as well to point out that this is far from being correct. It is true that one of the two species

*Colour*.—The most characteristic feature is the development, in a majority of species, of a brilliantly coloured mantle (nape of neck), contrasting with the colour of the back \*. But the character is far from being constant; the mantle shows any colour tinge, from light yellowish buff or even cream-buff or whitish, through any shade of buff, tawny, russet, or chestnut, to dark brown, seal-brown, or blackish. By darkening of the normal bright colour the mantle may become similar to the back; if at the same time the colour of the back is lightened, the mantle may even become much darker than the back (*Pt. aruensis*, some races of *Pt. hypomelanus*, and others).—The numerous variations in the total aspect of the colour of the pelage may be roughly classed as follows:—(1) Pelage approximately dark brownish above and beneath (often sprinkled

---

occurring in the Liu-kiu Islands, viz. *Pt. dasymallus*, has long and spreading fur extending upon the upperside of the tibiae, and that the three Mascarene species are all hairy-legged (one of them, *Pt. subniger*, a species hiding in caves, also long-furred), and it is probably on these facts that Dobson based his statement. But the second species inhabiting the Liu-kiu Islands, *Pt. lochoënsis*, has the fur rather short and the tibiae naked above; one of the two species known from Aneiteum (New Hebrides) is long-furred and hairy-legged (*Pt. anetianus*), the other very short-furred and naked-legged (*Pt. geddi*); of the five Australian species, one is long-furred with the tibiae unusually thickly clothed (*Pt. poliocephalus*), in a second the fur of the body is moderate in length and the tibiae clothed above (*Pt. brunneus*), while the three others are short-furred and naked-legged. If all the hairy-legged species are taken together, they cover the Philippines, Celebes, Moluccas, Lesser Sunda Islands, Bismarck Archipelago, Solomon Islands, Australia, Polynesia, Micronesia, Formosa, Liu-kiu Islands, and Mascarenes. All the naked-legged and short-furred species taken together cover practically the whole area inhabited by the genus, including nearly all the small wind-swept oceanic islands, with the only noteworthy exception of the Mascarenes.

\* The difference in colour between mantle and back, so conspicuous in many species of *Pteropus*, has been interpreted as an instance of "protective mimicry" (in the sleeping attitude of these bats "the brightly-coloured neck and head are presented to the view and resemble the extremity of a ripe cocoanut, with which the larger species closely correspond in size," Dobson, Cat. Chir. B. M. p. 17). This explanation, though perfectly natural, perhaps almost inevitable, in the golden age of the theories of "natural selection," "protective mimicry," &c., would scarcely meet with universal acceptance now. It would seem that, in this case, no other theory is required than the very simple one: similar causes, similar effects. The real fruits and the pseudo-fruits (*Pteropi*) hang side by side, from the same branches, in precisely similar positions, in precisely similar surroundings, subject to precisely the same effects of light and shade, and so it has been for countless generations of both; no wonder, therefore, if they become similar in colour. It has been stated (*l. s. c.*), obviously to support the protective-mimicry-theory, that the contrast in colour between mantle and back is "much less developed in the smaller species of the genus" (which, "by their small size, are less easily seen"); but the statement is entirely wrong; a strikingly bright-coloured mantle or a mantle practically similar in colour to the back are characters equally common in species of all sizes, from the very smallest, through the medium-sized, to the very largest. Also it would seem that, if Nature had given these bats a protective colour, then she would, so to say, have given with one hand and taken back the benefit of her gift with the other; the colour of some species may render them not too easily detectable for the untrained eye, but at the same time all species have so strong an odour that any of their enemies, be he man or animal, easily detects them with closed eyes.

with greyish hairs, particularly on underparts), and with brighter-coloured mantle (many species, particularly smaller, hairy-legged forms, predominant style *e.g.* in the *Pt. samoënsis* group); (2) back blackish or brownish (often thinly sprinkled with greyish hairs), mantle bright-coloured, underparts paler than back (many species, style purest in *Pt. rufus*, *giganteus*, and their closest allies); the pale colour of the underparts may be restricted to the centre of the breast (*Pt. melanotus* and others), or wholly replaced by blackish or brownish (*Pt. vampyrus* and others); the normally very inconspicuous pale sprinkling of the back may be greatly exaggerated, making the colour of the back nearly hair-brown (*Pt. niadicus*) or even silvery greyish (some races of *Pt. hypomelanus*, *Pt. aruensis*); (3) blackish above and beneath, generally more or less thinly sprinkled with greyish hairs, and with strongly contrasting yellowish-buff mantle (this style is found only in the eleven species of the *Pt. mariannus* and *conspicillatus* groups, and in *Pt. macrotis* and *epularius*); (4) uniform blackish above and beneath, with or without some trace of a "tippet" (*Pt. modigliani*, *natalis*, some races of *Pt. vampyrus*, *Pt. alecto*, *gouldi*, *livingstonei*).—The upperside is tricoloured (pale mantle, dark back, pale rump) in most of the species of the *Pt. rayneri* group inhabiting the Solomon Islands (*Pt. rayneri*, *rubianus*, *lavellanus*, *grandis*) and in a related Moluccan species (*Pt. chrysoproctus*). The whole of the fur of the body is unusually pale, nearly silvery buff or silvery whitish, in *Pt. temmincki*, *personatus*, and *capistratus*. One species is nearly uniform buffy above and beneath (*Pt. keyensis*). *Pt. personatus* and *capistratus* are unique in the genus in having the head marked with sharply pronounced dark brown stripes on pale ground (compare *Styloctenium*).

*Sexual differentiation*.—Canines in males of nearly all species longer and heavier than in females. Fur of mantle in most species which show no other external sexual differentiation more rigid and unctuous in males, softer and more spreading in females (nearly all species of the *Pt. hypomelanus*, *mariannus*, *rufus*, *melanotus*, *melanopogon*, *alecto*, *conspicillatus*, and *neohibernicus* groups, but the character is not equally conspicuous in all of these species); in some of these the concealed base of the fur of the mantle is dark brownish in females, contrasting with the light yellowish-buff tips of the hairs, whereas in males the fur of the mantle is light-coloured to the extreme base (*Pt. mariannus* and *conspicillatus* groups). Males of certain species have a well-developed rigid, generally richer-coloured tuft of glandular hairs on each side of the neck, while these tufts are either entirely wanting or indistinctly differentiated in females (*Pt. brunneus*, *cognatus*, *rayneri*, *rubianus*, *lavellanus*, *grandis*, *lombocensis*, *solitarius*, *giganteus*, *ariel*, *lylei*, *epularius*, *macrotis*, *scapulatus*, *woodfordi*).—Dobson's statement (Cat. Chir. pp. 17, 49, 54) that the mantle of the female is generally "darker or less brilliantly coloured than that of the male" must have been based on insufficient material; the individual variation in the colour of the mantle is in some species considerable, but in no species

examined by the present writer is there any appreciable sexual difference in the *exposed* colour of the mantle.

*Range*.—Malagasy region generally, but not extending to the continent of Africa: Oriental region; Austro-Malaya; North and East Australia (not known with certainty from Tasmania); western Polynesia, north-west to Volcano, Bonin, S. Liu-kin Islands (not Japanese main islands), and Formosa, east and south-east to Caroline, Sta Cruz, Fiji, Tonga, and Samoa Islands. See geographical review of species, *infra* pp. 79–86.

*Affinities*.—*Pteropus* has originated from a *Rousettus*-like type. It comes nearest the living species of *Rousettus* in the general shape of the skull, and the dental formula is the same in both genera. In at least one point *Pteropus* appears to be slightly more primitive than *Rousettus*; the tympanic is rather nearer in form (narrow, annular) to the generalized insectivorous type than to that of *Rousettus* (broader, annular; compare *Eidolon*: tympanic still broader, with short bony auditory meatus). Already in *Rousettus* the occipital region shows a slight tendency to lengthening (compare *Rousettus* with *Cynopterus* and allied genera); in *Pteropus* it is more distinctly lengthened into a short “tube”; the rostrum is relatively somewhat longer, the palate narrower, especially in its postdental portion, the skull on the whole (in all typical forms) more heavily built, with stronger crests, and broader and more steeply ascending coronoid process of the mandible. The dentition of *Pteropus* is conspicuously heavier,  $i_2$  enlarged (a slight enlargement of  $i_2$ , as compared with  $i_1$ , is already seen in certain species of *Rousettus*; compare also *Boneia*),  $p^1$  still more reduced and generally deciduous (compare *Rousettus brachyotis*), the cingulum of the canines and incisors stronger, and the posterior portion of the molariform teeth generally differentiated into a more or less conspicuous basal “ledge” (in certain specialized forms of the genus this ledge is again obliterated, but even then a trace of the ledge is often detectable in the young unworn teeth). Also externally, *Pteropus* is decidedly on a higher level than *Rousettus*: the tail has disappeared, its wing-structure is slightly less primitive (see p. 72), the mantle generally conspicuously different in colour from the back, and the size of the animals generally much larger. Both genera are distributed over continental S. Asia, Indo-Malaya, and Austro-Malaya; but whereas *Rousettus* extends to Palestine, Cyprus, and the Ethiopian region, exclusive of Madagascar and its adjacencies, *Pteropus* finds its western limit in the Indian Peninsula, including Ceylon and the Maldives, is rather richly represented in the whole of the Malagasy region, but perfectly unknown in the African continent; and eastward, *Rousettus* does not extend beyond the Solomon Islands, and is unrepresented in Australia, whereas *Pteropus* has spread over the whole western portion of Polynesia, northward over Micronesia, and southward to Australia.

*Subdivisions*.—The 82 species (99 distinguishable forms) are arranged in seventeen groups according to their probable natural affinities, viz.:—the *Pt. hypomelanus* (16 species, 26 forms), *mari-*



*annus* (8 species), *caniceps* (3), *rufus* (5 species, 6 forms), *melanotus* (5 species), *melanopogon* (4), *rayneri* (6), *lombocensis* (4), *samoënsis* (3), *pselaphon* (6), *temmincki* (3), *vampyrus* (5 species, 11 forms), *alecto* (4 species), *conspicillatus* (3), *neohibernicus* (2), *macrotis* (3), and *scapulatus* groups (2).—From a broader point of view these seventeen groups may be classed in three primary sections, as follows :—(1) The first six groups, the *Pt. hypomelanus*, *mariannus*, *caniceps*, *rufus*, *melanotus*, and *melanopogon* groups (altogether 41 species, 52 forms, thus almost exactly half the number of known forms), are chiefly characterized by the typical Pteropine skull and dentition (posterior basal ledges of premolars distinct); the large majority of species are short-furred and naked-legged; and they cover practically the whole Pteropine area with exception of the Himalayas, India, and Ceylon. (2) The second section, the *Pt. rayneri*, *lombocensis*, *samoënsis*, *pselaphon*, and *temmincki* groups (22 species), accords with the first in having distinct, or even unusually strong, posterior basal ledges in the premolars, but the rostrum is always shortened and the dentition modified, either by reduction of  $m_3$ ,  $m^2$ , and  $i_1$ , or by enlargement of  $i_2$  and  $p_1$ , or the whole of the dentition is noticeably (sometimes even excessively) weakened; nearly all species are hairy-legged; and they range over the whole of Austro-Malaya, Polynesia, and Micronesia, being represented also in the Mascarenes; but are unknown from the whole of the Oriental region, except the Philippines (one species). (3) The third section, the *Pt. vampyrus*, *alecto*, *conspicillatus*, *neohibernicus*, *macrotis*, and *scapulatus* groups (19 species, 25 forms), is characterized by the practically complete obliteration of the posterior basal ledges of the cheek-teeth; the skull is typical Pteropine (except in a few species with degenerate dentition); all species but one are naked-legged and short-furred; they range over the whole of the Oriental region (being the only section represented in the Himalayas, India, and Ceylon) and Austro-Malaya, as far east as the Solomon Islands, extending also to Australia; but is unrepresented in Polynesia, Micronesia, and the Malagasy region.

*Pteropus*, Brisson; 1762.—Three species were included by Brisson in his genus *Pteropus*; the first headed "*Pteropus*," the second "*Pteropus collo rubro*," and the third "*Pteropus auriculis patulis*." The first species, as being evidently considered by Brisson the *Pteropus*, must technically be taken as the type of the genus, on the tautology principle. It is marked in Brisson's book with two asterisks (indicating it as a species examined by the author himself in the Réaumur Museum), diagnosed "*Pteropus rufus aut niger, auriculis brevibus acutiusculis*" (the last three words absolutely excluding *Pt. vampyrus*), and stated to occur in the island of Bourbon (Reunion); these facts are evidence that Brisson had before him a *Pt. niger*, Kerr (*Pt. vulgaris*, E. Geoff.), not a *Pt. vampyrus*. But, as might be expected, Brisson places in the synonymy of the Reunion species also references to Seba's *Canis volans Ternatanus orientalis* (which is *Pt. vampyrus*) and Linné's *Vespertilio cauda nulla* (based on Seba), and therefore gives as

habitat not only Reunion but also Ternate.—Owing to a mistaken identification of Brisson's first species of *Pteropus*, the type of this genus has hitherto been given as *Pt. vampyrus* (Merriam, Science, (n. s.) i. p. 376, 1895; Miller, Fam. & Gen. Bats, p. 56, 1907; probably by a slip Matschie gives on p. 6 of his 'Megachiroptera' the type as *Pt. conspicillatus*, on p. 12 as *Pt. celeno* = *Pt. vampyrus*).

The genus *Pteropus* as understood by Dobson in his 'Catalogue of Chiroptera' (1878) corresponds to the genera *Pteropus*, *Acerodon*, and *Styloctenium* of the present catalogue. The genus as here defined is equivalent to *Pteropus* and *Desmalopex* in Miller's 'Families and Genera of Bats' (pp. 56 and 60, 1907).

*Spectrum*, Lacépède; 1799.—Type (only species), "*Spectrum vampirus*." Linné's *Vespertilio vampyrus* (1758) is a composite species, including *Pt. vampyrus*, *niger*, and *rufus*. Of these, *Pt. niger* was apparently the only species known to the early French mammalogists from autopsy (see Brisson, *l. s. c.*, and Buffon, Hist. Nat. x. p. 55, who distinguishes only two species of Fruit-bats, the Roussette, which is unquestionably *Pt. niger*, and the Rougette, which is *Pt. subniger*, both from the Mascarenes), and may therefore be fixed as the type of Lacépède's *Spectrum*.—In a revised reprint of Lacépède's 'Tableaux méthodiques,' published in 1802 in the Didot edition of Buffon (Quadr. xiv. p. 188), Daudin includes two species in the genus *Spectrum*, *S. vampirus* and *S. rubidum*; the former is *Pt. niger*, the latter *Pt. subniger*.

*Eumycteris*, Gray; 1866.—Type (only species), "*Pteropus phaiops*," Temm. Temminck's *Pt. phaiops*, 1825 (Mon. Mamm. i. p. 178), is *Pt. rufus*, E. Geoff., 1803 (*Pt. edwardsi*, E. Geoff., 1810); Temminck's *Pt. phaiops*, 1837 (Mon. Mamm. ii. p. 65), is *Pt. melanopogon*, Peters. From Gray's diagnosis of *Eumycteris* (only important characters: wings attached to the vertebral line, the part over the back bald, or nearly so) it is clear that the "*Pt. phaiops*" which he proposed to separate generically from *Pteropus* is *Pt. melanopogon*.—*Eumycteris* has been considered a synonym of *Pteropus* by all authors except Matschie (Megachir. pp. 6, 11; 1899), who revived the name for a subgenus of *Pteropus* including four (in reality three) forms, *Pt. melanopogon*, *papuanus*, *digener* [*neohibernicus*], and *neohibernicus*. I fail to see any characters that bind these three species together in contradistinction to all other species of the genus, except the narrowness of the furred area of the back. *Pt. papuanus* and *neohibernicus* are essentially different from *Pt. melanopogon* in dentition, and the latter species has no closer known allies than *Pt. aruensis* and *keyensis*, which by Matschie were referred to the subgenus *Pteropus*.

*Spectrum*, Gray; 1870.—Founded by Gray independently of Lacépède's *Spectrum*, with which he was apparently unacquainted. Separated from *Pteropus* on account of its round head, narrow face, and small hidden ears. Five species: *S. vulgare* [*Pt. niger*; type by subsequent designation; see Matschie, Megachir. p. 6 (1899)], *rubricolle* [*Pt. subniger*], *dasymallum*, *auctanum*, and *leucopteron*.—Name revived by Matschie (*l. s. c.*) for a subgenus of *Pteropus*

including twenty-five species. It is a purely artificial constellation of species, indefinable as a genus or subgenus.

*Pselaphon*, Gray: 1870.—Rests solely on the combination "*Pselaphon ursinus*" occurring in Gray's Catalogue (*l. s. c.*). But that this is a slip for *Pteropus ursinus* is beyond all doubt: *Pselaphon ursinus* is no. 23 of the genus *Pteropus*, preceded and followed by many other species all of which are styled "*Pteropus*"; a genus *Pselaphon* does not occur in Gray's synopsis of genera of the family Pteropodidæ in the same book (p. 99); and in the systematic index to the book (p. viii) the species is registered as *Pteropus ursinus*.

*Sericonycteris*, Matschie: 1899.—Subgenus of *Pteropus*; type by original designation, *Pt. rubricollis* [*Pt. subniger*]. Species six: *Pt. rubricollis*, *temminckii*, *personatus*, *capistratus*, *molossinus*, *woodfordi*. It is difficult to understand why these species were placed together in a distinct subgenus; the brief diagnosis given by the author does not touch any character of importance and does not hold good on any point; the six species, representing, as they do, four different groups of the genus, have in fact little more in common than their unusually small size.

*Desmalopex*, Miller: 1907.—The type and only species, *Pt. leucopterus*, differs in no character of generic importance from *Pt. pselaphon* (see *Ann. & Mag. N. H.* (8) iii. pp. 213–218, 1 Feb. 1909).

#### *Geographical Distribution of the Species and Subspecies of Pteropus.*

I. *Malagasy Region*.—8 species (9 forms), representing four different groups of the genus, viz.:—(1) *Pt. rufus*, *comorensis*, *seychellensis*, *aldabrensis*, *niger* (all of the *Pt. rufus* group); (2) *Pt. livingstonei* (*Pt. melanopogon* group); (3) *Pt. subniger* (*Pt. hypomelanus* group); (4) *Pt. rodricensis* (*Pt. lombocensis* group).

All the species are allied to Indo-Malayan or Austro-Malayan forms, none to species inhabiting India. The absolutely predominant type of *Pteropus* in the Malagasy region is the *Pt. rufus* group: it is the only group peculiar to the region, and the only one distributed over practically all its islands. It falls, however, into two sharply separated sections, a Malagasy type, represented by four closely related species, *Pt. rufus* (Madagascar), *Pt. comorensis* (Comoros), *Pt. seychellensis* (Seychelles), and *Pt. aldabrensis* (Aldabra), and a peculiarly modified Mascarene type, represented by a single species, *Pt. niger* (Mauritius, Reunion). The *Pt. rufus* group has no closer living relatives than the species of the *Pt. melanotus* group, all of which are confined to the Andaman-Nicobar chain and its south-eastern continuation (Nias, Engano, Christmas Island).—*Pt. livingstonei* (apparently restricted to Johanna Island, Comoros) is the only Malagasy species of a group represented elsewhere only in the Moluccas, Key, and Aru Islands. Likewise, *Pt. subniger* (Mauritius, Reunion) is the only Malagasy representative of the chiefly Austro- and Indo-Malayan *Pt. hypomelanus* group.

The single species inhabiting Rodriguez (*Pt. rodriguensis*) is rather closely related to *Pt. lombocensis* and *solitarius* (Lesser Sunda Islands). It is a remarkable fact that in the Mascarenes (the small islands of Mauritius, Reunion, and Rodriguez) have been preserved representatives of three different groups of the genus (*rufus*, *hypomelanus*, and *lombocensis* groups), two of which (the second and third groups) are found nowhere else in the Malagasy region. Of the three species, two (*Pt. niger*, *subniger*) are common to Mauritius and Reunion, while the third is only known with certainty from Rodriguez.

II. *Ceylonese, Indian, and Indo-Chinese Subregions* (including Mergui Archipelago, Formosa, and S. Liu-kiu Islands).—8 species (10 forms), of three groups, viz.:—(1) *Pt. arid*, *giganteus* (*giganteus* and *leucocephalus*), *intermedius*, *lylei* (*Pt. vampyrus* group); (2) *Pt. hypomelanus* (*condorensis* and *geminorum*), *formosus*, *dasyrnallus* (*Pt. hypomelanus* group); (3) *Pt. lochoënsis* (*Pt. mariannus* group).

The genus is remarkably poorly represented in continental South Asia, in fact chiefly, if not entirely, by western offshoots of Indo-Malayan types. *Pt. intermedius* (Tenasserim), *giganteus* (Himalayas, India, Ceylon), and *arid* (Maldivé Archipelago) are scarcely more than slightly modified immigrants of the Indo-Malayan *Pt. vampyrus*; it is not unlikely that, with much completer material, they will be considered subspecies of *Pt. vampyrus*. The small *Pt. lylei* (Siam, Saigon) is rather more distinct, perhaps a truly indigenous continental type of this group, as opposed to *Pt. vampyrus* and its continental ramifications. *Pt. hypomelanus condorensis* (Cambodja, Siam) and *geminorum* (Mergui Archipelago) are western races of an Indo- and Austro-Malayan species. The single species known from Formosa (*Pt. formosus*) and one of the Liu-kiu species (*Pt. dasyrnallus*) are representatives of the *hypomelanus* group, in skull and dentition very closely agreeing with the typical Indo- and Austro-Malayan species of that group: the second Liu-kiu species (*Pt. lochoënsis*) is decidedly of Polynesian origin, being an only slightly modified, extreme north-western offshoot of the otherwise exclusively Polynesian and Micronesian *Pt. mariannus* group; its nearest relative is found in the Mariannes.

III. *Indo-Malaya* (excl. Mergui Archipelago).—13 species (22 forms), of five groups, viz.:—(1) *Pt. tytléri*, *melanotus*, *niadiceus*, *medigianii*, *natalis* (*Pt. melanotus* group); (2) *Pt. vampyrus*; (3) *Pt. hypomelanus*, *speciosus*, *minus*, *satyrus*, *faunulus* (*Pt. hypomelanus* group); (4) *Pt. aterrimus* (*Pt. alecto* group); (5) *Pt. leucopterus* (*Pt. pselaphon* group). The subregion is easily divided into two provinces:—

(a) Andaman-Nicobar chain and its south-eastern continuation (Nias, Engano, Christmas Island).—9 species, of three groups, viz.:—(1) *Pt. tytléri*, *melanotus*, *niadiceus*, *medigianii*, *natalis*; (2) "*Pt. vampyrus*"; (3) *Pt. hypomelanus* (subsp. *enganus*), *satyrus*, *faunulus*.—Zoogeographically the most interesting part of the sub-

region. All the forms enumerated above ("Pt. *vampyrus*" perhaps excepted) are peculiar to this province. The largely predominant type is the *Pt. melanotus* group; it is entirely confined to this narrow chain of islands, but rather closely related to the Malagasy *Pt. rufus* group. The Indo- and Austro-Malayan *Pt. hypomelanus* group has developed peculiar forms in the Andamans (*Pt. satyrus*), Nicobars (*Pt. faunulus*), and Engano (*Pt. hypomelanus enganus*). The representatives of the *Pt. vampyrus* type occurring in the Andamans and Nicobars are as yet imperfectly known.

(b) Malay Peninsula, Sumatra, Java, Bali, Borneo (with Natuna and Tambelan Is.), Philippines.—6 species, of four groups, viz.:—(1) *Pt. vampyrus*; (2) *Pt. hypomelanus, speciosus, minus*; (3) *Pt. aterrimus*; (4) *Pt. leucopterus*.—Although vastly larger than the Andaman-Nicobar chain, this province is considerably poorer in species. The most characteristic type is decidedly *Pt. vampyrus*. The range of this species almost exactly covers the Indo-Malayan subregion, only in the extreme south-east it extends beyond the limits of this zoogeographical area, to Lombok, Savu, and Timor; but it has very close relatives in continental S. Asia. Within the borders of the present province *Pt. vampyrus* is differentiated into five races, one confined to the Malay Peninsula and Sumatra (*malaccensis*), a second to Java (*vampyrus*), a third to Bali (*pluton*, extending also to Lombok), a fourth to Borneo and the Natuna Islands (*natunae*), and a fifth to the Philippines (*lanensis*). For reasons given elsewhere it appears probable that *Pt. hypomelanus* is of Austro-Malayan origin; in the present province it has developed five very closely interrelated races; of the two other species of the *hypomelanus* type, one (*Pt. speciosus*) appears to be confined to the province, while the other (*Pt. minus*) is common to the Philippines and Celebes. *Pt. aterrimus* (Bawean Island, Java Sea) is the only representative of the Austro-Malayan and Australian *Pt. alecto* group. A connection between the Philippine and Micronesian *Pteropus faunas* is established by the occurrence in the former group of islands of a representative of the *Pt. pselaphon* group (otherwise exclusively Micronesian), viz. *Pt. leucopterus* (compare the spreading of the *hypomelanus* group to Formosa and the Liu-kiu Islands).

IV. *Austro-Malaya*.—35 species (38 forms), representing twelve groups of the genus, viz.:—(1) *Pt. hypomelanus, admiralitatum, colonus, solomonis, minus, griseus, pallidus*; (2) *Pt. dobsoni, caniceps, argentatus*; (3) *Pt. melanopogon, keeyensis, arvensis*; (4) *Pt. cognatus, rayneri, rubicatus, lavellanus, grandis, chrysoproctus*; (5) *Pt. lombocensis, solitarius*; (6) *Pt. temminckii, capistratus, personatus*; (7) *Pt. vampyrus*; (8) *Pt. alecto, morio*; (9) *Pt. chrysanchen, conspicillatus, ocularis*; (10) *Pt. papuamus, neohibernicus*; (11) *Pt. macrotis, epularius*; (12) *Pt. woodfordi* (*Pt. scapulatus* group).

No faunistic area can compare with Austro-Malaya in the wealth and multifariousness of its *Pteropus* population. The contrast between the Indo-Malayan and Austro-Malayan faunas is as

well-marked, and the change from the former to the latter as abrupt, in this genus of bats as in any group of non-flying mammalia; it is in this case an almost sudden change from a remarkably poor to an extremely rich and varied fauna. The number of species thus far known from Austro-Malaya is, as said above, 35, as against 13 from Indo-Malaya; but if the chain of islands extending from the Andamans through the Nicobars, Nias, and Engano, to Christmas Island, with its rather peculiar *Pteropus* fauna, were cut off from Indo-Malaya, the contrast would become greater still: 35 Austro-Malayan against only 6 Indo-Malayan species, or twelve mostly richly differentiated Austro-Malayan against four poorly represented Indo-Malayan groups of the genus.—Of the 35 species, 31 are peculiar to Austro-Malaya. The four species which extend beyond the limits of the subregion are *Pt. hypomelanus*, *mimus*, *vampyrus*, and *conspicillatus*. *Pt. vampyrus* has very little to do with the genuine Austro-Malayan fauna; it is an Indo-Malayan type extending only to the south-west corner of Austro-Malaya (Lesser Sunda Islands). *Pt. mimus* is perhaps a Celebean species which has spread to the Philippines, rather than the reverse, and *Pt. conspicillatus* is undoubtedly a New Guinean species which has made its way to N. Australia. Only *Pt. hypomelanus* is widely distributed both in Austro- and Indo-Malaya, but it has probably originated in the former area.

Of the twelve Austro-Malayan groups of the genus, four are peculiar to this faunistic area, viz., the *Pt. caniceps* (three species), *rayneri* (six), *temmincki* (three), and *neohibernicus* groups (two). Three, of the remaining eight, groups are common to Austro-Malaya and Australia, but unrepresented in Indo-Malaya, namely the *Pt. conspicillatus* (two Austro-Malayan species, one common to New Guinea and N. Australia), *macrotis* (two Austro-Malayan, one Australian species), and *scapulatus* groups (one Austro-Malayan, one Australian species). There can be little doubt that at least two of these groups, the *conspicillatus* and *macrotis* groups, are of Austro-Malayan, or more strictly Papuan, origin and have spread comparatively recently to Australia; as to the third group, the *Pt. scapulatus* group, which numbers only two species, one in the Solomon Islands (*Pt. woodfordi*) and one in Australia (*Pt. scapulatus*), both with precisely the same peculiar modifications of the dentition and skull, its place of origin is doubtful, but the group is closely connected with the Austro-Malayan *Pt. macrotis* type.—Of the remaining five groups, one, the *Pt. alecto* group, is nearly confined to Austro-Malaya (two species) and Australia (one), but has spread to the south-east corner of Indo-Malaya (Bawean Island, one species); it is probably of Austro-Malayan origin. A second, the *Pt. melanopogon* group, is common to Austro-Malaya (three species) and the Malagasy region (one), a third, the *Pt. lombocensis* group, to the same two areas (respectively two and one species) and Micronesia (one). Finally, the last two groups, the *Pt. hypomelanus* and *vampyrus* types, are common to Austro- and Indo-Malaya; of these, the former has probably spread east to west,

whereas *Pt. vampyrus* is an Indo-Malayan type which has spread only to the south-west corner of the present area.

Also the negative features of the Austro-Malayan *Pteropus* fauna must be referred to here. The five groups of the genus which have no representatives in Austro-Malaya are the *Pt. mariannus*, *samoënsis*, *pselaphon*, *melanotus*, and *rufus* groups. The two former are entirely Polynesian, but one of them, the *mariannus* group, is phylogenetically very intimately connected with the Austro-Malayan *hypomelanus* group, and the other is closely related to the Austro-Malayan *Pt. lombocensis* group. The *pselaphon* group is Micronesian and Philippine, but as being closely connected with the *samoënsis* group leads again back to *Pt. lombocensis*. The *melanotus* and *rufus* groups are geminate types, the one confined to the Andaman-Nicobar chain, the other to the Malagasy region, and related to the *hypomelanus* group.

The two facts, that the *Pteropus* fauna of Austro-Malaya is incomparably richer than that of any other zoogeographical area of similar size, and that all groups of the genus not represented in Austro-Malaya are very closely related to Austro-Malayan types, *i. e.* pointing back in their probable origin to Austro-Malaya, lend support to the hypothesis that the centre of dispersal of the genus was this subregion, or rather an area much larger than, but including, Austro-Malaya and probably excluding Australia. But any hypothesis is unsafe, so long as we know very little about the physical changes that have taken place in the area between the Malagasy region and the Indian Archipelago, and nothing about the past history of the genus.

V. *Australia*.—5 species, of five groups, viz.:—*Pt. conspicillatus* (*Pt. conspicillatus* group), *Pt. poliocephalus* (*Pt. macrotis* group), *Pt. gouldi* (*Pt. alecto* group), *Pt. brunneus* (*Pt. hypomelanus* group), *Pt. scapulatus* (*Pt. scapulatus* group).

The small number of species, representing as many groups, is evidence that the genus forms no part of the original fauna of the continent. The first species, *Pt. conspicillatus*, is common to S.E. New Guinea and Australia and has very close relatives in W. New Guinea and the Moluccas; the second, *Pt. poliocephalus*, is a peculiar modification of a New Guinean type. The third species, *Pt. gouldi*, points toward the Lesser Sunda Islands and Celebes, being very closely allied to *Pt. alecto* (Celebes, Salayer, Lombok). The fourth and fifth species, *Pt. brunneus* and *scapulatus*, have their closest relatives in the Solomon Islands. Of the five Australian species, *Pt. scapulatus* and *poliocephalus* are decidedly the most peculiarly modified, hence perhaps the earliest immigrants into the continent.

VI. *Polynesia*.—18 species, representing five groups, viz.:—(1) *Pt. pelawensis*, *yapensis*, *ualanus*, *mariannus*, *vanikorensis*, *geddiei*, *tonganus* (*Pt. mariannus* group); (2) *Pt. navetiensis*, *samoënsis*, *auctianus* (*Pt. samoënsis* group); (3) *Pt. insularis*, *phaeocephalus*, *pselaphon*, *pilosus*, *tuberculatus* (*Pt. pselaphon* group); (4) *Pt.*

*ornatus*, *auratus* (*Pt. hypomelanus* group); (5) *Pt. molossinus* (*Pt. lombocensis* group).

The relatively large number of species is chiefly due to the spreading of a few fundamental types over numerous widely scattered groups of islands, and their consequent differentiation into many, but often only slightly differing, forms. The fauna falls naturally into three classes of forms—those which are the extreme eastern offshoots of essentially Austro-Malayan groups, those belonging to a group which, though essentially Polynesian, is also represented in the Indo-Malayan Archipelago, and the peculiar Polynesian types. To the first category belong *Pt. ornatus* (New Caledonia) and *auratus* (Loyalty Islands), only slightly modified representatives of the widely distributed but chiefly Austro-Malayan *hypomelanus* group, which here finds its extreme south-eastern limit; and *Pt. molossinus* (Caroline Islands), a member of a group which now numbers only four species, but formerly must have had as wide a distribution as the *hypomelanus* group, since its surviving forms are spread over the Carolines, Lesser Sunda Islands, and Mascarenes. To the second class of forms belong the five species of the *Pt. pselaphon* group, inhabiting the Bonin and Volcano Islands (*pselaphon*), Pelew Islands (*pilosus*), Carolines (*insularis* and *phaeocephalus*), and (?) Vanikoro (*tuberculatus*); this group is represented also in the Philippines (*leucopterus*). All the remaining ten species, the genuine Polynesian fauna, are clearly modifications of only two types, the *mariannus* and *samoënsis* types. The *Pt. mariannus* group, seven closely interrelated species (with an eighth species, *Pt. loochoënsis*, in the S. Liu-kin Islands), is distributed over practically the whole subregion, so far as inhabited by the genus, from the Pelew and Marianne islands south-east to Tonga, Fiji, and Samoa; it is extremely closely connected with the *hypomelanus* group, scarcely more than its Polynesian representative, *Pt. admiralitatum* forming a transition between the two groups. The *Pt. samoënsis* group, three sharply differentiated species, is entirely South Polynesian (New Hebrides, Fiji, Samoa); but the group is undoubtedly a modification of the *lombocensis* type.

The subjoined geographical review of the species and sub-species is based almost entirely on material examined during the preparation of this Catalogue.

### 1. *Madagasy Region.*

Madagascar.—*Pt. rufus rufus* (northern and central), *rufus princeps* (southern).

Comoro Islands.—*Pt. comorensis* (generally distributed), *livingstonei* (Johanna I.).

Aldabra.—*Pt. aldabrensis*.

Seychelles.—*Pt. seychellensis*.

Mauritius, Reunion.—*Pt. niger, subniger*.

Rodriguez.—*Pt. rodricensis*.



2. *Ceylonese, Indian, and Indo-Chinese Subregions.*

Maldives.—*Pt. ariel*.

Ceylon, Indian Peninsula.—*Pt. giganteus giganteus*.

Himalayas (Kooloo, Nepal), Assam, Cachar, Manipur.—*Pt. giganteus leucocephalus*.

Tenasserim.—*Pt. intermedius*.

Mergui Archipelago.—*Pt. hypomelanus geminorum*.

Siam, Cambodia, Saigon.—*Pt. lylei, hypomelanus condorensis*.

Pulo Condor.—*Pt. hypomelanus condorensis*.

Formosa.—*Pt. formosus*.

South Liu-kiu Islands.—*Pt. dusymallus, lochoënsis*.

3. *Indo-Malaya.*

Andamans.—*Pt. tytleri, satyrus, ? campyrus*.

Nicobars.—*Pt. melanotus, faunulus, ? vampyrus*.

Nias.—*Pt. nialicus*.

Engano.—*Pt. modiglianii, hypomelanus enganus*.

Christmas Island (S. of Java).—*Pt. natalis*.

Borneo (incl. Labuan, Mengalun, Sibutu, Lamboyan Islands).—*Pt. vampyrus natunæ, hypomelanus tonesi, speciosus*.

North Natunas (Bunguran, Pulo Panjang, Pandak, Lantj).—*Pt. vampyrus natunæ, hypomelanus canus*.

South Natunas.—*Pt. hypomelanus annectens*. (*Pt. vampyrus natunæ*, not yet recorded.)

Tambelan Islands, Pulo Aor, Tioman.—*Pt. hypomelanus lepidus*.

Malay Peninsula.—*Pt. vampyrus malaccensis*.

Sumatra (Linga Archipelago, Banka).—*Pt. vampyrus malaccensis, hypomelanus tonesi*.

Java.—*Pt. vampyrus vampyrus*.

Bawean Island.—*Pt. aterrimus*.

Bali.—*Pt. vampyrus platon*.

Cagayan Sulu.—*Pt. hypomelanus cagayanus*.

Philippines.—*Pt. vampyrus lunensis* (generally), *hypomelanus cagayanus* (generally), *speciosus* (Malanipa I., off Zamboanga), *minus* (Luzon), *leucopterus*.

4. *Austro-Malaya.*

Celebes.—*Pt. hypomelanus macassaricus, minus, dobsoni, allecto, personatus*.

Sanghir Islands.—*Pt. hypomelanus macassaricus, caniceps, chrysoproctus, melanopogon*.

Talaut Islands.—*Pt. hypomelanus macassaricus*.

Bonerato, Dyampea, Salayer.—*Pt. griseus, allecto*.

Lombok.—*Pt. vampyrus platon, allecto, lombocensis*.

Sumba.—*Pt. morio*.

Flores.—*Pt. lombocensis*.

Alor.—*Pt. solitarius*.

Savu.—*Pt. vampyrus edulis, morio*.

Timor.—*Pt. vampyrus edulis, griseus, temmincki*.

Gilolo group (Morotai, Gilolo, Ternate, Batchian).—*Pt. hypomelanus hypomelanus, caniceps, chrysarchen, personatus*.

Ghebi, Salawati, Mysol.—*Pt. chrysarchen, papuanus*.

Sula Islands.—*Pt. caniceps*.

Amboina group (Baru, Amboina, Ceram, Goram, Manavolka, Watubella).—*Pt. melanopogon, ocularis, chrysoproctus, temmincki, personatus, ? argen-tatus*.

Banda Islands.—*Pt. pallidus, melanopogon*.

Timor Laut.—*Pt. melanopogon*.

Key Islands.—*Pt. keyensis*.

Aru Islands.—*Pt. aruensis, macrotis*. [Cf. *Pt. rubiginosus, fumigatus*, p. 243.

New Guinea.—*Pt. hypomelanus luteus*, *chrysauchen* (N.W.), *conspicillatus* (S.E.), *papuanus*, *epularius*.  
 Conflict. Trobriand, Woodlark, Kiriwina, Alcester Islands.—*Pt. hypomelanus luteus*, *conspicillatus*, *poliocephalus*.  
 Admiralty Islands.—*Pt. admiralitatum*.  
 Bismarck Archipelago.—*Pt. neohibernicus*, *capistratus*.  
 Solomon Islands.—Bougainville, Shortland: *Pt. colonus*, *grandis*. Vella Lavella: *Pt. lavellanus*. Ghizo. Rubiana New Georgia: *Pt. solomonis*, *rubianus*, *woodfordi*. Guadalcanar: *Pt. rayneri*, *woodfordi*. San Christoval: *Pt. cognatus*.

### 5. Australia.

N. and E. Australia.—*Pt. brunneus*, *gouldi*, *conspicillatus*, *poliocephalus*, *scapulatus*.

### 6. Polynesia.

Bonin and Volcano Islands.—*Pt. pselaphon*.  
 Mariannes.—*Pt. mariannus*, ? *tuberculatus*.  
 Pelew Islands.—*Pt. pelewensis*, *pilosus*.  
 Carolines.—Yap. Mackenzie: *Pt. yapensis*. Ruck Atoll: *Pt. insularis*.  
 Mortlock: *Pt. molossinus*, *phaeocephalus*. Ponapé: *Pt. molossinus*.  
 Ualan (Kushai): *Pt. ualanus*.  
 Sta. Cruz Islands (Vanikoro).—*Pt. vanikorensis*, ? *tuberculatus*.  
 New Caledonia.—*Pt. ornatus*, *geddici*. (Cf. note on *Pt. vetulus*, infra p. 155.)  
 Loyalty Islands.—*Pt. auratus*.  
 New Hebrides (Aneiteum).—*Pt. geddici*, *auctianus*.  
 Fijis.—*Pt. tonganus*, *nawaicensis*.  
 Tongas.—*Pt. tonganus*.  
 Samoas.—*Pt. tonganus*, *samoensis*.

### Chronological list of species and subspecies.

1605-1751.—The earliest known forms of *Pteropus* are the largest of the two species inhabiting Mauritius and Reunion (*Pt. niger*), the single Malagasy species (*Pt. rufus*), the single Indian (*Pt. giganteus*), and the largest Indo-Malayan species (*Pt. vampyrus*). *Pt. niger* was described and figured by Clusius, in 1605, under the name *Vespertilio ingens* (Exot. libri decem, p. 94). Next in chronological order comes, apparently, Flacourt's 'Fany' (Hist. Madag. p. 166, 1658), which is the Malagasy *Pt. rufus*; Edwards's description and figure of the 'Great Bat from Madagascar' (Nat. Hist. Birds, pt. iv. pl. 180), usually referred to as the earliest record of this species, is nearly a century later (1751). The Indian species (*Pt. giganteus*) was briefly mentioned by the Swedish traveller Nils Matson (Köping) in his once famous 'Reesa genom Asia,' 1667 ("Mycket stöora Nattblackor," p. 132), and soon found its way to the European Curiosity Cabinets (Olearius, Götterff. Kunst-Kamm. p. 24, pl. xv. fig. 1. 1674, 'Vespertilio Indica'; Jacobæus, Mus. Reg. p. 12, 1699, 'Vespertilioes duo Indici'). Seba's *Canis volans Ternatanus Orientalis*, 1734 (Thesaur. i. pp. 91-92, pl. lvii. figs. 1, 2), is the large Indo-Malayan *Pt. vampyrus*; the original of his fig. 2 is now in the collection of the British Museum. To these early records may perhaps be added Camels' 'Cabug vel Panicui,' 1708, from the Philippines (Phil. Trans. xxv. p. 2198), which is not determinable with certainty, but must be either *Pt. vampyrus* or *Acerodon jubatus*.

Brisson, Daubenton, Buffon.—Two species were known to Brisson, in 1756 (Regn. Anim., based chiefly on the collections in the Cabinet Réaumur), from personal examination, both of them from the Mascarenes, viz. *Pt. rufus* aut *niger*, 'La Roussette,' which is *Pt. niger*, and *Pt. fuscus*, *auriculis brevibus acutiusculis, collo superiore rubro*, the 'Roussette à col rouge,' which is *Pt. subniger* (this third species of "*Pteropus*," *Pt. auriculis patulis*, is a Phyllostome Bat, *Vampyrum spectrum*). Daubenton's 'Chien-volant,' 1759 (Mém. Acad.

R. Sci. Paris, p. 384), is *Pt. niger*, his 'Roussette' probably either the same species or *Pt. subniger*. Buffon, 1763 and 1776 (Hist. Nat. x. pls. xiv. and xvii., and Suppl. iii.), gives figures and detailed descriptions of the 'Roussette' [*Pt. niger*] and 'Rougette' [*Pt. subniger*], together with an excellent account of the habits of the former species based on letters from de la Nux, who for more than 50 years was a resident of Reunion.

Linné.—Seba's *Canis volans Ternatanus Orientalis* was by Linné, in the second (1740) and seventh (1748) editions of the 'Systema Nature,' referred to as *Vespertilio cauda nulla*; in the tenth edition (1758) it was named *Vespertilio vampyrus*, in reference to its alleged blood-sucking habits. Technically, the name *Pt. vampyrus* must therefore stand for the large Indo-Malayan species, but other synonyms given by Linné are evidence that it was intended to cover any then known form of Fruit-bat (formally with the exclusion of *Pt. subniger*, inasmuch as Linné ignored Brisson's writings).

1782.—The Indian species described and named, *Vespertilio gigantea*, Brinnich.—Number of technically named forms now 2.

1792.—Most of the early post-Linnéan compilers recognized three "varieties" of *Pteropus* (or *Vespertilio*) *vampyrus*: a large [= *Pt. niger* + *vampyrus* + *rufus*, or two, or one of these species], a small [= *Pt. subniger*], and a straw-yellow [= *Eidolon helvum*]. Kerr (1792) was the first to propose technical names for these "varieties," viz. *Vesp. vampyrus niger*, *subniger*, and *helvus*.—Number of named forms, 4.

1797.—*Vespertilio caninus*, Blumenbach [= *V. vampyrus* L., 1758].

1802.—*Spectrum rubidum*, Daudin [= *Pt. subniger*, 1792].

1803.—E. Geoffroy's Cat. Mamm. Mus. Nation. d'Hist. Nat. (subsequently suppressed by the author); descriptions of *Pt. fuscus* [= *niger*, 1792], *rufus* [earliest name of the Malagasy species], and *ruber* [= *subniger*, 1792].—*Pt. fuscus*, Desmarest, nec Geoffroy [the name 'fuscus' evidently an abbreviation of Brisson's diagnosis of the 'Roussette à col rouge,' see above; = *Pt. subniger*].—Named forms, 5.

1804.—Hermann's Obs. Zool.; *Vesp. celano* [= *Pt. vampyrus vampyrus*, 1758], *nudus* [indeterminable, perhaps a young *Pteropus*], and *mauritanus* [= *niger*, 1792].

1808.—*Pt. rufus*, Tiedemann, nec Geoffroy [the name 'rufus' an abbreviation of Brisson's diagnosis of 'La Roussette,' see above; = *Pt. niger*, 1792].

1810.—E. Geoffroy's classical paper in Ann. Mus. d'Hist. Nat. xv.; five forms described, two of which were new: *Pt. edulis* [*vampyrus edulis*], from Timor, *edwardsi* [= *rufus*, 1803], *vulgaris* [= *niger*, 1792], *rubricollis* [= *subniger*, 1792], and *griseus*, from Timor.—Named forms, 7.

1814, 1815, 1816.—*Pt. torquatus*, G. Fischer [= *subniger*, 1792]. *Pt. collaris*, Illiger [= *subniger*]. *Pt. madagascariensis*, Oken [= *rufus*, 1803].

1820, 1822.—Desmarest's Mammalogie; *Pt. javanicus* [= *vampyrus vampyrus*, 1758], *marianus* (Guam, Marianes).—Named forms, 8.

1824.—Voyage of the 'Uranie'; *Pt. kerandren*, Quoy & Gaimard [= *marianus*, 1822].

1825.—Temminck's Monographies de Mammalogie, vol. i.; six supposed new forms, four of which were really undescribed: *Pt. medius* [= *giganteus*, 1782], *phaiops* [= *rufus*, 1803], *poliocephalus* (first Australian species known), *dasydallus* ("Japan," really Liu-kiu Islands), *pallidus* (Banda Islands), and *personatus* (Ternate).—Named forms, 12.

1828, 1829.—*Pt. dussumieri*, Is. Geoff. [indeterminable, externally like *Pt. vanikorensis*]. *Pt. pselaphon*, Tradescant Lay, from the Bonin Islands.—Named forms, 13.

1830.—Voyage of the 'Astrolabe': Quoy & Gaimard: *Pt. vanikorensis*, Vanikoro, and *tonganus*, Tonga Tabu.—Named forms, 15.

1835.—Hodgson: *Pt. leucocephalus*, Nepal [*giganteus leucocephalus*].—Named forms, 16.

1837.—The second volume of Temminck's Mon. Mamm.: *Pt. funereus* [= *vampyrus edulis*, 1810], *chrysoproctus*, Amboina, and *alecto*, Celebes.—Named forms, 18.

1839.—*Pt. assamensis*, McClelland [= *giganteus leucocephalus*, 1835].

1842.—Hombron and Jacquinot (Voy. Pôle Sud): *Pt. insularis*, Caroline Islands.—Named forms, 19.

1844.—Gray (Voy. of the 'Sulphur'): *Pt. argentatus*, presumably Amboina.—Named forms, 20.

1848.—Peale (U.S. Exploring Expedition): *Pt. vociferus*, Mangsi I., Balabac Straits (indeterminable, perhaps *Pt. hypomelanus*), and *samoensis*.—Named forms, 21.

1850.—*Pt. conspicillatus*, Gould (second Australian species; cf. 1825).—Named forms, 22.

1853.—Temminck's Esquisses Zoologiques: *Pt. pluton*, Bali and Lombok [*campyrus pluton*], *leucopterus*, Philippines, *hypomelanus*, Ternate, and *molossinus*, unknown locality [Caroines].—Named forms, 26.

1858.—Gray, on Wallace's Aru Islands collections: *Pt. argentatus* [name preoccupied, 1844; species redescribed by Peters, 1867, as *Pt. melanopogon* var. *arucensis*].

1860.—*Pt. geddiei*, MacGillivray, New Hebrides.—Named forms, 27.

1862.—By Peters: *Pt. scapulatus* (third Australian species known, cf. 1825 and 1850), and *chrysanchen*, Batchian.—Named forms, 29.

1863, 1866.—*Pt. cetulus*, Jouan, New Caledonia [cf. p. 155]. *Pt. melanotus*, Blyth, Nicobars. *Pt. livingstonei*, Gray, Comoros.—Named forms, 31.

1867.—Peters's revision of the genus: *Pt. ocellaris*, Ceram, *macrotis*, "Burn" [really Aru Is.], *melanopogon*, Amboina group, *melanopogon* var. *arucensis*, Aru Is. [*Pt. arucensis*], *melanopogon* var. *keyensis*, Key Is. [*Pt. keyensis*], *temminckii*, Amboina, and *gouldi* (fourth Australian species described, cf. 1825, 1850, 1862).—Rosenberg's Reis naar de Zuidoostereilanden: *Pt. rubiginosus* [= ? *arucensis*], *funugatus* [= ? *arucensis*], and *insignis* [= *macrotis*].—Named forms, 38.

1868.—Peters, on the Marquis Doria's Bornean collections: *Pt. hypomelanus* var. *tomesi*.—Named forms, 39.

1869.—Zebebor ('Novara' Expedition): *Pt. nicobaricus* [= *melanotus*, 1863]. Peters, revision of material in the Paris Museum: *Pt. condorensis*, Pulo Condor [*hypomelanus condorensis*], and *tuberculatus*, unknown locality [probably either Vanikoro or Guam].—Named forms, 41.

1870.—Gray, Catalogue of Monkeys, Lemurs, and Fruit-eating Bats; sixteen supposed (six really) new forms: *Spectrum aneticum*, New Hebrides, *Pt. kelaarti* [= *giganteus giganteus*, 1782], *mysolensis* [= *chrysanchen*, 1862], *mysolensis* var. *ceramensis* [= *ocularis*, 1867], *ornatus*, New Caledonia, *locohoensis*, Liu-kiu Islands, *caniceps*, Batchian, *nawaiensis*, Pijis, *flavicollis* [= *tonganus*, 1830], *affinis* [= *caniceps*], *tricolor* [= *hypomelanus hypomelanus*, 1853], *raypert*, Guadalecanar, *elseyi* [= *scapulatus*, 1862], *vitensis* [= *nawaiensis*], *nackloti* var. *batchiana* [= *caniceps*], and *chinensis* [= *leucopterus*, 1853].—Named forms, 47.

1873, 1874.—*Pt. formosus*, Formosa, P. L. Selater. *Pt. whitmeei*, Alston [= *samoensis*, 1848].—Named forms, 48.

1876.—Peters ('Gazelle' Expedition): *Pt. capistratus* and *melanopogon* var. *neohibernicus* [*Pt. neohibernicus*], both from the Bismarck Archipelago. Same author (dealer's specimen): *Pt. degener*, stated to be from the Aru Islands, in reality from the Bismarck Archipelago [= *Pt. neohibernicus*].—Named forms, 50.

1878.—Dobson's Cat. Chir. B. M.: *Pt. lombocensis*, Lombok, *rodricensis*, Rodriguez, *brunneus* (fifth and last Australian species described, cf. 1825, 1850, 1862, 1867), *pteronotus* [= *campyrus campyrus*, 1758], and *fuscus*, Celebes [name preoccupied; renamed, 1908, *Pt. dobsoni*, K. And.].—*Pt. epularius*, Ramsay, New Guinea.—Named forms, 54.

1879.—Dobson, on material from the Paris Museum: *Pt. germaini*, New Caledonia [type apparently lost; = *retulus*, 1863].

1881.—Peters and Doria, on Dr. O. Beccari's collections: *Pt. melanopogon* var. *papua*, New Guinea [*Pt. papuanus*].—Named forms, 55.

1882.—Thomas, on specimens from the Godeffroy Museum: *Pt. phaecephalus* and *breviceps*, both from the Carolines [the latter withdrawn by Thomas, 1887; = *molossinus*, 1853].—Named forms, 56.

1883.—Peters (Dr. O. Finsch's Caroline Islands collections): *Pt. nulanus*; *Pt. molossinus*, based (1853) on specimen from unknown locality, rediscovered in Ponapé.—Named forms, 57.

1887.—By Thomas : *Pt. grandis*, Shortland, Solomon Islands (C. M. Woodford's collections), and *natalis*, Christmas Island, S. of Java (H.M.S. 'Flying Fish'). By A. Milne-Edwards : *Pt. seychellensis*.—Named forms, 60.

1888.—By Thomas : *Pt. woodfordi*, Guadalupe, Solomon Islands, and *coronatus* [= *neohibernicus*, 1876].—Named forms, 61.

1890, 1891.—*Pt. laniger*, H. Allen, "Samoa Islands," in reality Carolines [= *iusularis*, 1842]. *Pt. rufus*, Ramsay [name preoccupied; = *neohibernicus*, 1876].

1893, 1894.—True, Dr. Abbott's collections : *Pt. aldabrensis*, Aldabra. By Thomas : *Pt. modiglianii*, Engano, and *admiralitatum*, Admiralty Islands.—Named forms, 64.

1896.—By Père Heude : *Pt. macassaricus*, S. Celebes [*hypomelanus macassaricus*], *chrysargyrus* [= *keyensis*, 1867], and *tricolor* [name preoccupied, 1870; renamed *heudei*, 1899, Matschie; = ? *lombocensis*, 1878].—Named forms, 65.

1899.—Matschie's 'Megachiroptera des Berliner Museen': *Pt. aterrimus*, Bawean Island [name proposed, but without description, by Temminck, 1846], *petersi* [= *temminckii*, 1867], and *heudei* [renaming of *Pt. tricolor*, Heude (1896), nec Gray (1870); = ? *lombocensis*, 1878].—Named forms, 66.

1900, 1902, 1903.—Dr. Abbott's collections, described by Miller : *Pt. lepidus*, Tambelan Islands [*hypomelanus lepidus*], *faunulus*, Nicobars, and *geminorum*, Mergui Archipelago [*hypomelanus geminorum*].—Named forms, 69.

1904, 1905.—By Thomas : *Pt. solomonis*, Central Solomon Islands. By Mearns : *Pt. lanensis*, Philippines [*vampyrus lanensis*], and *cagayanus*, Cagayan Sulu [*hypomelanus cagayanus*].—Named forms, 72.

1906.—By Miller : *Pt. baveanus* [= *atterrimus*, 1899], *niadicus*, Nias, and *enganus*, Engano [*hypomelanus enganus*].—Named forms, 74.

1907, 1908.—*Pt. mascarinus*, Mason [= *rodricensis*, 1878]. *Pt. comorensis*, Nicoll. *Pt. tytleri*, Mason, Andamans. *Pt. ariel*, G. M. Allen, Maldives.—Named forms, 77.

Oct. 1908, Feb. 1909.—K. Andersen, revision of genus : *Pt. hypomelanus canus*, N. Natunas, *h. annexens*, S. Natunas, *h. luteus*, New Guinea, *satyrus*, Andamans, *colonus*, Shortland, Solomon Islands, *speciosus*, Malanipa Island, off Zamboanga, *minus*, Macassar, *pelewensis*, Pelew Islands, *yapensis*, W. Carolines, *coquatus*, San Christoval, *rubianus*, Rubiana, off New Georgia, *lavellanus*, Vella Lavella, *solitarius*, Alor Island, *rufus princeps*, S. Madagascar, *lylei*, Bangkok, *intermedius*, Tenasserim, *vampyrus malaccensis*, Malay Peninsula, *v. natunæ*, N. Natunas, *morio*, Sumba, *pilosus*, Pelew Islands, *dobsoni*, Celebes, and *auratus*, Loyalty Islands.—Named forms, 99.

Two-thirds of the 99 known forms have been described by six authors, namely Peters (16), Temminck (10), Gray (8), Thomas (7), Miller (5), and Andersen (22).

The types of the 99 forms are distributed as follows :—

British Museum, 47 : *Pt. admiralitatum*, *anelianus*, *annectens* (*hypomelanus a.*), *argentatus*, *auratus*, *brunneus*, *caniceps*, *canus* (*hypomelanus c.*), *coquatus*, *colonus*, *comorensis*, *conspicillatus*, *dobsoni*, *formosus*, *geddici*, *grandis*, *intermedius*, *lavellanus*, *leucocephalus* (*giganteus l.*), *livingstonei*, *lombocensis*, *lombocensis*, *luteus* (*hypomelanus l.*), *lylei*, *malaccensis* (*vampyrus m.*), *minus*, *modiglianii* (cotype in Genoa Museum), *morio*, *natalis*, *natunæ* (*vampyrus n.*), *nawaiensis*, *ornatus*, *pelewensis*, *phaeocephalus*, *pilosus*, *princeps* (*rufus p.*), *psclaphon*, *rayneri*, *rodricensis*, *rubianus*, *satyrus*, *solitarius*, *solanensis*, *speciosus*, *vampyrus*, *woodfordi*, *yapensis*; described by the following authors, Dobson (3), Gould (1), Gray (8), Hodgson (1), Lay (1), Linné (1), MacGillivray (1), Nicoll (1), Schlater (1), Thomas (7), Andersen (22);

Berlin Museum, 14 : *Pt. aruensis*, *atterrimus*, *capistratus*, *chrysauchen*, *condorensis* (*hypomelanus c.*), *gouldi*, *keyensis*, *melanopogon*, *neohibernicus*, *ocularis*, *pallidus* (cotype in Leyden Museum), *scapillatus*, *temminckii*, *ulanus*; described by Matschie (1), Peters (12), Temminck (1);

Leyden Museum, 11 : *Pt. alecto*, *chrysoproctus*, *dasypterus*, *hypomelanus*, *leucopterus*, *macrotis*, *mariannus* (cotype in Paris Museum), *molossinus*, *pallidus* (cotype in Berlin Museum), *personatus*, *pluton* (*vampyrus p.*); described by Desmarest (1), Peters (1), Temminck (9);

U.S. National Museum, 9: *Pt. aldubrensis*, *cagayanus* (*hypomelanus* c.), *enganus* (*hypomelanus* c.), *faunulus*, *geminorum* (*hypomelanus* g.), *lanensis* (*vampyrus* l.), *lepidus* (*hypomelanus* l.), *niadicus*, *samoensis*; described by Mearns (2), Miller (5), Peale (1), True (1);

Paris Museum, 8: *Pt. edulis* (*vampyrus* c.), *griscus*, *insularis*, *mariannus* (cotype in Leyden Museum), *seychellensis*, *tonganus*, *tuberculatus*, *vanikorensis*; described by Desmarest (1), E. Geoffroy (2), Hombron & Jacquinot (1), Milne-Edwards (1), Peters (1), Quoy & Gaimard (2);

Genoa Museum, 2: *Pt. modiglianii* (cotype in British Museum), *papuanus*; described by Peters & Doria, and Thomas;

and one each in the Copenhagen (*Pt. giganteus*, Brünnich), Calcutta (*Pt. melanotus*, Blyth), ? Zi-ka-wei (*Pt. hypomelanus mucassaricus*, Heude), Sydney (*Pt. epularius*, Ramsay), and Cambridge (Massachusetts) Museums (*Pt. ariel*, G. M. Allen); one is presumably in private possession (*Pt. lytleri*); while five are apparently not in existence [*Pt. niger*, *poliocephalus*, *rufus*, *subniger*, *tomesi* (*hypomelanus* l.)].

### Synopsis of Groups and Species\*.

A. Posterior basal ledges of large premolars distinct.

I. Skull and dentition unmodified Pteropine †.

Tibia generally naked above ‡.

a. Dentition not unusually heavy. Size moderate or small: forearm 94–171 mm.

a'. Interfemoralscarcely developed in centre.

a<sup>2</sup>. Ears moderate or short, not narrowly pointed.

a<sup>3</sup>. Colour varying, but never blackish above and beneath with sharply contrasting light yellowish mantle . . .

a<sup>4</sup>. Cheek-teeth of normal size: breadth of p<sup>1</sup> about one-third that of palate between p<sup>4</sup>–p<sup>1</sup>.

a<sup>5</sup>. Tibia naked above.

a<sup>6</sup>. Skull larger: total length 61.3–68.7 mm.

a<sup>7</sup>. Fur shorter: 10–14 mm. on back. Forearm 121–146 mm. (Mergui Archip. to New Guinea) . . . . .

b<sup>7</sup>. Fur longer: 18–19 mm. on back. (Blackish above and beneath with pale mantle and centre of breast.) Forearm 139 mm. (Andamans) . . . . .

A. 1<sup>st</sup>. HYPOMELANUS GROUP, p. 98.

[p. 101.  
1. *Pt. hypomelanus*,

6. *Pt. satyrus*, p. 142.

\* The geographical review of the species and subspecies (pp. 84–86) and the list of the species arranged according to the lengths of forearms (pp. 97–98) will often greatly facilitate the identification of the specimens to be determined.

† Except the Mascarene *Pt. subniger*, in which the cheek-teeth are small and unusually narrow, and the skull modified accordingly.

‡ The tibia is naked above in all species of this section, except in seven peripheral species of the *Pt. hypomelanus* group, viz., *Pt. solomonis* (Central Solomon Is.), *brunneus* (E. Australia), *ornatus* (New Caledonia), *auratus* (Loyalty Is.), *dasyptellus* (Lin-Kius), *formosus* (Formosa), and *subniger* (Mascarenes), and in the single Mascarene species of the *Pt. rufus* group (*Pt. niger*).

- b*<sup>6</sup>. Skull smaller: total length 54.5-59.8 mm.
- c*<sup>5</sup>. Ears from orifice 25-26 mm.
- a*<sup>8</sup>. Forearm 120.5-128 mm.
- a*<sup>9</sup>. Darker: underparts tawny. (Sibutu I.; Malanipa I.) . . . . . 2. *Pt. speciosus*, p. 132.
- b*<sup>7</sup>. Lighter: underparts golden ochraceous. (Philippines; Celebes) . . . . . 3. *Pt. minus*, p. 133.
- b*<sup>8</sup>. Forearm 113-119 mm.
- c*<sup>9</sup>. Flanks dark brown. (Banda Is.) . . . . . 4. *Pt. pallidus*, p. 136.
- d*<sup>9</sup>. Flanks pale like underparts. (Timor; Bonerato; Dyampea; Salayer) . . . . . 5. *Pt. griseus*, p. 137.
- d*<sup>7</sup>. Ears from orifice 21-22 mm.
- c*<sup>8</sup>. Forearm 118-126 mm.
- c*<sup>9</sup>. Underparts ochraceous - buffy tinged with cinnamon. (Nicobars) . . . . . 7. *Pt. faunulus*, p. 143.
- f*<sup>9</sup>. Underparts seal-brown heavily mixed with greyish. (Admiralty Is.) . . . . . [p. 144.
8. *Pt. admiralitatum*,
- d*<sup>8</sup>. Forearm 109-114 mm. (Underparts dark brownish.) (W. Solomon Is.) . . . . . 9. *Pt. colonus*, p. 147.
- b*<sup>5</sup>. Tibia clothed above, at least for proximal half.
- c*<sup>6</sup>. Fur of back directed posteriorly.
- c*<sup>7</sup>. Forearm about 110-120 mm. Mantle russet, cinnamon, or mars-brown.
- e*<sup>8</sup>.  $c-m^2$ \* less than 22 mm. Forearm 110 mm. (Central Solomon Is.) . . . . . [p. 148.
10. *Pt. solomonis*,
- f*<sup>8</sup>.  $c-m^2$  more than 22 mm. Forearm 118 mm. (E. Australia). [p. 149.
11. *Pt. brunneus*,
- f*<sup>7</sup>. Forearm about 145-152 mm. Mantle buffy.
- g*<sup>8</sup>. Head, back, and underparts dark brown. (New Caledonia) 12. *Pt. ornatus*, p. 153.
- h*<sup>8</sup>. Head and underparts ochraceous, back mixed ochraceous and brown. (Loyalty Is.) . . . . . 13. *Pt. auratus*, p. 156.
- d*<sup>6</sup>. Fur of back long and spreading.
- g*<sup>7</sup>. Varied with buffy on back. Forearm 125-137 mm. (S. Liu-kia Is.) . . . . . p. 159.
14. *Pt. dasymallus*,
- h*<sup>7</sup>. Nearly uniform dark brownish above and beneath. Forearm 130-137 mm. (Formosa) . . . . . [p. 163.
15. *Pt. formosus*,
- b*<sup>4</sup>. Cheek-teeth reduced: breadth of  $p^4$  less than one-fourth that of palate between  $p^1-p^1$ . Ears very small, hidden in fur; tibia thickly clothed. Forearm 95-99 mm. (Mascarenes) 16. *Pt. subniger*, p. 164.

\* Maxillary tooth-row, from front of canine to back of last molar.

- b*<sup>1</sup>. Blackish above and beneath, often sprinkled with pale greyish, and with sharply contrasting light yellowish mantle. . . . .
- c*<sup>1</sup>. Small: forearm about 113 mm. (Pelew Is.) . . . . .
- d*<sup>1</sup>. Larger: forearm 133-154 mm.
- e*<sup>3</sup>. Eyes smaller: orbit 11.5-11.8 mm.
- e*<sup>6</sup>. Fur shorter: 9-11 mm. on back.
- i*<sup>7</sup>. Dentition weak: length of  $p^3$  3.8-4 mm. Forearm 130-134 mm. (E. Carolines) . . . . .
- j*<sup>7</sup>. Dentition stronger: length of  $p^3$  4.5-5 mm.
- i*<sup>8</sup>. Dentition moderate: length of  $p^4$  3.9-4.1 mm. Forearm about 130 mm. (W. Carolines) . . . . .
- j*<sup>8</sup>. Dentition strongest: length of  $p^4$  4.8-5 mm. Forearm 134-137 mm. (Marianne Is.) . . . . .
- f*<sup>5</sup>. Fur longer: 14-17 mm. on back. Forearm 135-143 mm. (S. Liu-kiu Is.) . . . . .
- d*<sup>1</sup>. Eyes larger: orbit 12.5-13.8 mm.
- g*<sup>6</sup>. Smaller:  $c-m^2$  24.5-26, forearm 136-150 mm.
- k*<sup>7</sup>. Shorter-winged: third metacarpal about 88-89, forearm 136-137 mm. (Sta. Cruz Is.) . . . . .
- l*<sup>7</sup>. Longer-winged: third metacarpal about 93.5-102.5, forearm 139-150 mm. (Fiji; Tonga; Samoa) . . . . .
- h*<sup>6</sup>. Larger:  $c-m^2$  27.8-30, forearm about 154 mm. (New Hebrides; New Caledonia) . . . . .
- b*<sup>2</sup>. Ears longer (reaching back of eye), narrowly pointed above\*. Dentition heavier . . . . .
- c*<sup>3</sup>. Ears about 24 mm. (orifice to tip). Back sepia suffused with golden buffy. Forearm 145 mm. (Celebes) . . . . .
- d*<sup>3</sup>. Ears about 31 mm. (orifice to tip).
- e*<sup>4</sup>. Dentition stronger: length of  $m_1$  5.1-5.5 mm.; fur short. Forearm 135-140 mm. (Gilolo group; Sula Is.; Sanghir) . . . . .
- f*<sup>4</sup>. Dentition weaker; length of  $m_1$  about 4.7 mm.; fur longer. Forearm ? 136 mm. (? Amboina). . . . .
- b*<sup>1</sup>. Interfemoral distinct in centre.
- c*<sup>2</sup>. Ears strongly attenuated above, sub-acutely pointed. . . . .
- B. PT. MARIANNUS GROUP, p. 172.
17. *Pt. pelewensis*, [p. 173.]
19. *Pt. ualanus*, p. 177.
18. *Pt. yapensis*, p. 174.
20. *Pt. marianus*, [p. 178.]
21. *Pt. lochoënsis*, [p. 181.]
22. *Pt. vanikorensis*, [p. 184.]
23. *Pt. tonganus*, [p. 186.]
24. *Pt. geddivi*, p. 189.
- C. PT. CANICEPS GROUP, [p. 192.]
25. *Pt. dobsoni*, p. 192.
26. *Pt. caniceps*, p. 194.
27. *Pt. argentatus*, [p. 197.]
- D. PT. RUFUS GROUP, [p. 200.]

\* Except *Pt. dobsoni*, in which the ears are nearly similar in form to those of *Pt. hypomelanus*.



- c*<sup>3</sup>. Tibia naked above. Ears exposed. No colour contrast between lateral and median tract of back.
- g*<sup>4</sup>. Ears much longer; 37-38 mm. Size larger: forearm 158-171 mm. (Madagascar) ..... 28. *Pt. rufus*, p. 202.
- h*<sup>4</sup>. Ears much shorter; 31-32 mm. Size smaller: forearm 134-157 mm.
- e*<sup>5</sup>. Back blackish, uniform or sprinkled with greyish. Larger: forearm 143-157 mm.
- i*<sup>6</sup>. Back not, or extremely thinly, sprinkled with greyish; breast and belly yellowish buff. Forearm 151-157 mm. (Comoros) ..... [p. 208. 29. *Pt. comorensis*,
- j*<sup>6</sup>. Back conspicuously sprinkled with greyish; breast and belly much darkened with brownish. Forearm 143-154 mm. (Seychelles). [p. 212. 30. *Pt. seychellensis*,
- f*<sup>5</sup>. Back strongly tinged with broccolbrown. Small: forearm about 134 mm. (Aldabra I.) ..... [p. 213. 31. *Pt. aldabrensis*,
- f*<sup>3</sup>. Tibia clothed above. Ears nearly concealed in fur. Buffy sides of back contrasting with dark spinal tract. Forearm 159-171 mm. (Mascarenes) 32. *Pt. niger*, p. 215.
- d*<sup>2</sup>. Ears rather broadly rounded off at tip. E. PT. MELANOTUS
- g*<sup>3</sup>. Centre of breast light-coloured. GROUP, p. 223.
- i*<sup>4</sup>. Back blackish seal-brown. Forearm 153-165 mm. (Nicobars) ..... [p. 224. 33. *Pt. melanotus*,
- j*<sup>4</sup>. Back approaching hair-brown. Forearm 153-160 mm. (Nias) ..... 35. *Pt. niadicus*, p. 229.
- h*<sup>3</sup>. Underparts uniform blackish.
- k*<sup>4</sup>. Forearm about 150 mm. Mantle sometimes pale-coloured. (Andamans) ..... 34. *Pt. tytlerei*, p. 227.
- l*<sup>4</sup>. Forearm 125-141 mm. Mantle never pale-coloured.
- g*<sup>1</sup>. Skull 61.5-67; fur of back 18; forearm 134-141 mm. (Engano) .. [p. 232. 36. *Pt. modiglianii*,
- h*<sup>1</sup>. Skull 54.5-56; fur of back 25; forearm 125-135 mm. (Christmas I.) 37. *Pt. natalis*, p. 233.
- b*. Dentition unusually heavy. Large: forearm 162-204 mm. .... F. PT. MELANOPOGON
- c*<sup>1</sup>. Ears not peculiar. Forearm 179-204 mm. GROUP, p. 237.
- e*<sup>2</sup>. Furred area of back restricted to narrow spinal line. Forearm 196-204 mm. (Amboina group; Banda; Timor Laut) ..... [p. 238. 38. *Pt. melanopogon*,
- f*<sup>2</sup>. Furred area of back of normal breadth.
- i*<sup>3</sup>. Back silvery whitish. Forearm about 190 mm. (Aru Is.) ..... [p. 241. 39. *Pt. aruensis*,
- j*<sup>3</sup>. Nearly uniform yellowish above and beneath. Forearm 179-188 mm. (Key Is.) ..... 40. *Pt. keyensis*, p. 246.
- d*<sup>1</sup>. Ears semicircularly rounded off above. Forearm 162-172 mm. (Comoros) .. [p. 247. 41. *Pt. livingstonei*.

11. Rostrum shortened, dentition more or less modified. Tibia nearly always clothed above\*.
- c. Dentition heavy. Fur never silvery whitish or buffy above and beneath.
- e'.  $m_3$  always,  $m^2$  often, conspicuously reduced;  $i_2$  and  $p_1$  normal.
- g'. Rostrum less shortened;  $i_1$  not reduced,  $\frac{2}{3}$  of  $i_2$ ..... G. PT. RAYNERI GROUP, [p. 250.
- k'. Tibia densely furred above, at least for proximal half. (Solomon Is.).
- m'. Brownish above and beneath with cinnamon or russet mantle. Forearm at least 121 mm. (San Christoval) ..... 42. *Pt. cognatus*, p. 251.
- n'. Upperside tri-coloured: bright mantle, dark back, bright rump.
- p'. Smaller: forearm 137-141 mm. (Guadalcanar) ..... 43. *Pt. rayneri*, p. 253.
- j'. Larger: forearm 151-172 mm.
- k'. Crown and face grizzled with buffy and greyish.
- m'. Lower leg about 76.5 mm.; colour much lighter. Forearm about 103 mm. (Rubiana) ..... 44. *Pt. rubianus*, p. 255.
- n'. Lower leg about 65-68 mm.; colour much darker. Forearm 151-156 mm. (Vella Lavella)..... [p. 258.
- l'. Crown and face blackish seal-brown. Forearm 167-172 mm. (Bougainville; Shortland) .... 45. *Pt. lavellanus*,
- l'. Tibia thinly haired above. Upperside generally tri-coloured. Forearm 163-177 mm. (Amboina group) ..... 46. *Pt. grandis*, p. 259.
- k'. Rostrum much shortened;  $i_1$  reduced,  $\frac{1}{4}$  of  $i_2$ ..... [p. 260.
- m'. Tibia furred above: forearm 108-127 mm. II. PT. LOMBOCENSIS GROUP, p. 265.
- o'. Ears exposed.
- k'. Larger, darker. Forearm 113-122 mm. (Lombok; Flores) .... [p. 266.
- l'. Smaller, paler. Forearm about 108 mm. (Alor I.) ..... 48. *Pt. lombocensis*, [p. 269.
- p'. Ears nearly concealed in fur. Forearm 124-127 mm. (Rodriguez) .. 49. *Pt. solitarius*, [p. 273.
- n'. Tibia naked above. Very small: forearm 94-99 mm. (Carolines) .. 50. *Pt. rodricensis*, [p. 275.
- f'.  $m_3$ ,  $m^2$ , and  $i_1$  normal;  $i_2$  and  $p_1$  enlarged; rostrum very short.
- c. Posterior ledges of upper incisors of normal breadth ..... I. PT. SAMOËNSIS GROUP, [p. 280.
- o'. No inner basal ledge in lower cheek-teeth.

\* The tibia is clothed, and generally (thickly clothed, above in all species of this section except *Pt. molossinus*, *insularis*, and *phaecephalus* (Caroline Is.).

- $q^1$ .  $i_2$  and  $p_1$  slightly enlarged. Forearm 124-132 mm. (Fijis)..... [p. 280.  
 52. *Pt. nawaiensis*,  
 $r^1$ .  $i_2$  and  $p_1$  much enlarged. Forearm about 144 mm. (Samoas)..... [p. 284.  
 53. *Pt. samoensis*,  
 $p^3$ . A broad inner basal ledge in  $p_1$ ,  $m_1$ , and  $m_2$ . Forearm 123-130 mm. [p. 288.  
 54. *Pt. anetianus*,  
 $j^2$ . Posterior basal ledges of upper incisors unusually broad ..... J. PT. PSELAPHON  
 $q^3$ . Tibia naked above. Small: forearm 101-109 mm. (Carolines). GROUP, p. 293.  
 $s^1$ . Back dark brown. (Ruck atoll) .. 55. *Pt. insularis*, p. 295.  
 $t^1$ . Back golden cream-buff. (Mortlock) ..... [p. 298.  
 56. *Pt. phaeocephalus*,  
 $r^3$ . Tibia furred above. Larger: forearm 120-151 mm.  
 $u^1$ . Upper molariform teeth not shortened.  
 $m^5$ . Upper canine without secondary cusp. Larger: forearm 132-151 mm.  
 $m^6$ . Feet hairy above; fur of back 30 mm. Forearm 132-141 mm. [p. 301.  
 (Bonin and Volcano Is.) ..... 57. *Pt. pselaphon*,  
 $n^6$ . Feet naked above; fur of back 20 mm. Forearm about 151 mm. (Pelew Is.) ..... 58. *Pt. pilosus*, p. 306.  
 $n^3$ . Upper canine with small secondary cusp. Small: forearm about 120 mm. (? Marianne Is.; ? Vanikoro) ..... [p. 309.  
 59. *Pt. tuberculatus*,  
 $e^1$ . Upper molariform teeth shortened, subquadrate. Forearm about 140 mm. (Philippines)..... [p. 311.  
 60. *Pt. leucopterus*,  
*d*. Dentition weak or even degenerate. Unusually pale-coloured; silvery whitish or silvery buffy above and beneath .... K. PT. TEMMINCKI  
 $g^1$ . Head not striped. Forearm 94-101 mm. GROUP, p. 315.  
 (Amboina group; Timor) ..... 61. *Pt. temminckii*,  
 $h^1$ . Head striped. [p. 316.  
 $k^2$ . Cheek-teeth of normal breadth. Forearm 110-116 mm. (Bismarck Archip.) [p. 319.  
 62. *Pt. capistratus*,  
 $l^2$ . Cheek-teeth excessively narrow. Forearm 86-96 mm. (Gilolo group; Celebes)..... [p. 321.  
 63. *Pt. personatus*,  
*B*. Posterior basal ledges of premolars practically obliterated. (Tibia naked above in all species, except *Pt. poliocephalus*.)  
 $e$ . Cheek-teeth of normal breadth (breadth of  $p^1 \frac{1}{3}$ , rarely  $\frac{1}{4}$ , that of palate between  $p^1$ - $p^4$ ).  
 $i^1$ .  $p^3$  and  $p^4$  normal.  
 $m^2$ . Furred area of back of normal breadth (not restricted to narrow spinal line). Middle divided palate-ridges less than 8.  
 $s^3$ . Ears long and sharply pointed ..... L. PT. VAMPYRUS  
 GROUP, p. 324.

- w*<sup>1</sup>. Smaller; forearm 148-154 mm.  
(Siam; Saigon) ..... 66. *Pt. lylei*, p. 339.
- a*<sup>4</sup>. Larger; forearm 160-220 mm.
- o*<sup>5</sup>. Underside of body paler than back.
- o*<sup>6</sup>. Rather larger, with slenderer rostrum and smaller teeth. Forearm 163-177 mm. (India; Ceylon; Himalayas) ..... [p. 326.  
64. *Pt. gigantens*,
- p*<sup>6</sup>. Rather smaller, with broader rostrum and heavier teeth. Forearm about 160 mm. (Maldives) .... 65. *Pt. ariel*, p. 335.
- p*<sup>5</sup>. Underside of body quite, or nearly, as dark as back.
- q*<sup>6</sup>. Smaller; foreneck much lighter than breast. Forearm about 180 mm. (Tenasserim)..... [p. 340.  
67. *Pt. intermedius*,
- r*<sup>6</sup>. Larger; foreneck subsimilar to breast. Forearm 183-220 mm. (Malacca; Indo-Malaya; Lesser Sunda Is.) ..... [p. 343.  
68. *Pt. vampyrus*,
- t*<sup>3</sup>. Ears not long and sharply pointed.
- y*<sup>1</sup>. Blackish above and beneath, but never with light yellowish mantle. . . . M. PT. ALECTO GROUP,  
[p. 363.
- q*<sup>5</sup>. Smaller; forearm about 141 mm. (Sumba; Savu) ..... 71. *Pt. morio*, p. 370.
- r*<sup>5</sup>. Larger; forearm 152-176 mm.
- s*<sup>6</sup>. Orbit smaller; 13.7-13.9 mm.; dentition heavier; length of *p*<sup>4</sup> 4.6-5.1 mm. Forearm 152-160 mm. (Bawean I.) ..... [p. 353.  
69. *Pt. aterrimus*,
- t*<sup>6</sup>. Orbit larger; 14.2-14.8 mm.; dentition weaker; length of *p*<sup>4</sup> 4.1-4.7 mm.
- o*<sup>7</sup>. Cheek-teeth broader; breadth of *p*<sup>1</sup>  $\frac{5}{7}$  of length. Forearm 160-175 mm. (Celebes; Salayer; Lombok) ..... 70. *Pt. alecto*, p. 365.
- p*<sup>7</sup>. Cheek-teeth narrower; breadth of *p*<sup>1</sup>  $\frac{3}{4}$  of length. Forearm 153-180 mm. (Australia) .... 72. *Pt. gouldi*, p. 370.
- z*<sup>1</sup>. Blackish above and beneath with sharply defined light yellowish mantle ..... N. PT. CONSPICILLATUS GROUP, p. 375.
- s*<sup>5</sup>. Larger; forearm about 157-181 mm.
- w*<sup>6</sup>. No well-defined spectacles. Forearm about 175-183 mm. (Gilolo group; W. New Guinea) ..... [p. 375.  
73. *Pt. chrysauchen*,
- r*<sup>6</sup>. Circumocular space and lores pale-coloured. Forearm 157-181 mm. (E. New Guinea; Australia) .. [p. 378.  
74. *Pt. conspicillatus*,
- t*<sup>5</sup>. Smaller; forearm about 135 mm. (Amboina group) ..... 75. *Pt. ocularis*, p. 381.
- u*<sup>2</sup>. Furred area of back (in adults) restricted to narrow spinal line. Palate-ridges 5+8+3. .... [GROUP, p. 384.  
O. PT. NEOHIBERNICUS
- n*<sup>3</sup>. Back dark vandyck-brown. Forearm about 190 mm. (New Guinea) .... [p. 385.  
76. *Pt. papuanus*,

- e<sup>3</sup>. Back lighter, from yellowish buffy to  
 mars-brown. Forearm 187-199 mm.  
 (Bismarck Archip.) ..... [p. 387.  
 77. *Pt. neohibernicus*,  
 j'. p<sup>3</sup> and p<sup>4</sup> subsquarish. Ears long and  
 sharply pointed ..... P. PT. MACROTIS GROUP,  
 o<sup>2</sup>. Tibia naked above. (Blackish above  
 and beneath with sharply contrasting  
 light yellowish mantle.) [p. 392.  
 w<sup>3</sup>. Larger: forearm 136-141 mm. (New  
 Guinea) ..... 78. *Pt. epularius*,  
 a<sup>2</sup>. Smaller: forearm about 120 mm.  
 (Aru Is.) ..... 79. *Pt. macrotis*, p. 396.  
 p<sup>2</sup>. Tibia thickly clothed above. Fore-  
 arm about 160 mm. (Australia).... 80. *Pt. poliocephalus*,  
 f. Cheek-teeth excessively narrow (breadth  
 of p<sup>4</sup>  $\frac{1}{5}$ - $\frac{1}{6}$  that of palate between p<sup>1</sup>-p<sup>4</sup>) .. [p. 397.  
 Q. PT. SCAPULATUS  
 k'. Ears long and pointed. Much larger:  
 forearm 131-143 mm. (Australia).... GROUP, p. 402.  
 81. *Pt. scapulatus*,  
 l'. Ears small, nearly concealed in fur.  
 Much smaller: forearm 92-99 mm.  
 (Solomon Is.) ..... [p. 403.  
 82. *Pt. woodfordi*,  
 [p. 407.

*Lengths of forearms of species and subspecies\*.*

- 86-89 mm.:—*Pt. personatus* (Celebes; Gilolo and Amboina groups).  
 90-99 mm.:—*Pt. molossinus* (Carolines), *personatus* (Celebes; Gilolo and Am-  
 boina groups), *subniger* (Mascarenes), *temmincki* (Amboina group;  
 Timor), *woodfordi* (Solomon Is.).  
 100-109 mm.:—*Pt. colonus* (Shortland, Solomon Is.), *insularis* (Ruck group,  
 Carolines), *phaecephalus* (Mortlock group, Carolines), *solitarius* (Alor  
 I.), *solomonis* (Ghizo, Solomon Is.), *temmincki* (Amboina group;  
 Timor).  
 110-119 mm.:—*Pt. admiralitatum* (Admiralty Is.), *brunneus* (Australia),  
*capistratus* (Bismarck Arch.), *colonus* (Shortland, Solomon Is.), *faunulus*  
 (Nicobars), *griseus* (Timor, Bonerato, Dyampea), *lombocensis* (Lombok;  
 Flores), *pallidus* (Banda Is.), *pelewensis* (Pelew Is.), *solomonis* (Ghizo,  
 Solomon Is.), *tuberculatus* (? Sta. Cruz Is.; ? Mariannes).  
 120-129 mm.:—*Pt. admiralitatum* (Admiralty Is.), *anetianus* (New Hebrides),  
*cognatus* (San Christoval, Solomon Is.), *dasyvallus* (Liu-kius), *faunulus*  
 (Nicobars), *hypomelanus* (Indo- and Austro-Malaya), *lombocensis* (Lom-  
 bok; Flores), *macrotis* (Aru Is.), *minus* (Celebes; Philippines), *natalis*  
 (Christmas I., S. of Java), *nawaiensis* (Fijis), *rodricensis* (Rodriguez),  
*spectosus* (Sulu Is.), *tuberculatus* (? Sta. Cruz Is.; ? Mariannes), *yapensis*  
 (W. Carolines).  
 130-139 mm.:—*Pt. aldabrensis* (Aldabra), *anetianus* (New Hebrides),  
*?argentatus* (Amboina?), *caniceps* (Gilolo group; Sula Is.; Sanghir),

\* When two or more species of *Pteropus* occur together in one place, they are generally conspicuously different in size. The length of the forearm of a specimen to be determined, together with the precise locality given on its label, will therefore in most cases help the non-specialist to an easier and quicker identification than the necessarily long and complicated dichotomic "Key" to the species (pp. 90-97). To serve such purpose is the sole object of the list given above. It has been compiled entirely from material examined by the writer, but a reasonable individual variation in size, rather greater than that actually observed, has been presupposed in those species of which the available material has not been considered large enough to show the true variation.

*dasyrnallus* (Liu-kius), *epularius* (New Guinea), *formosus* (Formosa), *hypomelanus* (Indo- and Austro-Malaya), *leucopterus* (Philippines), *lochoënsis* (Liu-kius), *marianus* (Marianes), *modiglianii* (Engano), *natalis* (Christmas I., S. of Java), *nawaiensis* (Fijis), *ocularis* (Amboina group), *pselaphon* (Bonin Is.; Volcano Is.), *rayneri* (Guadalecanar, Solomons), *satyrus* (Andamans), *scapulatus* (Australia), *tonganus* (Fijis; Tongas; Samoas), *ulanus* (E. Carolines), *vanikorensis* (Sta. Cruz Is.), *yapensis* (W. Carolines).

140-149 mm.:—*Pt. auratus* (Loyalty Is.), *caniceps* (Gilolo group; Sula Is.; Sanghir), *dubsoni* (Celebes), *epularius* (New Guinea), *hypomelanus* (Indo- and Austro-Malaya), *leucopterus* (Philippines), *lochoënsis* (Liu-kius), *lylei* (Siam; Saigon), *modiglianii* (Engano), *morio* (Sumba; Savu), *ornatus* (New Caledonia), *pselaphon* (Bonin Is.; Volcano Is.), *rayneri* (Guadalecanar, Solomon Is.), *samoënsis* (Samoas), *satyrus* (Andamans), *scapulatus* (Australia), *seychelleusis* (Seychelles), *tonganus* (Fijis; Tongas; Samoas), *tytleri* (Andamans).

150-159 mm.:—*Pt. ariel* (Maldives), *aterrimus* (Bawean I., Java Sea), *auratus* (Loyalty Is.), *comorensis* (Comoros), *conspicillatus* (S.E. New Guinea; Australia), *geddici* (New Hebrides; New Caledonia), *gouldi* (Australia), *lavellanus* (Vella Lavella, Solomon Is.), *lylei* (Siam; Saigon), *melanotus* (Nicobars), *niadicus* (Nias), *niger* (Mascarenes), *ornatus* (New Caledonia), *pilosus* (Pelew Is.), *rufus* (Madagascar), *seychelleusis* (Seychelles), *tonganus* (Fijis; Tongas; Samoas), *tytleri* (Andamans).

160-169 mm.:—*Pt. alecto* (Celebes; Salayer; Lombok), *ariel* (Maldives), *aterrimus* (Bawean I., Java Sea), *chrysoproctus* (Amboina group; Sanghir), *conspicillatus* (S.E. New Guinea, Australia), *giganteus* (Ceylon; India; Himalayas), *gouldi* (Australia), *grandis* (Shortland, Bougainville, Solomon Is.), *livingstonei* (Comoros), *melanotus* (Nicobars), *niadicus* (Nias), *niger* (Mascarenes), *poliocephalus* (Australia; Trobriand Is.), *rubianus* (Rubiana, Solomon Is.), *rufus* (Madagascar).

170-179 mm.:—*Pt. alecto* (Celebes; Salayer; Lombok), *chrysauchen* (Gilolo group; N.W. New Guinea), *chrysoproctus* (Amboina group; Sanghir), *conspicillatus* (S.E. New Guinea; Australia), *giganteus* (Ceylon; India; Himalayas), *gouldi* (Australia), *grandis* (Shortland, Bougainville, Solomon Is.), *intermedius* (Tenasserim), *keyensis* (Key Is.), *livingstonei* (Comoros), *niger* (Mascarenes), *rufus* (Madagascar).

180-189 mm.:—*Pt. chrysauchen* (Gilolo group; N.W. New Guinea), *conspicillatus* (S.E. New Guinea; Australia), *gouldi* (Australia), *intermedius* (Tenasserim), *keyensis* (Key Is.), *neohibernicus* (Bismarck Arch.), *papuanus* (New Guinea), *vampyrus edulis* (Timor; Savu), *vampyrus lanensis* (Philippines), *vampyrus natunæ* (Natunas; Borneo).

190-199 mm.:—*Pt. aruensis* (Aru Is.), *melanopogon* (Amboina group; Banda Is.; Timor Laut; Sanghir), *neohibernicus* (Bismarck Arch.), *papuanus* (New Guinea), *vampyrus lanensis* (Philippines), *vampyrus malaccensis* (Malay Pen.; Sumatra), *vampyrus natunæ* (Natunas; Borneo).

200-209 mm.:—*Pt. melanopogon* (Amboina group; Banda Is.; Timor Laut; Sanghir), *neohibernicus* (Bismarck Arch.), *papuanus* (New Guinea), *vampyrus lanensis* (Philippines), *vampyrus malaccensis* (Malay Pen.; Sumatra), *vampyrus pluton* (Bali; Lombok), *vampyrus vampyrus* (Java).

210-220 mm.:—*Pt. vampyrus pluton* (Bali; Lombok), *vampyrus vampyrus* (Java).

#### A. THE *PTEROPUS HYPOMELANUS* GROUP.

*Species*.—Sixteen (twenty-six forms): *Pt. hypomelanus* (eleven subspecies), *speciosus*, *mimus*, *pallidus*, *griseus*, *satyrus*, *faunulus*, *admiralitatum*, *colonus*, *solomonis*, *brunneus*, *ornatus*, *auratus*, *dasyrnallus*, *formosus*, *subniger*.

*Range*.—The Austro- and Indo-Malayan subregions, extending

west to southern Indo-China, north to Formosa and South Liu-kiu Islands, east and south-east to Australia, Central Solomon Islands, New Caledonia, and Loyalty Islands. One species in the Mascarenes.

*General characters.*—Skull and dentition unmodified Pteropine; posterior basal ledges of premolars quite short, but distinctly marked off from teeth (at least in  $p^3$ ,  $p^4$ , and  $p_3$ ). Ears moderate or short, broad, tip not narrowly pointed; interfemoral short or undeveloped in centre; fur short, adpressed on back, tibia naked above, except in certain peripheral species (see below). Colour in typical forms not peculiar: dark brownish back, pale mantle, head, and underparts, but in all Indo-Malayan, as well as in the Formosan and Liu-kiu forms, a pronounced tendency to partial or complete suppression of light colours. Sexual differentiation inconspicuous: males without glandular neck-tufts (except *Pt. brunneus*), but generally with slightly heavier canines and slightly more rigid fur of mantle. Size moderate or small (forearm 95-146 mm.).—The Mascarene species is in certain respects aberrant.

*Differentiation of species.*—*Pt. hypomelanus*, in its full specific sense, is the most widely distributed species of the genus; it covers the whole area from New Guinea, through the Moluccas, Celebes, and Philippines, to Borneo, Sumatra, Cochin-China, Siam, and the Mergui Archipelago, each group of islands having generally its own race, but is apparently absent from the southern chain of islands from Java, through the Lesser Sunda Islands, to the Banda, Key, and Aru Islands, as well as from the Andamans and Nicobars. In many of these islands it is however replaced by closely allied species, Java being apparently the only large island in the Indian Archipelago in which no species of the *hypomelanus* group is known to occur. The numerous races of *Pt. hypomelanus* differ chiefly in the colour of the fur; those inhabiting the Moluccas (*hypomelanus*), Celebes (*macassaricus*), and New Guinea (*luteus*) are unquestionably the most ordinary-looking: back dark, mantle and underparts pale (buffy), as in a majority of species of *Pteropus*; passing westward, the most noticeable change in the races is a darkening or suppression of all buffy colours, not infrequently combined with a sprinkling of the dark colours with greyish; to the modifications in colour are added in certain islands in the South China Sea (N. Natunas: *Pt. h. canus*; Tambelan Is.: *Pt. h. lepidus*) a slight increase in the average size of the teeth, and in the extreme south-west (Engano: *Pt. h. enganus*) a well-marked decrease in the average size of the individuals.—*Pt. speciosus* (Sula Is.) and *Pt. minus* (Celebes, Philippines) are very similar to *Pt. hypomelanus* in skull, dentition, and colour of fur, but differing by their comparatively smaller size.

In the Andamans *Pt. hypomelanus* is apparently replaced by the smaller-eyed, longer-furred, and very dark-coloured *Pt. satyrus*; in the Nicobars by *Pt. faunulus*, which in many respects comes rather near to the Engano race (*enganus*) of *Pt. hypomelanus*, but is smaller, with smaller teeth and longer fur; in Timor by the

smaller and very pale-coloured *Pt. griseus*; and in the Banda Islands by the closely allied but darker *Pt. pallidus*. The species inhabiting the extreme eastern islands of Austro-Malaya, viz. the Admiralty (*Pt. admiralitatum*) and Solomon Islands (*Pt. colonus* and *solomonis*), as well as the single Australian species (*Pt. brunneus*); differ from *Pt. hypomelanus* chiefly in smaller size, relatively smaller ears, and peculiar colour of the fur, *Pt. solomonis* and *brunneus* also slightly in the distribution of the fur (tibia clothed above).

The eleven species referred to above are in all essential characters (both in skull, dentition, and externally) typical representatives of the *hypomelanus* group. So far as the skull and dentition are concerned, nearly the same might be said of the four extreme south-eastern and northern species, inhabiting respectively New Caledonia, the Loyalty Islands, Formosa, and the Liu-kiu Islands, but in these the external characters are more or less conspicuously modified. In *Pt. ornatus* (New Caledonia) and *auratus* (Loyalty Islands) the general structure of the teeth is unmodified hypomelanine, but the individual teeth are rather heavier, the cranial crests and the coronoid process of the mandible therefore stronger, the fur is longer and less closely adpressed, the tibiæ clothed, the colour different. In the two northern species, isolated the one in Formosa (*Pt. formosus*) and the other in the South Liu-kiu Islands (*Pt. dasy-mallus*), the skull and dentition are perfectly hypomelanine, but the fur is long and spreading, extending thickly on the upperside of the tibiæ, the ears small, almost concealed in the fur, the colour peculiar. Finally in the single Mascarene representative of the group, *Pt. subniger* (Mauritius, Reunion), not only the external characters but also the dentition and skull are modified: size of teeth reduced, premolars and molars narrow, skull showing the modifications usually found in species with weak dentition (see above, p. 63); ears small, fur long and spreading, extending thickly on upperside of tibia, colour dark brown above and beneath with paler collar, size very small.

*Affinities of group.*—The complete lack of specialization in skull and dentition (the Mascarene species excepted), the enormous range of group, its differentiation into many species and local races, the fact that it is represented by distinct species in the Andamans, Nicobars, Formosa, Liu-kius, Solomon Islands, Australia, New Caledonia, Loyalty Islands, and Mascarenes,—are evidence that its origin dates far back in the history of the genus. Its affinities to the Polynesian *Pt. mariannus* type are so extremely close, that it is difficult or impossible to draw a hard-and-fast line between the two groups. If taken together, they cover practically the whole area inhabited by the genus, with exception of the Himalayas, India, and Ceylon.



1. *Pteropus hypomelanus*, Temm.*Pteropus hypomelanus* (pt.), Dobson, Cat. Chir. B. M. p. 57.

(Synonyms under the subspecies.)

*Diagnosis*.—Skull typical Pteropine. Posterior ledge of  $p^3$ ,  $p^4$ , and  $p_3$  short, but distinctly marked off from tooth. Ears moderate, broad, exposed, tip rounded off. Tibia naked above. Fur of back short, adpressed. Back varying from seal-brown to Prout's brown or mars-brown, often conspicuously and sometimes excessively sprinkled with silvery greyish-white; mantle and underparts varying from pale buffy, through various darker shades, to chestnut or seal-brown. Size below medium: forearm 121–145.5 mm. *Hab.* Indo- and Austro-Malayan Archipelagos, west to Siam and Mergui Archipelago.

*Skull* (fig. 6, on p. 62).—Typical Pteropine. Deflection of braincase moderate, alveolar line if projected posteriorly passing through middle or upper half of occipital condyles. Rostrum long, rather low and slender, somewhat compressed laterally; distance from tip of postorbital process to gnathion larger than distance from former point to lambda. Orbits rather large, diameter greater than width of rostrum across alveolar borders of  $p^1$ – $p^1$ ; front of orbit vertically above some point of front half of  $m^1$ . Postorbital processes long, curved, strong, in aged individuals separated by narrow space from, but rarely quite reaching, corresponding processes on zygoma; base of postorbital processes raised distinctly above level of frontal plateau, making this latter between orbits somewhat concave. Sagittal crest well developed. Coronoid moderate, somewhat sloping; coronoid height of mandible less than  $c$ – $m_3$ ; condyle considerably above level of alveolar line of mandible.

*Teeth* (fig. 6, on p. 62).—No special modifications. Upper canines distinctly recurved; cingulum moderate, forming a well defined but rather narrow rim at inner and posterior base of tooth.  $p^1$  minute, terete, early deciduous. Posterior basal ledge of  $p^3$  short, separated postero-externally by distinct notch from base of outer main cusp; ledge of  $p^4$  generally less distinctly marked off from tooth.  $m^1$  simple.  $m^2$  generally slightly larger than, sometimes equal to,  $p_1$ .— $i_2$  twice or twice and a half the bulk of  $i_1$ . Lower canines recurved, cingulum moderate.  $p_1$  once and a half or twice the size of  $i_2$ . Posterior ledge of  $p_3$  short, though generally distinctly separated from tooth postero-externally; in  $p_4$  still shorter and postero-external notch rather often obsolescent.  $m_1$  and  $m_2$  simple.  $m_3$  equal to or smaller than  $p_1$ .

*Palate-ridges* (fig. 11, on p. 71).—5 + 5 + 3, but occasionally with some trace of an additional ridge between the normal ninth and tenth (compare *Pt. auratus*). First ridge terminating laterally at front of canines; second at back of canines; third at front of  $p^3$ ; fourth at back of  $p^3$ ; fifth at (middle of)  $p^4$ ; sixth at front of  $m^1$ ; seventh at back of  $m^1$ ; eighth at  $m^2$ ; ninth and tenth behind  $m^2$ ; eleventh to thirteenth situated at palation border.

*Ears*.—Moderate in length, not nearly reaching eye, broad, exposed. Inner margin convex from base to tip, though rather flatter in upper than lower half; outer margin convex in lower two-thirds, straight or very flatly concave in upper third. Upper half of conch broad, not constricted, tip rather broadly rounded off. Conch naked, except posteriorly at base and along lower third or half of inner and outer margins.

*Wings*.—About 15–22 millimetres apart at origin from back.

*Interfemoral*.—Very short or undeveloped in centre.

*Fur*.—Short, adpressed on back. Longest hairs at middle of back 10–14 mm. Width of hairy space across middle of back 35–55 mm.

Above, humerus covered with short, closely adpressed hairs; elbow naked; thinly spread, short, closely adpressed hairs on proximal fourth or third of forearm. Knee and upper surface of tibia naked. Fur extending on lateral interfemoral along inner side of tibia to about middle of same.

Below, antebrachial membrane, lateral membrane along outer side of forearm and between humerus and femur covered with woolly hair. Tibia naked.

*Colour*.—Varying according to the subspecies (see summary of modifications of colours, pp. 102–104, and descriptions of subspecies).

*Range*.—The Indo-Malayan and Austro-Malayan Archipelagos, eastward to New Guinea, Trobriand Islands, and Woodlark Island, westward to CochinChina, Siam, the Mergui Archipelago, Sembilan Islands, and Engano.—No form of *Pt. hypomelanus* is known from Java, the Lesser Sunda Islands, Timor Laut, Key, and Aru Islands; so that the species chiefly covers the Archipelago north of the Java, Flores, Sunda, and Banda Seas. In the Andamans (*Pt. satyrus*), Nicobars (*Pt. faunulus*), Timor (*Pt. griseus*), Banda Islands (*Pt. pallidus*), Admiralty Islands (*Pt. admiralitatum*), and Solomons (*Pt. colonus* and *solomonis*), it is replaced by distinct, but closely allied, species.

*Subspecies*.—The principal characters of the eleven geographical races of *Pt. hypomelanus* described below may be briefly summed up as follows:—

(1) Size of teeth:—Unmodified in all races, except *Pt. h. canus* and *lepidus*, in which the teeth average slightly larger than usual.

(2) General size of animal:—The same in all races, except *Pt. h. enganus*, which averages smaller than usual.

(3) Colour of fur:—The general scheme of coloration in *Pt. hypomelanus* and its principal modifications according to the subspecies are these:—

(a) Back some shade of brown, varying from nearly black, through seal-brown, to Prout's brown or mars-brown; rarely these blackish and brownish shades are perfectly uniform, generally more or less sprinkled with greyish-white hairs. The greater or less amount of pale greyish admixture on back and rump is, broadly speaking, a racial character:—In the Papuan and Austro-Malayan races (*luteus*, *hypomelanus*, *macassaricus*) the

pale sprinkling is thin or absent; in the Philippine race (*caqayanus*) it is usually more conspicuous, though not changing, to any large degree, the general dark impression of the colour of the back; in the Mergui Archipelago and Engano forms (*geminorum*, *enganus*) it is usually so strong as to change the general effect of the colour to a grizzled silvery greyish and blackish (brownish); and in the races inhabiting the S. China Sea Islands (*canus*, *lepidus*) it is so excessive as to make the colour of the back and rump appear silvery greyish-white more or less sprinkled with blackish. The difference in the colour of the back between geographically widely separated races (*luteus* contrasted with *geminorum*, *hypomelanus* with *canus*, &c.) is very great, but, all races taken together, there is a perfect intergradation from the one to the other. The individual variation in the amount of greyish admixture, within the same geographical race, is so considerable that in any race specimens occur which are indistinguishable from the average of neighbouring eastern or western races: in *Pt. h. tomesi* (Borneo) the dark colour of the back is generally moderately sprinkled with greyish; but some specimens are as grey-backed as *canus* and *lepidus*, while, on the other hand, some individuals of *canus* and *lepidus* are not greyer-backed than pale-coloured specimens of *geminorum* and *enganus*.—The general colour of the back and rump is often further modified by a more or less pronounced suffusion with mars-brown, russet or buffy; in some individuals this suffusion is confined to the rump and sides of the back, in others extending over the whole of the back and rump. It occurs sporadically in all races, though apparently more often in the western than in the eastern.

(b) Breast, belly, and flanks:—In the palest-bellied race, *Pt. h. luteus* (New Guinea), the whole of the underparts, except throat and flanks, are cream-buff, buff, or ochraceous-buff. Passing from New Guinea westward there is a very gradual decrease in the pale-coloured area of the underparts combined with a darkening of the colour itself. In *hypomelanus* (Gilolo group) and *macassaricus* (Celebes, Sanghir) the colour of the breast and belly is deeper in tinge, and the dark colour of the flanks shows a tendency to spread to the anal region, hinder belly, and sides of belly and breast. In *caqayanus* (Philippines), *tomesi* (Borneo), *annectens* (S. Natunas), *lepidus* (Tambelan Is.), *canus* (N. Natunas), and *condorensis* (P. Condor, CochinChina), the bright colour has generally darkened to golden ochraceous, cinnamon-rufous, or chestnut, and become restricted to the breast and front of the belly, or the breast only, or the centre of the breast. Finally, in *geminorum* (Mergui Archipelago) and *enganus* the underparts are wholly dark-coloured, sometimes with, but more often without, some trace of bright colour on the centre of the breast.

(c) The colour of the mantle and head shows the same gradual darkening from the eastern to the western races. Generally speaking, the mantle and head are similar, or nearly similar, in tinge to the bright colour of the breast and belly. In the eastern

racés, the contrast between the pale (buffy) mantle and head and brownish back is considerable; passing from New Guinea and the Moluccas westward, the colour becomes darker, partly through a darkening of the colour itself, partly through a more or less extensive clouding with chestnut or maroon-chestnut or even chestnut seal-brown. While in the eastern races the mantle and head are much lighter than the back, this contrast becomes, through darkening of the former, much less striking in the central and western races; and in the generally silvery-backed races (*canus*, *lepidus*) the contrast is reversed, the hazel or chestnut or blackish-chestnut mantle being much darker than the light silvery grey back.

(4) Phases:—(a) Through partial or almost complete suppression of all bright colours, as well as of the greyish admixture (if normally present in the race), the colour, in certain individuals, becomes approximately blackish above and below, though generally some trace of the normal brighter colour (darkened to chestnut seal-brown) is observable on the mantle and head, sometimes also on the centre of the breast. This "blackish" phase is not rare in all western and central races, which in this phase are entirely indistinguishable from each other; it appears to be absent in the extreme eastern, light-coloured races (*hypomelanus*, *luteus*).—(b) A phase characterized by grizzled grey-and-blackish (dark "hair-brown") head, back, rump, flanks, and sides of breast and belly occurs in some western races (observed in *geminorum*, *enganus*, *canus*, and *annectens*, but probably occurring in all western and central races). It seems to be due in some cases to an extension of the greyish sprinkling (of normal occurrence on back and rump) to head, flanks, and sides of breast and belly, while in other cases it appears to be a blackish phase modified by heavy sprinkling with greyish.

*Key to the Subspecies of Pteropus hypomelanus.*

- |   |                                       |
|---|---------------------------------------|
| a. Crown and sides of head generally similar in colour to back: blackish thickly mixed with greyish-white hairs, producing the general effect of a very dark shade of hair-brown. (Individuals occur with back and head more or less suffused with russet or wood-brown.) |                                       |
| a'. Mantle chestnut more or less clouded with seal-brown, rarely as bright as cinnamon-rufous. Size normal; forearm 134–137 mm. (Mergui Archipelago) .....  | [p. 106.<br><i>Pt. h. geminorum</i> , |
| b'. Mantle much lighter; varying from bright hazel to almost ochraceous-buff. Averaging smaller; forearm 121–133.5 mm. (Engano) .....   | [p. 107.<br><i>Pt. h. enganus</i> ,   |
| b. Crown and sides of head, in the ordinary phase, similar to or paler than mantle, varying from deep chestnut through several shades of ochraceous to almost cream-buff. (In some  |                                       |

faces a blackish phase occurs, and a phase with head, back, flanks, and belly grizzled greyish and blackish.)

- c'*. Breast and belly or at least centre of breast, in the ordinary phase, some shade of cinnamon-rufous or hazel or rich ochraceous, darkening on flanks and anal region (often also on belly) into dark chestnut or seal-brown.

*a*<sup>2</sup>. Back usually dark hair-brown. Forearm about 135 mm. (Pulo Condor; Camibodja; Siam) . . . . .

[p. 110.

*Pt. h. condorensis*,

- b*<sup>2</sup>. Back usually pale mouse-grey or silvery whitish-grey sprinkled with blackish, with or without buffy or brownish or russet suffusion. [Compare *c*<sup>2</sup>.]

*a*<sup>3</sup>. Teeth averaging larger; *p*<sup>3</sup>, length 4.6-5.1 mm.

*a*<sup>4</sup>. Mantle usually hazel or chestnut; back and rump not, or only slightly, suffused with buffy. (A blackish phase occurs, and a phase with head, flanks, and belly grizzled greyish and blackish.) Size as *lepidus*. (N. Natunas) . . . . .

*Pt. h. canus*, p. 113.

*b*<sup>4</sup>. Mantle usually darker, chocolate or seal-brown; back and rump conspicuously suffused with buffy or brownish. (Phases as in *canus*.) Forearm 131-139 mm. (Tambelan Is.; P. Aor; P. Tioman) . . . . .

*Pt. h. lepidus*, p. 115.

*b*<sup>3</sup>. Teeth of normal size; *p*<sup>3</sup>, length 4.2-4.8 mm. Back usually strongly suffused with golden ochraceous or Prout's brown. (Phases as in *canus*.) Forearm about 130-133.5 mm. (S. Natunas) . . . . .

[p. 116.

*Pt. h. annexens*,

- c*<sup>2</sup>. Back usually seal-brown or approximately Prout's brown more or less sprinkled with light greyish. (Individuals occur with the back strongly suffused with russet.)

*c*<sup>3</sup>. Mantle varying from dark maroon-chestnut to cinnamon-rufous; prevailing colour of back seal-brown. Forearm 128-142.5 mm. (N. Borneo and coast islands; Sembilan Is.) . . . . .

*Pt. h. tomesi*, p. 119.

*d*<sup>3</sup>. Mantle averaging brighter, rich golden ochraceous-buff; back more tinged with Prout's brown. Forearm 135-141.5 mm. (Cagayan Sulu; Philippines) . . . . .

[p. 121.

*Pt. h. cagayanus*,

- d'*. Breast and belly, in the ordinary phase, averaging paler, tawny ochraceous or pale ochraceous or ochraceous-buff; flanks and anal region seal-brown or chestnut seal-brown (a phase with blackish underparts

- occurs, at least in *macassaricus*); back and rump seal-brown or Prout's brown. [Compare *e'*.]
- d*<sup>2</sup>. Underparts tawny ochraceous or pale ochraceous; head and mantle tawny. Forearm 131-145.5 mm. (Celebes; Sanghir Is.; Talaut Is.) ..... [p. 124.  
*Pl. h. macassaricus*,
- e*<sup>2</sup>. Underparts paler, golden buffy; head and mantle light ochraceous. Size as foregoing. (Gilolo group) ..... [p. 127.  
*Pl. h. hypomelanus*,
- e'*. palest extreme; underparts, head, and mantle ochraceous-buff or cream-buff; back and rump from seal-brown to mars-brown. Forearm 128.5-135.5 mm. (New Guinea; Trobriand Is.; Woodlark I.) .. *Pl. h. luteus*, p. 128.

### 1 a. *Pteropus hypomelanus geminorum*, Miller.

- ? *Pteropus nicobaricus* (pt., *nec Zeeboer*), *J. Anderson, Cat. Mamm. Ind. Mus.* pt. i. p. 103 (1881: Mergui Arch.).
- Pteropus geminorum*, *Miller, Smiths. Misc. Coll.* xlv. p. 60 (6 Nov. 1903: S. Twin I., Mergui Arch.); *id.*, *Fam. & Gen. Cats*, p. 58 (1907).
- ? *Pteropus celano* (pt., *nec Herm.*), *Mason, Rec. Ind. Mus.* ii. pt. ii. p. 165 (1908: Mergui Arch.).

*Diagnosis*.—Back and head generally dark hair-brown, mantle deep chestnut, underparts uniform blackish (a hairbrown-bellied phase occurs). Size not smaller than usual. Forearm 134-137 mm. *Hab.* Mergui Archipelago.

*Colour*.—Two "phases" are represented in the small series examined: in most specimens the underparts are almost uniform blackish, in one hair-brown like back and crown. Corresponding phases occur in the allied races of the species.

(*a*) Black-bellied phase (*♂* ad., *♂* yg. ad., two *♀* ad. skins; U.S. N. M. nos. 104461, 62, 63, 65).—Back and rump blackish or blackish seal-brown more or less heavily mixed with silvery greyish-white or buffy-white hairs, producing the general effect of a very dark shade of hair-brown. Individual variation not very great, chiefly dependent on the greater or less preponderance of the pale greyish element of the colour; but even in the darkest (blackish hair-brown) individuals the pale sprinkling is quite conspicuous.—Breast, belly, and flanks generally nearly uniform blackish or blackish seal-brown inconspicuously sprinkled with buffy or whitish-grey hairs; in one specimen (*♀* ad., 104465, with mantle rather paler than usual) the centre of the breast is slightly washed with dull russet.—Mantle chestnut more or less clouded with (sometimes nearly darkened into) seal-brown; in one specimen (104465) rather brighter, nearly cinnamon-rufous; colour gradually darkening on sides of neck, and passing on foreneck into the general blackish seal-brown of the underside. The seal-brown clouding of the colour of the mantle is (if present) generally confined to the tips of the hairs; subapical portion same shade of

cinnamon-rufous, base generally blackish.—Crown and sides of head similar to back, occasionally slightly suffused with a tinge similar to or darker than that of mantle. Throat blackish or blackish seal-brown like rest of underparts.

(b) Hairbrown-bellied phase (♀ yg. ad. skin; no. 104466).—The peculiar colour of this phase is due to an increase in the amount of silvery white hairs on back, breast, and belly. Back and rump greyish hair-brown. Breast, belly, and flanks mixed greyish white and blackish, the former colour predominating. Mantle seal-brown inconspicuously sprinkled with silvery white hairs; sides of neck and foreneck nearly blackish. Head grizzled greyish white and blackish as rump.

*Measurements.* On pp. 111, 112.

*Specimens examined.* Six skins and skulls, paratypes, from the collection of the U.S. National Museum\*.

*Range.* Mergui Archipelago (S. Twin Island).

*Type* in the U.S. National Museum (no. 104464).

*Pteropus geminorum*, Miller; 1903.—Miller separated *Pt. geminorum* from *lepidus* on account of its darker colour and smaller teeth. But *lepidus* is an unusually pale-backed and large-toothed form. The skull and teeth of *geminorum* are in every respect indistinguishable from those of most other forms of *Pt. hypomelanus*, and even from those of *lepidus* they differ only in average characters. The grizzled greyish and blackish colour of the head and back, the dull chestnut or chestnut and seal-brown mantle, and generally blackish underside give a series of *geminorum*, if taken as a whole, a somewhat peculiar aspect, but individuals which to the smallest details of colour are similar to an average specimen of *geminorum* are found in *lepidus* and *cagayanus*. *Pt. h. geminorum* is a well-marked geographical race of *hypomelanus*, but I am unable to draw a "hard-and-fast" line between this and allied forms of the species.

### 1 b. *Pteropus hypomelanus enganus*, Miller.

*Pteropus hypomelanus* (*nec Temm.* subsp.), Thomas, *Ann. Mus. Civ. Genova* (2) xiv. p. 106 (April, 1894: Engano); ? *id.*, *tom. cit.* p. 664 (June, 1895: Si Oban, Mentawai); Trouessart, *Cat. Mamm.* i. p. 82 (pt.) (1897: Engano); Willink, *Nat. Tijds. Nederl. Ind.* lxx. p. 274 (pt.) (1905: Engano; ? Mentawai).

*Pteropus* (Spectrum) *hypomelanus* (pt.), Matschie, *Megachir.* p. 24 (1899: Engano; ? Mentawai).

*Pteropus enganus*, Miller, *Proc. U. S. Nat. Mus.* xxx. pp. 822, 824 (1906: Engano, Pulo Dua, Pulo Mirban).

*Diagnosis.*—Averaging smaller than any other race of the species. Back and head darker or lighter hair-brown with or without russet or buffy suffusion; underside approximately seal-brown, more or less sprinkled with grey, and more or less suffused with buffy.

\* Nos. 104461-63, 104465-67.

or ochraceous-buff; mantle brighter than in *geminorum*, varying from bright hazel to almost ochraceous-buff. Forearm 121-133.5 mm. *Hab.* Engano.

*Skull and teeth.*—Skull averaging decidedly smaller than in *geminorum* and *lepidus*, but scarcely distinguishable from that of small individuals of *cagayanus*. Teeth averaging smaller than in *geminorum*;  $p^1$ , length 3.7-4.6 mm., against 4.2-4.8. Most of the teeth are absolutely smaller than in *lepidus*.

*External dimensions.*—*Pt. h. enganus* averages in every respect smaller than any other race of the species; forearm 121-133.5 mm., against 128-145.5 in all other races; third metacarpal 82-91, against 87-97.5; lower leg 54-60, against 57.5-66; calcar 11-14, against 13-18. The sexes do not seem to differ appreciably in size; in six adult males the forearm measures 121, 125.5, 125.5, 128.5, 129.5, and 133.5 mm., average 127.3; in seven adult females 123.5, 126.5, 127, 127.5, 128, 128, and 129, average 127.1.

*Colour.*—♂ ad., paratype, teeth slightly worn, 2 Nov. 1904 (U.S. N. M. no. 140960). Back and rump blackish brown rather thickly mixed with silvery greyish white, producing the total effect of a dark shade of hair-brown very similar to that of an average specimen of *geminorum*: rump very slightly washed with a paler brown.—Breast and belly blackish brown, thinly but distinctly sprinkled with shiny silvery grey hairs.—Mantle bright hazel, in some places lightened by golden ochraceous-buff, in others clouded with cinnamon-rufous, darkening on sides of neck to chestnut, this again on foreneck to dark seal-brown. Base of hairs of mantle not differing.—Crown and sides of head light greyish hair-brown; individual hairs silvery whitish grey, everywhere mixed with blackish or dark brown hairs; throat similar in colour to foreneck.

The specimen described above is one of the most plain-coloured in the series, but it scarcely represents the average coloration in this form; in most individuals the back, head, and underparts are more or less conspicuously suffused with russet or light tawny ochraceous. The individual variation may be briefly summed up as follows:—

Back and rump: owing to the greater or less amount of sprinkling with shiny silvery greyish-white hairs, the general colour varies from dark hair-brown (pale sprinkling comparatively thin), through greyish hair-brown, to mouse-grey. Some individuals are scarcely, or only very slightly, washed with russet on back and rump; others are conspicuously suffused with light russet or ochraceous-buff along edges of membranes and inner sides of tibiae, but only slightly so on middle of back and rump; in others the russet suffusion extends over the whole of the back and rump, making the central portion mars-brown, the lateral edges along membranes tawny ochraceous-buff; one specimen (♀ ad., 140968), representing the extreme in pale colour, is almost wood-brown edged with buffy along membranes.—Breast and belly: in some specimens approximately seal-brown slightly sprinkled with shiny



silvery grey hairs; but the greyish admixture is often so predominant as to make the general colour a darker or lighter hair-brown clouded with seal-brown in the centre of the breast; in other specimens a greater or less amount of the greyish hairs have turned buff or ochraceous-buff, making the total colour a seal-brown or hair-brown more or less strongly, and more or less extensively, suffused with buff, ochraceous-buff, or light russet.—Mantle varying from bright hazel or bright russet through several lighter tinges to yellowish ochraceous-buff (♀ ad., 140968); the foreneck is always seal-brown or blackish seal-brown.—Crown of head: a darker or lighter shade of hair-brown, dependent on the smaller or greater amount of grizzling with silvery greyish white; in many specimens more or less strongly washed with buffy.

The variation in colour is independent of the sex of the individuals (six males, eight females examined); thirteen of the specimens were obtained in November, one in July; teeth in different stages of wear (from slightly worn to well worn).

*Measurements.* On pp. 111, 112.

*Specimens examined.* Fourteen (nine skins), from the collections of the U.S. National \* and British Museums.

*Range.* Engano, with Pulo Dua (one mile S.E. of Engano) and Pulo Mirban (1½ miles S. of Pulo Dua); ? Mentawai Islands (no specimens examined).

*Type* in the U.S. National Museum (no. 140966).

*Pteropus enganus*, Miller: 1906.—Type locality: Pulo Dua, off Engano. Described by Miller as “similar to *Pt. lepidus*, but smaller, and with back darker than mantle: larger than *Pt. hypomelanus*, Temm.” It is true that in *enganus* the mantle is brighter than the back, whereas in the normal, pale-coloured phase of *lepidus* the mantle is much darker than the back; but *lepidus* is an unusually pale-backed form; in all races of *Pt. hypomelanus*, except *lepidus* and *geminorum*, the back is, as a general rule, darker than the mantle, so that in this respect *enganus* does not differ from most other forms of the species. The statement that *enganus* is larger than *hypomelanus* (i. e. Ternate individuals) is based on Dobson’s measurements (forearm 119 mm.) of what he calls the “type specimen,” but which is in reality not the type of *hypomelanus* Temm. but of *tricolor* Gray, and this specimen is immature; as pointed out above, *enganus* averages, on the contrary, in every respect smaller than any other known race of the species.

*Remarks.*—This form is undoubtedly most closely allied to *Pt. h. geminorum*, from the Mergui Archipelago. It accords with *geminorum* in the grizzled light grey and blackish-brown colour of the back and head, and the generally dark (seal-brown) colour of the breast and belly, sprinkled with light grey hairs; but it averages smaller, the mantle is noticeably brighter, and there is a much stronger tendency in *enganus* to a russet or buffy wash of the colour of the upper and under side. So far as the available

\* Nos. 140960-62, 140967-70, 140972, 141003-5, 141007-8; paratypes.

material goes, *enganus* is always separable, at least by the brighter colour of the mantle, from *geminorum*, but certain individuals of *geminorum* are in every respect indistinguishable from some specimens of *lepidus* and *cagayanus*, and the same is the case with certain individuals in the series of *enganus*; in other words, though apparently always separable from each other, *geminorum* and *enganus* are so intimately related to the forms inhabiting the islands on the eastern side of the Malay Peninsula as to be sometimes indistinguishable from these.

- a. ♂ ad. sk.; skull. Pulo Dua, off Engano; Marquis G. Doria 94.1.7.10.  
July, 1891 (*Dr. E. [P.]*).  
*Modigliani*).

### 1 c. *Pteropus hypomelanus condorensis*, *Pet.*

- Pteropus edulis* (pt., *nec Geoff.*), *Horsfield, Cat. Mamm. Mus. E. Ind. Co.* p. 27 (1851: Siam).  
*Pteropus condorensis*, *Peters, MB. Akad. Berlin*, 1869, p. 393 (Pulo Condor); *Dobson, Mon. As. Chir.* p. 18, footnote (1876); *Matschie, Megachir.* pl. viii. figs. 2, 2 a (skull) (1899: P. Condor).  
*Pteropus* (Spectrum) *hypomelanus g. condorensis*, *Matschie, Megachir.* p. 25 (1899: P. Condor). *f. condorensis*, *Trouessart, Cat. Mamm., Suppl.* p. 52 (1904: P. Condor).  
*Pteropus nicobaricus* (pt., *nec Zelebor*), *Dobson, Cat. Chir. B. M.* p. 55 (1878: P. Condor); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 202 (1879: P. Condor); *id., Cat. Mamm. i.* p. 81 (1897: P. Condor).  
*Pteropus hypomelanus* (*nec Temm.* subsp.), *Dobson, Rep. Brit. Assoc.* 1880, p. 173 (1880: Cambodja); *Trouessart, Cat. Mamm. i.* p. 82 (pt.) (1897: Cambodja).

*Diagnosis*.—Back mixed seal-brown and silvery grey, producing the general effect of a dark shade of hair-brown; breast and belly approximately hazel; mantle blackish chestnut. Size not smaller than usual. Forearm about 135 mm. *Hab.* Pulo Condor; Cambodja; Siam.

*Colour* (type).—Back and rump mixed seal-brown and silvery grey; the brownish and greyish hairs about equal in number and uniformly mixed, producing the total effect of a dark shade of hair-brown; very faint traces of a pale russet suffusion along edges of lateral membranes.—Breast and belly hazel, brightest (washed with golden ochraceous-buff) in the centre of the breast, gradually darkening through chestnut to seal-brown on flanks. Woolly hair on underside of membranes blackish seal-brown.—Mantle blackish chestnut with hazel bases to the hairs, lightening to chestnut with ochraceous-buff hair-bases posteriorly in a transverse line across shoulders; on the sides of the neck and foreneck the colour passes to blackish seal-brown.—Upper surface of head chestnut with ochraceous-buff hair-bases, passing through a darker shade of chestnut on sides of head to chestnut seal-brown on throat.

*Measurements.* On pp. 111, 112.

*Specimens examined.* Nine, in the collections of the Berlin, Paris, and British Museums, including the type and six paratypes of the subspecies.

*Range.* Pulo Condor, off Lower CochinChina; Cambodja; Siam.

*Type* in the Berlin Museum.

*Pteropus condorensis*, Peters; 1869.—Type: ♂ ad., teeth well worn, mounted, skull separate; collected in Pulo Condor by R. Germain; Berlin Museum, no. 3945 (from Paris Museum); skull figured in 'Megachiroptera des Berliner Museums,' pl. viii. figs. 2, 2a. Paratypes: five mounted specimens, same locality and collector, Paris Museum, nos. 46, 46a (two specimens), 46 bis (young), and 46 ter; and one unmounted skeleton, Paris Museum (Mus. d'Anat. Comp.) no. A. 12. 609. Most of the mounted specimens in the Paris Museum are more or less faded by exposure to light; a skin in the same Museum collected in Pulo Condor by Harmand (Reg. no. 30) is similar in colour to the type.

a. ♀ ad. sk.; skull. Siam (*Finlayson*). India Museum [P.]. 79.11.21.576.

*External measurements of Pteropus hypomelanus geminorum, enganus, and condorensis.*

	<i>Pt. hypomelanus</i>					
	<i>geminorum.</i> 4 ad.		<i>enganus.</i> 14 ad.		<i>condorensis.</i> 2 ad. (Type and paratype.)	
	MIN.	MAX.	MIN.	MAX.	TYPE.	PARATYPE.†
	mm.	mm.	mm.	mm.	mm.	mm.
Forearm .....	134	137	121	133.5	135	
Pollex, total length, c. u. ....	58	61	54	59.5	59	59
" metacarpal .....	13	14.5	12	14	13.5	13
" 1st phalanx .....	29.5	33	28	31.5	30.5	32
2nd digit, metacarpal .....	66	70	62.5	69	69.5	72.5
" 1st phalanx .....	14	17	14	18	14.5	17
" 2nd-3rd phalanx, c. u. .	14.5	17	13.5	16	15	15
3rd digit, metacarpal .....	90.5	96.5	82	91	94.5	96.5
" 1st phalanx .....	66.5	68.5	61.5	66	66.5	69
" 2nd phalanx.....	95.5	99.5	87	94.5	...	? 99
4th digit, metacarpal .....	89	91	80	90	92.5	93
" 1st phalanx .....	54.5	56	50.5	55	55	55.5
" 2nd phalanx .....	54	57	47.5	54.5	...	54
5th digit, metacarpal .....	94.5	100	87	96.5	99	102
" 1st phalanx .....	40.5	43.5	37	43	40.5	42
" 2nd phalanx.....	41.5	46	36	42.5	...	43.5
Ears, length from orifice .....	...	...	22	23.5		
" greatest width, flattened ...	...	...	15.5	17		
Front of eye to tip of muzzle .....	...	...	25.5	26.5		
Interfemoral .....	...	...	0	1		
Lower leg .....	63	66	54.5	60		
Foot, c. u. ....	45.5	50	38.5	45.5		
Calc. ....	14.5 *	16.5 *	12.5	14		

\* Approximate measurements (skins).

† Paris Museum, no. 46 ter.

*Measurements of skulls and teeth of Pteropus hypomelanus  
geminorum, enganus, and condorensis.*

	<i>Pt. hypomelanus</i>				
	<i>geminorum.</i> Skulls : 4 ad. Teeth : 4 ad., 1 mm.		<i>enganus.</i> Skulls : 8 ad. Teeth : 9 ad.		<i>condorensis.</i> Type.
	MIN.	MAX.	MIN.	MAX.	
Skull, total length to gnathion .....	64.7	68.7	61.7	64.5	64
„ palation to incisive foramina .....	31.8	33	30.2	33	...
„ front of orbit to tip of nasals .....	21.8	23	20	22.2	21.8
„ width of brain-case at zygomata .....	22.8	23.2	22.2	23	...
„ zygomatic width .....	32.2	36.2	31.5	35.2	...
„ width across $m^1$ , externally .....	17	18.3	16.8	17.8	17.8
„ lachrymal width .....	13.2	15.7	14	14.5	15
„ width across canines, externally .....	12.2	13.5	12	13.2	12.8
„ postorbital constriction .....	7.2	8.2	6.8	8	7.5
„ interorbital constriction .....	9	9.7	8	8.8	9
„ width of mesopterygoid fossa .....	7.8	8	7	7.8	...
„ between $p^1$ - $p^4$ , internally .....	10	10.5	9.8	10.2	10.5
„ between cingula of canines .....	6.8	7.2	6.8	7.8	7
„ orbital diameter .....	12.8	13.2	12.7	13	13
Mandible, length .....	51	53.7	48.7	51.8	51.8
„ coronoid height .....	23	25	20.7	22.8	25.2
Upper teeth, $c-m^2$ .....	25	26.2	22.8	26.2	25.7
Lower teeth, $c-m_3$ .....	27.2	28.2	25.8	28.2	28.2
Upper incisors, combined width .....	6.2	6.6	5.8	7	6
$p^3$ , length .....	4	4.7	3.9	4.2	4.8
„ width .....	3.1	3.2	2.9	3.1	3.2
$p^4$ , length .....	4.2	4.8	3.7	4.6	4.9
„ width .....	3.2	3.5	3	3.7	3.3
$m^1$ , length .....	5	5.2	4.9	5.2	5.7
„ width .....	3	3.1	3	3.1	3.2
$m^2$ , length .....	2.2	2.7	2	2.5	2.5
„ width .....	2.1	2.2	1.8	2	2
$p_1$ , length .....	2	2.1	1.8	2	2.2
„ width .....	1.8	2	1.7	1.8	2.1
$p_2$ , length .....	4.3	4.8	4.1	4.7	4.8
„ width .....	2.8	2.9	2.5	2.9	2.8
$p_3$ , length .....	4.5	4.8	4.1	4.7	4.8
„ width .....	3	3.1	2.8	3	3
$m_1$ , length .....	4.6	4.8	4.7	5	4.8
„ width .....	2.8	3	2.8	3	3
$m_2$ , length .....	3.2	3.7	3.2	3.8	3.8
„ width .....	2.5	2.8	2.7	2.8	2.7
$m_3$ , length .....	1.8	2	1.6	2	2
„ width .....	1.7	1.9	1.6	1.8	1.8

1 d. *Pteropus hypomelanus canus*, K. Andl.

*Pteropus hypomelanus* (nec *Temm.* subsp.), *Thomas*, Nov. Zool. ii. p. 489 (1895: Pulo Pandak; P. Panjang; P. Laut); *Miller*, *Proc. Wash. Acad. Sci.* iii. p. 137 (pt.) (1901: Pulo Laut).

*Pteropus* (Spectrum) *hypomelanus* (pt.), *Matschie*, *Megachir.* p. 24 (1899).

*Pteropus hypomelanus canus*, K. Andersen, *Ann. & Mag. N. H.* (8) ii. p. 361 (1 Oct. 1908: N. Natunas).

*Diagnosis*.—Teeth averaging larger than in other races of the species, except *lepidus*. Back, in the normal pale-coloured phase, pale mouse-grey, lightening to silvery whitish-grey on rump, and with or without a buffy suffusion; mantle some shade of hazel or chestnut; head similar to or brighter than mantle. A blackish phase occurs, and a phase with head, flanks, and belly grizzled greyish and blackish. Size as *lepidus*. *Hab.* North Natuna Is.

*Skull and teeth*.—Skull as in *Pt. h. cagayanus*, but with mandible and tooth-rows averaging a little longer. Teeth averaging larger than in any other race of *Pt. hypomelanus* except *lepidus*:  $p^3$ , length 4.6–5.1 mm., against 3.9–4.9 in all other cases exclusive of *lepidus*;  $p^4$ , length 4.7–5.5, against 3.7–5.

*Colour*.—Three colour phases are represented in the small series examined, viz. :—

(1) Back light grey; head, mantle, and underparts some shade of chestnut or hazel or ochraceous; flanks thinly or heavily mixed with greyish (two skins: ♂ ad., type, teeth well worn, P. Pandak, Sept., 95.11.8.3; ♀ ad., teeth somewhat worn, P. Panjang, July, 95.11.8.2).—General colour of back pale mouse-grey, gradually lightening on hinder back and rump to silvery whitish-grey. Individual hairs silvery white and blackish; on the anterior half of the back the blackish and whitish hairs are nearly equal in number, thus producing the general effect of a pale mouse-grey; further back the blackish hairs gradually become scarcer, until on the rump the silvery whitish colour is largely predominant. All hairs with a distinct silky gloss. In one specimen the colour of the back and rump is almost imperceptibly, in the other (type) distinctly washed with buffy especially on rump and along edges of membranes.—Centre of breast and belly rich golden ochraceous or orange-buff, gradually darkening on sides of breast and belly through hazel into chestnut; flanks in one specimen (type) seal-brown thinly sprinkled with greyish, in the other pale mouse-grey like back.—Mantle hazel partly clouded with chestnut (type), or chestnut with ochraceous-buffy hair-bases (the other), passing through a darker shade on sides of neck into deep chestnut or chocolate on foreneck.—Crown nearly ochraceous-buff in centre, darkening through tawny ochraceous or deep mars-brown on sides of head into chestnut or light seal-brown on throat.

(2) Head, belly, sides of breast, and flanks grizzled hair-brown or broccoli-brown; mantle and centre of breast some shade of chestnut (♀ ad., teeth well worn, P. Laut, Sept., 95.11.8.4).—Back and rump as in phase (1). Belly, sides of breast, and flanks a light greyish shade of hair-brown rather slightly suffused with dark

buffy, producing as general effect a shade very nearly approaching broccoli-brown. Mantle dark chestnut, passing through a still darker shade on sides of neck into almost seal-brown on foreneck; colour of foreneck continued backward on centre of breast, gradually merging into the broccoli-brown of the rest of the underside. Crown and sides of head grizzled mouse-grey and seal-brown; throat blackish seal-brown.

(3) Blackish phase (♂ jun., P. Laut, Aug., 190737).—Back glossy seal-brown thinly sprinkled with greyish-white hairs particularly on rump and thighs. The whole of the underside from throat to interfemoral, including flanks, glossy blackish seal-brown, with a faint indication of a brighter (glossy seal-brown) tinge on foreneck; a few greyish-white hairs scattered on breast and belly. Mantle dark chocolate. Crown and sides of head dark seal-brown.

Phase (1), as described above, is chiefly characterized by the bright (chestnut, hazel, ochraceous) colour of the head, breast, and belly; but the flanks may occasionally be thickly grizzled with pale greyish. In phase (2) the greyish admixture has spread over the head, flanks, belly, and sides of breast, entirely or partly replacing the normally brighter colour of these portions of the pelage; at the same time the colour of the mantle and foreneck is darkened to chestnut or seal-brown. It is probable that a larger series will show a gradual transition from (1) to (2). The blackish phase (3) stands apparently more isolated; it seems to be due to a partial or, in some places, total suppression of the greyish element, combined with a darkening of the chestnut parts into chocolate (mantle) and blackish seal-brown (head and underparts).

*Measurements.* On pp. 117, 118.

*Specimens examined.* Four, from the collections of the U.S. National \* and British Museums.

*Range.* North Natuna Islands: Pulo Panjang, P. Pandak, P. Laut.

*Type* in collection.

*Remarks.*—This form belongs to a small group of races of *Pt. hypomelanus* characterized (so far as the normal light-coloured phase is concerned) by the strong predominance of silvery white in the colour of the rump and back. Three races of this group are known, *Pt. h. canus*, *lepidus*, and *amectens*, distributed over probably all the islands in the S. China Sea; in two of these races, *canus* (N. Natunas) and *lepidus* (Tambelan group, P. Aor, P. Tioman), the teeth average rather larger than usual in the species. *Pt. h. canus* is very closely related to *lepidus*, differing, in its normal phase, only in the conspicuously brighter tinge of the mantle and head; the blackish phase is apparently indistinguishable from that of *lepidus*; to the phase described above under (2) I have seen no equivalent in *lepidus*.

- a. ♀ ad. sk.; skull. Pulo Panjang, N. Natunas; Tring Museum. 95.11.8.2.  
July, 1894 (*E. Hose*).
- b. ♂ ad. sk.; skull. Pulo Pandak, N. Natunas; Tring Museum. 95.11.8.3.  
Sept. 1894 (*Ch. Hose*). (*Type* of subspecies.)
- c. ♀ ad. sk.; skull. Pulo Laut, N. Natunas; Tring Museum. 95.11.8.4.  
Sept. 1894 (*E. Hose*).

\* ♂ jun. skin and skull; Pulo Laut, N. Natunas, Aug. 8, 1900 (*Dr. W. L. Abbott*); Reg. no. 101737.

1 c. *Pteropus hypomelanus lepidus*, Miller.

*Pteropus lepidus*, Miller, *Proc. Wash. Acad. Sci.* ii. p. 237, text-fig. (skull) (20 Aug. 1900: Saddle I.; Big Tambelan I.); Trouessart, *Cat. Mamm., Suppl.* p. 53 (1904: Tambelan Group); Miller, *Fam. & Gen. Bats*, p. 58, fig. 8 (skull) (1907).

*Pteropus hypomelanus lepidus*, Thomas, *Journ. Fed. Mal. St. Mus.* ii. no. 3, pp. 101, 102 (1908: Juara Bay, P. Tioman).

*Pteropus (hypomelanus) lepidus*, Kloss, *Journ. Fed. Mal. St. Mus.* ii. no. 3, p. 153 (1908: P. Tioman; Permangil; Aor).

? *Pteropus nicobaricus (nec Zelebor)*, Bonhote, *P. Z. S.* 1900, p. 875 (Apr. 1901: Great Redang I.); Kloss, *Journ. Fed. Mal. St. Mus.* ii. no. 3, p. 152 (1908: Great Redang I.).

*Diagnosis*.—Similar to *Pt. h. canus*, but mantle and head, in the normal pale-coloured phase, conspicuously darker. Forearm 131–139 mm. *Hab.* Tambelan group; P. Aor; P. Tioman.

*Skull and teeth*.—As in *Pt. h. canus*.

*Colour*.—(1) Pale phase (six skins).—Light greyish colour of back sometimes nearly without any trace of buffy suffusion (one specimen, ♂ ad., Sept., P. Tioman; 8.2.25.2); generally strongly washed with golden buffy (one, ♂ ad., Aug., Big Tambelan I., 101649), or irregularly clouded with pale cinnamon-buffy or very pale mars-brown (three; ♀ ad., Aug., Big Tambelan I., 101650; ♀ ad., June, P. Aor, 112404; ♂ ad., June, P. Tioman, 8.1.25.2).—Centre of breast golden ochraceous tinged with orange-buff, or rich buffy russet, or chestnut-hazel, passing into dark chestnut on sides of breast and centre of belly; flanks greyish broccoli-brown or light hair-brown sprinkled with blackish hairs, this grizzled colour sometimes extending to sides of belly and anal region.—Mantle sometimes chocolate with paler hair-bases, but generally more or less clouded with seal-brown, sometimes nearly uniform seal-brown; sides of neck and head, foreneck, and throat similar or darker. Crown similar to mantle or paler.

(2) Blackish phase (♂ ad., Aug., Big Tambelan I., 101651).—Indistinguishable from corresponding phase of *Pt. h. canus*. The only specimen has a faint trace of a brighter colour on the centre of the breast.

*Measurements*. On pp. 117, 118.

*Specimens examined*. Seven, from the collections of the U.S. National \* (three, Big Tambelan I., paratypes; one, P. Aor), Kuala Lumpur (one, P. Tioman), and British Museums.

*Range*. Tambelan Islands (Saddle I.; Big Tambelan I.); Pulo Aor; Pulo Tioman; probably also Permangil and Great Redang Island (see references above).

*Type* in the U.S. National Museum (no. 101670, Saddle I.).

*Remarks*.—The closest known relative of this form is undoubtedly *Pt. h. canus*; but in the colour of the back (light greyish generally more or less strongly suffused with buffy or some buffy shade of pale brownish) it shows leanings towards its eastern neighbour, *Pt. h. annectens*, from S. Natunas.

\* Nos. 101649–51, 112404.

- a. ♂ ad. sk.; Juara Bay, Pulo Tioman, S. China Kuala Lumpur 8.1.25.2.  
skull. Sea; 14 June, 1906 (H. C. Museum [P.].  
Robinson).
- b. ♂ ad. sk.; Juara Bay, P. Tioman; 14 Sept. Kuala Lumpur 8.2.25.2.  
skull. 1907. Museum [P.].

1 f. *Pteropus hypomelanus annectens*, K. And.

*Pteropus hypomelanus* (nee Temm. subsp.), Thomas & Hartert, Nov. Zool. i. p. 655 (1894: Sirhassen); Miller, Proc. Wash. Acad. Sci. iii. p. 137 (pt.) (1901: Sirhassen).

*Pteropus* (Spectrum) *hypomelanus* (pt.), Matschie, Megachir. p. 24 (1899).

*Pteropus hypomelanus annectens*, K. Andersen, Ann. & Mag. N. H. (S) ii. p. 361 (1 Oct. 1908: Sirhassen).

*Diagnosis*.—Teeth not averaging larger than usual. Normal pale-coloured phase rather similar in colour to corresponding phase of *Pt. h. lepidus*, but generally more strongly suffused with golden ochraceous or paler or darker Prout's brown on back, and with brighter mantle and breast. Forearm 130–133.5 mm. Hab. S. Natuna Is.

*Skull and teeth*.—Only two skulls of perfectly adult specimens have been examined; they average smaller than in *Pt. h. canus* and *lepidus* (total length 61.3–64.5 mm., against 62.5–67.2 in *canus* and *lepidus*), one of them being in fact quite as small as the smallest skull of *Pt. h. enganensis*. Teeth (five specimens) as in most races of the species, not averaging larger than usual as in *canus* and *lepidus*: p<sup>3</sup>, length 4.2–4.8 mm. (in *Pt. h. tomesi* 4.2–4.8), against 4.6–5.1 in *canus* and *lepidus*.

*Colour*.—Three colour phases are represented in the series examined, viz. :—

(1) Pale phase with ochraceous, or cinnamon-rufous, or mars-brown underside (three specimens; imm. al., 94.9.28.25; ♂ ad. skin, teeth slightly worn, June, 104732; ♂ jun. skin, June, 104733).—Back and rump a light shade of hair-brown approaching mouse-grey and very strongly suffused with golden ochraceous or paler or darker Prout's brown, particularly along middle of back and rump; greyish fur distinctly sprinkled with blackish hairs.—Breast and belly ochraceous darkening to cinnamon on flanks (94.9.28.25), or uniform cinnamon-rufous slightly clouded with chestnut and with concealed ochraceous-buff bases to the hairs (104732), or approximately dull mars-brown, palest and washed with golden buffy in centre of breast, darkening to seal-brown on flanks (104733).—Mantle generally closely similar in tinge to colour of underparts: ochraceous, gradually darkening on sides of neck, passing into hazel on foreneck (94.9.28.25), or hazel clouded with chestnut, darkening to chestnut on foreneck (104732), or dark mars-brown, passing to dark vandyck-brown on foreneck (104733).—Crown similar to mantle or paler, darkening on sides of head into colour of throat, which is similar to that of foreneck.

(2) Grey-bellied phase (one; ♀ ad. al., teeth well worn, 94.9.28.26).—Similar in colour to corresponding phase of *Pt. h. canus* (supra, p. 113, phase 2).

(3) Seal-brown-bellied phase (one; ♂ jun. skin, 104734).—Back



and rump essentially as in the ordinary pale phase. Centre of breast seal-brown, darkening to blackish seal-brown on sides of breast, belly, and flanks. Mantle dark chocolate, passing to seal-brown on sides of neck, foreneck, throat, and sides of head. Crown slightly paler than mantle.—This specimen probably represents some transitional stage rather than the true "blackish phase"; the whole of the underparts is, roughly speaking, dark seal-brown, but the colour of the upperside does not show any clear sign of darkening.

*Measurements.* Below and on p. 118.

*Specimens examined.* Five, from the collections of the U.S. National\* and British Museums.

*Range.* South Natuna Islands: Sirhassen.

*Type* in collection.

*Remarks.*—In characters as in habitat this race seems to occupy an intermediate position between *Pt. h. lepidus* and *tomesi*; in the size of the teeth it agrees with the latter form, in the colour of the fur it approaches the former; in the size of the skull it may prove to average smaller than either.

- a. Imm. al.; skull. Sirhassen, S. Natunas. A. Everett [C.]. 94.9.23.25.  
(Type of subspecies.)  
b. ♀ ad. al.; skull. Sirhassen. A. Everett [C.]. 94.9.23.26.

*External measurements of Pteropus hypomelanus canus, lepidus, and annectens.*

	<i>Pt. hypomelanus</i>					
	<i>canus</i> , 3 ad. (Incl. types.)		<i>lepidus</i> , 7 ad.		<i>annectens</i> , 2 ad.	
	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Forearm .....	...	...	131	139	130	133.5
Pollex, total length, c. u. ....	59.5	61.5	59.5	62.5	55	58.5
" metacarpal .....	13.5	14.5	13.5	14.5	13	
" 1st phalanx .....	30	32.5	30	33	28	
2nd digit, metacarpal .....	68.5	72	66.5	72	64	66
" 1st phalanx .....	15.5	18	15	17	...	17
" 2nd-3rd phalanx, c. u. ....	15	16	14	15.5	13	16
3rd digit, metacarpal .....	94.5	96	91	97	89	
" 1st phalanx .....	63.5	70.5	66	70	63	63.5
" 2nd phalanx .....	96	106	96.5	101	92	97.5
4th digit, metacarpal .....	92.5	95	89	94	88.5	87.5
" 1st phalanx .....	52	56.5	55	58.5	51.5	53
" 2nd phalanx .....	56	53.5	51.5	60	50	52.5
5th digit, metacarpal .....	97	102	96	101	92.5	92.5
" 1st phalanx .....	40	43	39	41.5	39	39.5
" 2nd phalanx .....	...	43.5	39.5	45.5	38.5	42
Ears, length from orifice .....	...	...	...	26.5	26	
" greatest width, flattened .....	...	...	...	18	17	
Front of eye to tip of muzzle .....	...	...	...	27	25.5	
Interfemoral .....	...	...	0	2		
Lower leg .....	...	63	61	64	53	59
Foot, c. u. ....	44.5	45	43	45	42	43
Calcaneal .....	14†	15.5†	...	16	...	17.5

\* Nos. 104732-34; Sirhassen.

† Approximate measurements (skins).

*Measurements of skulls and teeth of Pteropus hypomelanus canus, lepidus, and annectens.*

	<i>Pt. hypomelanus</i>					
	<i>canus.</i> Skulls: 3 ad. Teeth: 3 ad., 1 imm. (Incl. type.)		<i>lepidus.</i> Skulls and teeth: 6 ad.		<i>annectens.</i> Skulls: 2 ad. Teeth: 2 ad., 3 imm. (Incl. type.)	
	Min.	Max.	Min.	Max.	Min.	Max.
Skull, total length to gnathion .....	63.8	67.2	62.5	67.5	61.3	64.5
„ palation to incisive foramina .....	32	33	31.8	34.5	31.5	...
„ front of orbit to tip of nasals .....	22	23	20.2	22.2	21.3	...
„ width of brain-case at zygomata .....	...	23.5	23	24.2	22	22.8
„ zygomatic width .....	...	38.5	34.2	38	31.2	33.7
„ width across $m^1$ , externally .....	18.2	18.8	17.3	19	16.5	17.2
„ lachrymal width .....	15	15.2	13.5	15.2	13.2	14
„ width across canines, externally .....	12.8	14	12.8	13.8	11.6	...
„ postorbital constriction .....	7.2	...	7.2	8.7	6.8	7
„ interorbital constriction .....	8.8	9.8	8.7	10	8	8.2
„ width of mesopterygoid fossa .....	7.2	...	7.2	8.2	7.2	7.7
„ between $p^1$ - $p^1$ , internally .....	10.3	10.6	9.8	11	9.5	...
„ between cingula of canines .....	6.8	7.8	7	7.8	6.4	...
„ orbital diameter .....	12.8	13	12.8	12.8	12.9	13.1
Mandible, length .....	50.5	54.7	50	53	48.7	49.8
„ coronoid height .....	25	26	24	25.8	22.8	23.7
Upper teeth, $c$ - $m^2$ .....	25	27.5	25	26.2	24	24.7
Lower teeth, $c$ - $m_3$ .....	27.8	30.2	27.8	29.8	26.2	27.2
Upper incisors, combined width .....	5.8	6	5.8	6.1	...	6.8
$p^3$ , length .....	4.6	5.1	4.6	5	4.2	4.8
„ width .....	3.2	3.5	3.1	3.5	3	3.2
$p^4$ , length .....	4.7	5.5	4.8	5.3	4.6	4.9
„ width .....	3.5	3.7	3.3	3.7	3.2	3.7
$m^1$ , length .....	5.5	5.9	5.4	5.8	5.2	5.7
„ width .....	3	3.2	3	3.2	2.9	3
$m^2$ , length .....	2.2	2.7	1.7	2.8	2.1	2.8
„ width .....	2	2.2	1.8	2.1	1.9	2.1
$p_1$ , length .....	2	2.2	1.8	2.2	2	2.2
„ width .....	1.8	2	1.8	2.2	1.8	2
$p_3$ , length .....	4.9	5.7	4.6	5.5	4.1	5
„ width .....	2.9	3	2.8	2.9	2.8	3
$p_4$ , length .....	4.8	5.2	4.8	5.1	4.3	5
„ width .....	3	3.2	2.9	3.2	2.8	3.1
$m_1$ , length .....	4.8	5	4.8	5	4.7	5
„ width .....	2.9	3	2.8	3	2.8	2.9
$m_2$ , length .....	3.6	3.8	3.5	3.8	3.6	3.8
„ width .....	2.7	2.8	2.7	2.8	2.3	2.7
$m_3$ , length .....	1.8	2.2	1.8	2.2	1.8	2.2
„ width .....	1.8	2	1.7	2	1.7	1.9

1 g. *Pteropus hypomelanus tomesi*, *Pet.*

- ? *Pteropus vociferus*, *Peale, U.S. Expl. Exp.* viii. *Mamm.* p. 19, text-fig. (skull) (1848: Mangsi I., Balabac Straits); *Wagner, Schreber's Säug., Suppl.* v. p. 601 (1853-55: Mangsi); *Giebel, Säug.* p. 1003, footnote (1855: Mangsi); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 444 (1870: Mangsi).
- ? *Pteropus* (*Spectrum*) *hypomelanus f. vociferus*, *Matschie, Megachir.* p. 25, cf. p. 11 (1899: Mangsi). *e. vociferus*, *Trouessart, Cat. Mamm., Suppl.* p. 52 (1904: Mangsi).
- ? *Pteropus inackloti* (*nec Temm.*), *Cassin, U.S. Expl. Exp.* viii. (2 ed.) p. 10, text-fig. (skull) (1858: Mangsi); *Peters, MB. Akad. Berlin*, 1867, p. 333 (pt.); *Dobson, Cat. Chir. B. M.* p. 66 (pt.) (1878); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 203 (pt.) (1879); *id., Cat. Mamm.* i. p. 83 (pt.) (1897).
- Pteropus hypomelanus* (*nec Temm.* subsp.), *Tomes, P. Z. S.* 1858, p. 536 (1859: Labuan); *Dobson, Cat. Chir. B. M.* p. 58 (pt.) (1878: Borneo); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 202 (pt.) (1879: Borneo); *Hose, Mamm. Borneo*, p. 38 (1893); *Everett, P. Z. S.* 1893, p. 494 (Borneo); *Trouessart, Cat. Mamm.* i. p. 82 (pt.) (1897: Borneo); *Willink, Nat. Tijds. Nederl. Ind.* lxx. p. 274 (pt.) (1905: Borneo).
- Pteropus hypomelanus var. tomesi*, *Peters, MB. Akad. Berlin*, 1868, p. 626 (Sarawak).
- Pteropus* (*Spectrum*) *hypomelanus e. tomesi*, *Matschie, Megachir.* p. 25 (1899: Borneo). *d. tomesi*, *Trouessart, Cat. Mamm., Suppl.* p. 52 (1904: Sarawak).
- Pteropus* (*hypomelanus*) *tomesi*, *Kloss, Journ. Fed. Mat. St. Mus.* ii. no. 3, p. 153 (1908: Pulo Rampa, Sembilan Is.).

*Diagnosis*.—Similar in size of teeth and external dimensions to *Pt. h. annexens*, but on the whole much darker; approximately seal-brown thinly sprinkled with greyish, and with mantle, head, and breast varying from dark maroon-chestnut to cinnamon-rufous. Forearm 123-142.5 mm. *Hab.* N. Borneo, with adjacent coast islands; Sembilan Is.

*Skull and teeth*.—Teeth as in *Pt. h. annexens*, but the skull may prove to average a little larger.

*Colour*.—Ordinary phase: breast a pale shade of hazel or cinnamon-rufous, generally washed with orange-buff (four specimens; ad. skin, teeth slightly worn, April, Mengalun I., 94.7.2.2: ♀ ad. al., teeth slightly worn, Darvel Bay, 94.7.14.3; ♂ ad. skin, teeth much worn, July, Sibutu I., 93.11.2.2; ad. skin, teeth somewhat worn, Aug. or Sept., Lamboyan I., 95.7.30.1).—Back and rump varying from blackish seal-brown to pale seal-brown, slightly or moderately, but never heavily, sprinkled with silvery whitish hairs.—Breast, or at least centre of breast, a pale shade of hazel or cinnamon-rufous, as a rule more or less conspicuously washed with orange-buff; on sides of breast, flanks, and belly the colour gradually, sometimes rather abruptly, darkens to seal-brown or blackish seal-brown with or without a slight admixture of greyish hairs.—Mantle varying from dark maroon-chestnut to chestnut cinnamon-rufous or chestnut-hazel, becoming gradually darker on

sides of neck, and dark chestnut or seal-brown on foreneck.—Crown similar to mantle, or rather brighter, or somewhat clouded with dark brown, indistinctly sprinkled with greyish or buffy hairs, passing through a darker shade on sides of head, into blackish seal-brown on throat.

A fifth specimen (♂ ad. al., teeth slightly worn, Darvel Bay, 94.7.14.2) is similar to the above in the colour of the mantle, head, and underparts, but on the sides of the back the number of silvery greyish-white hairs, washed with buffy, has so greatly increased as to change the general effect of the colour to buffy greyish-white sprinkled with blackish; rump greyish-white suffused with buffy and russet and slightly sprinkled with blackish. In the colour of the back and rump this specimen comes very near to certain individuals of *Pt. h. lepidus*, the only noteworthy difference being that the greyish-white colour does not extend to the median portion of the back.

In a sixth specimen (♂ ad. al., teeth much worn, Darvel Bay, 94.7.14.1) the whole of the back is very strongly suffused with russet, darkest on front of back, gradually merging into a paler (more golden ochraceous) shade on rump, and the colour of the breast and belly is rather brighter, more washed with ochraceous, than usual. In the whole of the coloration this specimen comes very near to *Pt. h. annexens*.

The blackish and the grey-bellied phases of this form are as yet unknown.

*Measurements.* On pp. 125, 126.

*Specimens examined.* Eight, in the collection of the British Museum.

*Range.* Sarawak; Labuan and Mengalun Islands (off N.W. Borneo); Sibutu Island (off N.E. Borneo); Lamboyan (off S. Palawan); Sembilan Islands (off N.E. Sumatra).

*Type* not in existence (?).

*Pteropus vociferus*, Peale; 1848.—Type locality, Mangsi Island, Balabac Straits; type in the U.S. National Museum (no. 3961). Ten years later identified by Cassin (*l.s.c.*) with *Pt.* [i. e. *Acerodon*] *mackloti*.—The following details about the type-specimen were kindly contributed by Dr. Marcus W. Lyon, Washington: Once mounted and on exhibition, then put away in storage; no skull found in the skin, and none in the collection known to belong to it [but must have been examined by Peale, since figured by him]; specimen not full-grown, actual length of forearm 117 mm., of tibia 60 mm.; furred area of back of normal breadth; fur so bleached that there is no telling what were the original colours.—Without an examination of the dentition it is impossible to decide whether *Pt. vociferus* is a *Pteropus* (in which case there can presumably only be question of a form of the *hypomelanus* type) or a small *Acerodon*. When to this it is added that the specimen is young and the colours unrecognizable, *Pt. vociferus* must, for the present at least, be put down as indeterminable.

*Pteropus hypomelanus* var. *tomesi*, Peters: 1868.—Name proposed

by Peters (*l. s. c.*) in a nominal list of Chiroptera obtained by the Marquis G. Doria in Sarawak. Peters refers, without description, to Tomes's paper in P. Z. S. for 1858 (*l. s. c.*), in which this latter author describes a specimen of *Pt. hypomelanus* obtained by James Motley in the island of Labuan and, in 1858, in the possession of Mr. L. L. Dillwyn. Type locality therefore Labuan, and type the specimen described by Tomes and considered by him a "dark variety" of *hypomelanus*. I have been unable to trace the fate of this specimen; judging from the description given by Tomes it was perfectly similar to the specimens here referred to *Pt. h. tomesi*.

*Remarks.*—*Pt. h. tomesi* is closely related to *Pt. h. canus*, *lepidus*, and *annectens*; it agrees with these races in the colour of the mantle, head, and underparts; but whereas in *canus*, *lepidus*, and *annectens* the back and rump are silvery greyish or silvery whitish sprinkled with blackish and with or without a buffy, russet, or Prout's brown suffusion, these parts are in *tomesi*, owing to a decrease of the silvery whitish and corresponding increase of the dark element of the colour, blackish or seal-brown sprinkled with greyish. The intimate relationship between all these races is further proved by the fact that *tomesi* is occasionally almost indistinguishable in the colour of the fur from *lepidus* (the fifth specimen described above) or *annectens* (the sixth). In dentition *tomesi* agrees perfectly with the majority of races of *hypomelanus*, i. e. it does not show the enlargement of the average size of the teeth characteristic of *canus* and *lepidus*.

a-c. 2 ♂ ad. al.; skulls.	Darvel Bay, N.E. Borneo.	Commander of H.M.S. 'Egeria' [P].	94.7.14.1-3.
d. Ad. sk.; skull.	Mengalun I., off N.W. Borneo; April, 1892.	A. Everett [C].	94.7.2.2.
e. ♂ ad. sk.; skull.	Sibutu I., off N.E. Borneo; July, 1893.	A. Everett [C].	93.11.2.2.
f. ♂ ad. al.; skull.	Sibutu I.; July, 1893.	A. Everett [C].	94.7.2.47.
g. Ad. sk.; skull.	Lamboyan I., off S. Palawan; Aug. or Sept. 1894.	Douglas Cator, Esq. [C. & P.].	95.7.30.1.
h. ♀ ad. sk.; skull.	Pulo Rampa, Sembilan Is., N.E. Sumatra; 7 Aug. 1906 ( <i>H. C. Robinson</i> ).	Kuala Lumpur Museum [P.].	8.1.25.32.

#### 1 h. *Pteropus hypomelanus cagayanus*, *Mearns*.

*Pteropus* [sp.], *Waterhouse*, P. Z. S. 1843, p. 67 (Philippines).  
*Pteropus hypomelanus* (*nee* Temm. subsp.), *Dobson*, Cat. Chir. B. M. p. 58, specimens a-d (1878: Dinagat); *Trouessart*, Rev. & Mag. Zool. (3) vi. p. 202 (pt.) (1879: S.E. Philippines); *Günther*,

- P. Z. S.* 1879, p. 74 (Dinagat; Surigao); *Steere, List Birds & Mamm. Steere Exp. Philipp.* p. 28 (1890: Guimaras; Panay; Leyte); *Elera, Cat. Sist. Faun. Filipinas*, p. 5 (pt.) (1895: Luzon; Dinagat; Mindanao); *Elliot, Field Col. Mus. Publ. ii. Zool. Ser. i. no. 3*, p. 76 (1896: Panay; Guimaras); *Trouessart, Cat. Mamm. i. p. 82* (1897: Dinagat); *Sanchez, An. Soc. Españ. Hist. Nat.* xxix. pp. 241, 275, 288 (1900-1901: Luzon; Leyte; Panay; Guimaras); *Elliot, Cat. Mamm. Field Col. Mus.* p. 491 (1907: Panay).
- Pteropus* (Spectrum) hypomelanus (pt.), *Matschie, Megachir.* pp. 23, 24 (1899: Cuyos Is.; Mindanao); *Trouessart, Cat. Mamm., Suppl.* p. 52 (1904: Philippines).
- Pteropus cagayanus*, *Mearns, Proc. U.S. Nat. Mus.* xxviii. p. 433 (13 May, 1905: Cagayan Sulu); *Miller, Fam. & Gen. Bats*, p. 58 (1907).

*Diagnosis*.—Similar in skull, teeth, and external dimensions to *Pt. h. tomesi*, but mantle averaging considerably brighter, and back and rump usually of a more Prout's brown tinge. A dark-coloured phase occurs. Forearm 135-141.5 mm. *Hab.* Cagayan Sulu; Philippines generally.

*Colour*.—(1) Brighter phase: breast and belly, or at least centre of breast, golden ochraceous or ochraceous-buff, with or without a tinge of orange-buff; mantle similar (three specimens; ad. skin, teeth much worn, June, Cagayan Sulu, 95.7.30.2, topotype; ♂ ad. al., teeth very slightly worn, Dinagat, 77.10.6.8; ♀ yg. ad. skin, Jan., Panay, 105445).—Back and rump varying from a dark shade of Prout's brown approaching seal-brown to almost typical Prout's brown, sometimes with a rather slight wash of dark russet; practically uniform, or more or less conspicuously sprinkled with silvery greyish-white hairs.—Breast, or breast and belly, varying from rich golden ochraceous to a tinge intermediate between buff and ochraceous-buff, in any case generally washed with orange-buff; on sides of breast and belly passing into dark chestnut, this again darkening into the seal-brown of the flanks.—Mantle rich golden ochraceous-buff, generally tinged with orange-buff and more or less clouded with tawny or hazel, particularly in front near occiput and posteriorly near back; passing through a darker shade on sides of neck into the dark cinnamon-rufous or pale chestnut of foreneck.—Crown of head similar to mantle, or more clouded with brownish and grizzled with silvery hairs; passing through a gradually darker tinge on sides of head, into seal-brown or chestnut seal-brown on throat.

(2) Intermediate stages.—One skin (♂ ad., teeth very slightly worn, Jan., Panay, 105441) has the whole of the back nearly uniform Prout's brown, and the mantle nearly uniform chestnut, lightening to rich golden ochraceous-buff in a transverse band between shoulders.—In two skins (♀ imm., Jan., Panay, 105446-47) the bright colour of the underparts is restricted to a narrow space on the centre of the breast; mantle approximately as in 105441.

(3) Dark phase: underparts seal-brown; a narrow space in centre of breast washed with tawny or ochraceous; mantle very

dark (♀ imm. al., Dinagat, 77.10.6.9; ♂ ad. skin, teeth somewhat worn, Jan., Panay, 105442).—Back and rump as in ordinary phase. Underparts uniform seal-brown, darkening to blackish on throat, and with a small area in centre of breast sprinkled with deep tawny hairs (one specimen) or washed with ochraceous (the other). Mantle chestnut heavily clouded with seal-brown, gradually darkening into the uniform seal-brown of the underparts. Head nearly similar to mantle, or strongly grizzled with hair-brown.

*Measurements.* On pp. 125, 126.

*Specimens examined.* Thirteen, from the collections of the U.S. National† and British Museums.

*Range.* \*Cagayan Sulu; Philippines: \*Luzon, Cuyos Is., \*Panay, Guimaras, Leyte, \*Dinagat, \*Mindanao (Surigao). Specimens have been examined from the localities marked with an asterisk.

*Type* in the U.S. National Museum (no. 125289).

*Pteropus cagayanus*. Mearns; 1905.—Original description based on three skins and skulls from Cagayan Sulu. Separated by Mearns from *Pt. hypomelanus* chiefly on colour characters; the skins "were temporarily preserved in formalin, but the colors [Mearns writes] have not been materially changed." A comparison of Mearns's two paratypes with a topotype in the British Museum proves, beyond doubt, that the colour of the mantle in Mearns's specimens has been considerably bleached by the preserving fluid, which has also partly discoloured the membranes; these specimens have therefore been entirely excluded from the above description of the colours. According to Mearns, "the skull and teeth of *P. cagayanus* are decidedly smaller than in Steere's specimens from Panay, which he called '*Pteropus hypomelanus*'"; I am unable to see any difference in the size of the skull and teeth between three specimens from Cagayan Sulu and five of Steere's specimens from Panay.

*Remarks.*—*Pt. h. cagayanus* is intermediate between *Pt. h. tomesi* (Borneo) and *macassaricus* (Celebes); from either of these races it can only be discriminated on average colour characters. It differs from *tomesi* in the rather brighter mantle and rather more Prout's brown tinge of the back; in both of these respects it agrees with, or comes very near to, *macassaricus*, in which, however, the underparts average slightly paler.

a, b. ♀ ad., ♂ pull. al.	Luzon ( <i>H. Cuning</i> ).	Zool. Soc. Coll.	Not reg.
c, d. ♂ ad., ♀ imm. al.; skulls.	Dinagat.	Purchased (Higgins).	77.10.6.8, 9.
e. ♀ pull. al.	Surigao.	Purchased (Higgins).	77.10.6.10.
f. Ad. sk.; skull.	Cagayan Sulu; June, 1894.	Douglas Cator, Esq. [C. & P.].	95.7.30.2.

† Nos. 125290-91 (Cagayan Sulu: paratypes of *Pt. cagayanus*, Mearns); 105141-42, 105445-47 (Panay: Steere Exp.).

1 i. *Pteropus hypomelanus macassaricus*, Heude.

- Pteropus hypomelanus* (nec Temm. subsp.), Dobson, *Cat. Chir. B. M.* p. 58, specimens *f, g, h* (1878: Sanghir Is.; N. Celebes); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 202 (pt.) (1879: Sanghir; N. Celebes); Jentink, *Notes Leyden Mus.* v. p. 173 (1883: N. Celebes); *id.*, *Cat. Ost. Mamm.* p. 262, specimens *l, o* (1887: Siao, Sanghir); *id.*, *Cat. Syst. Mamm.* pp. 148, 149, specimens *n, q, r* (1888: Siao, Sanghir); *id.*, in *Weber's Zool. Ergebn. Reise Niederl. Ost-Ind.* i. p. 96 (1890-91: Macassar); Trouessart, *Cat. Mamm.* i. p. 82 (pt.) (1897: N. Celebes); Willink, *Nat. Tijds. Nederl. Ind.* lxx. p. 274 (pt.) (1905: Sanghir; Celebes).
- Pteropus* (Spectrum) *hypomelanus* (pt.), Matschie, *Megachir.* pp. 23, 24 (1899: Sanghir; Gorontalo; Macassar); Trouessart, *Cat. Mamm., Suppl.* p. 52 (1904: Sanghir; Celebes).
- Pteropus macassaricus*, Heude, *Mém. Hist. Nat. Emp. Chin.* iii. p. 177, footnote, pl. v. fig. 4 (teeth) (1896: Macassar).
- Pteropus* (Spectrum) *hypomelanus i. macassaricus*, Matschie, *Megachir.* p. 26 (1899). *h. macassaricus*, Trouessart, *Cat. Mamm., Suppl.* p. 52 (1904: Macassar).

*Diagnosis*.—Similar to *Pt. h. cagayanus*, but underparts paler. A dark phase occurs. Forearm 131-145.5 mm. *Hab.* Celebes; Sanghir Is.; Talaut Is.

*Colour*.—(1) Bright phase: underparts some shade of ochraceous (four specimens: ♂ imm., ♂ ad. skins, teeth slightly worn, Sanghir Is., 76.10.21.1, 2; ♂ ad. al., teeth somewhat worn, N. Celebes, 72.4.15.2; ♂ juv. skin, Talant Is., 8.7.26.5).—Back and rump between seal-brown and Prout's brown, with or without a distinct wash of russet, and generally rather thinly sprinkled with silvery greyish-white hairs.—Breast and belly yellowish ochraceous-buff, in one specimen clouded with tawny, passing into seal-brown or chestnut seal-brown on flanks and anal region; extreme bases of bright-coloured hairs dark brown.—Mantle tawny, nearly pure in tinge or somewhat clouded with hazel, generally distinctly paler posteriorly near back, becoming slightly darker on sides of neck, and passing into russet, or russet washed with hazel, on foreneck.—Crown similar to mantle or rather paler (one specimen), or very distinctly grizzled with silvery grey, darkening on sides of head into the dark vandyck-brown or seal-brown on throat.

(2) Dark phase: breast, belly, and flanks uniform blackish seal-brown (♂ ad. skin, teeth well worn, Oct., Menado, 97.1.2.3).—Back and rump uniform glossy seal-brown. Breast, belly, and flanks uniform glossy blackish seal-brown. Mantle rich golden tawny hazel tinged with orange-ochraceous, darker on sides of neck, and clouded with seal-brown on foreneck. Head similar to mantle, but considerably clouded with dark chestnut, this latter tinge predominating on sides of head, and passing into chestnut seal-brown on throat.—The fur of this specimen is new and perfectly unabraded.

*Measurements*. On pp. 125, 126.

*Specimens examined*. Nine, in the collections of the Leyden and British Museums.

*Range*. Celebes (Menado; Macassar); Sanghir Islands; Talant Islands (Lirong).



*Type* presumably in the Zi-ka-wei Museum, near Shanghai.

*Pteropus macassaricus*, Heude; 1896.—From the description clearly a member of the *Pt. hypomelanus* group. One of ten specimens examined by Heude had "le dos d'un roux foncé ainsi que la poitrine et le ventre," *i. e.* belonged to the dark phase.

*Remarks*.—In the skull, teeth, size, and colour of the head, mantle, and back, this race is similar to the Philippine form, *Pt. h. cagayanus*, but the underparts average rather paler. In this latter point it shows decidedly leanings to its eastern neighbour, *Pt. h. hypomelanus*.

a. ♂ ad. al.; skull.	N. Celebes.	Dr. A. B. Meyer	72.4.15.2.
b. ♂ ad. sk.; skull.	Menado, N. Celebes; Oct. 1895.	[C.] Dr. Chas. Hose	97.1.2.3.
c. ♀ ad. sk. in al.	Macassar, S. Celebes; 29 Aug. 1895.	Drs. Sarasin[E.].	99.10.1.15.
d. c. ♂ imm., ♂ ad. sks.; skulls.	Sanghir Is.	Dr. A. B. Meyer	76.10.21.1.2.
f. ♂ juv. sk.; skull.	Lirong, Talaut Is.; May, 1897 ( <i>J.</i> <i>Waterstradt</i> ).	[C.] Hon. W. Rothschild [P.].	8.7.26.5.

*External measurements of Pteropus hypomelanus tomesi, cagayanus, and macassaricus.*

*Pt. hypomelanus*

	<i>tomesi</i> , 8 ad.		<i>cagayanus</i> , 6 ad.		<i>macassaricus</i> , 4 ad.	
	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Forearm .....	128	142.5	135	141.5	131	145.5
Pollex, total length, c. u. ....	56	61	56	62	55	62.5
„ metacarpal .....	13	14	13	14	13	14.5
„ 1st phalanx .....	29	31	29.5	32	29.5	33
2nd digit, metacarpal .....	65	74.5	67	74	66.5	73
„ 1st phalanx .....	15	17	15	18.5	15	17
„ 2nd-3rd phalanx, c. u. ....	14.5	15.5	14	16.5	14.5	18
3rd digit, metacarpal .....	87.5	96.5	91	96.5	88.5	97.5
„ 1st phalanx .....	63	69.5	65	70.5	66	71
„ 2nd phalanx .....	94	101.5	92.5	99	95.5	99
4th digit, metacarpal .....	85.5	93.5	89	94.5	87	93.5
„ 1st phalanx .....	53.5	58.5	54	57.5	54	58
„ 2nd phalanx .....	54.5	58.5	54	57.5	52.5	...
5th digit, metacarpal .....	91	100	93.5	102	93.5	102
„ 1st phalanx .....	39	43.5	39	42.5	38	42
„ 2nd phalanx .....	41	44.5	40	41.5	37	38.5
Ears, length from orifice .....	24.5	26	24	26.5	22	25
„ greatest width, flattened ...	17	18	16.5	18.5	16.5	18
Front of eye to tip of muzzle .....	24	27.5	24.5	26	...	...
Interfemoral .....	0	2.5	0	0	0	3
Lower leg .....	60.5	65	59	63	60.5	...
Foot, c. u. ....	40.5	45	40.5	44.5	38	40.5
Calcari .....	14.5	16	15	16	...	17.5

*Measurements of skulls and teeth of Pteropus hypomelanus tomesi, cagayanus, and macassaricus.*

	<i>Pt. hypomelanus.</i>					
	<i>tomesi.</i>		<i>cagayanus.</i>		<i>macassaricus.</i>	
	Skulls and teeth: 7 ad.		Skulls: 5 ad. Teeth: 6 ad., 4 imm.		Skulls: 3 ad. Teeth: 3 ad., 2 imm.	
	Min.	Max.	Min.	Max.	Min.	Max.
Skull, total length to gnathion .....	62.8	67.7	63.7	65	64	...
„ palation to incisive foramina .....	30	35	30.8	33	30.7	33.5
„ front of orbit to tip of nasals .....	20.8	22.7	20.8	22.2	19.8	...
„ width of brain-case at zygomata .....	22	23.7	21.8	23.2	...	23.2
„ zygomatic width .....	32.5	37.5	35	37	35	...
„ width across $m^1$ , externally .....	17	18.7	17.2	18	17.7	18.2
„ lachrymal width .....	13.5	15.7	13.2	13.5	...	14.8
„ width across canines, externally .....	11.8	13.2	12.5	13	13.2	13.7
„ postorbital constriction .....	6.8	8	7.2	8.2	...	8.7
„ interorbital constriction .....	8	9.3	8.7	9.5	9	9.8
„ width of mesopterygoid fossa .....	7.6	8	7	7.8	...	7.8
„ between $p^4$ - $p^4$ , internally .....	9.8	11.7	9	10.2	10.7	11.2
„ between cingula of canines .....	6.5	7.7	7	7.5	7.3	7.6
„ orbital diameter .....	12.7	13.2	12.7	12.9	12.9	13.1
Mandible, length .....	49	53.7	49.7	51.5	50.5	53
„ coronoid height .....	22.8	25.8	23.2	25.2	23	26.2
Upper teeth, $c-m^2$ .....	23.8	26.2	23.8	25.7	23.8	25.8
Lower teeth, $c-m_3$ .....	26.5	28.8	25.7	28.5	26	28.2
Upper incisors, combined width .....	5.7	6.1	6	6.2	6	...
$p^3$ , length .....	4.2	4.8	4	4.5	4.2	4.7
„ width .....	3	3.2	3	3.2	3.2	3.2
$p^4$ , length .....	4.4	5	4.2	4.8	4.7	4.8
„ width .....	3.2	3.6	3.2	3.6	3.5	3.7
$m^1$ , length .....	4.8	5.7	4.9	5.5	5	5.6
„ width .....	3	3.2	3	3.1	3	3.2
$m^2$ , length .....	2	2.7	2	2.5	2	2.8
„ width .....	1.8	2.2	1.8	2.2	2	2.2
$p_1$ , length .....	2	2.1	1.8	2.5	1.8	2
„ width .....	1.8	1.8	1.7	2	1.7	1.8
$p_3$ , length .....	4.1	5	4.1	4.8	4.2	4.8
„ width .....	2.8	2.9	2.7	2.9	2.8	3
$p_5$ , length .....	4.2	5	4.5	4.9	4.7	5
„ width .....	3	3.1	2.8	3	3	3.1
$m_1$ , length .....	4.2	4.8	4.6	5	4.8	4.9
„ width .....	2.9	3	2.8	3	2.8	3
$m_2$ , length .....	3.5	3.8	3.2	3.8	3.5	4
„ width .....	2.7	2.8	2.6	2.8	2.6	2.8
$m_3$ , length .....	2	2.1	1.7	2.2	2	2.1
„ width .....	1.7	2	1.6	2	1.7	2

1j. *Pteropus hypomelanus hypomelanus*, Temm.

*Pteropus hypomelanus*, Temminck, Esq. Zool. p. 61 (pt.) (1853: Ternate); Wagner, Schreber's Säug., Suppl. v. p. 599 (1853-55: Ternate); Peters, MB. Akad. Berlin, 1867, p. 330 (Ternate); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 434 (1870: Ternate); Dobson, Cat. Chir. B. M. p. 58 (pt., viz. specimen i) (1878: Ternate); Trouessart, Rev. & Mag. Zool. (3) vi. p. 202 (pt.) (1879: Ternate); Jentink, Cat. Ost. Mamm. p. 261 (pt., viz. specimens b-e) (1887: Ternate); id., Cat. Syst. Mamm. p. 148 (pt., viz. specimens c, d, f, g, h) (1888: Ternate); Trouessart, Cat. Mamm. i. p. 82 (pt.) (1897: Ternate); Willink, Nat. Tijd. Nederl. Ind. lxx. p. 274 (pt.) (1905: Ternate; Gilolo); Miller, Fam. & Gen. Bats, p. 58 (pt.) (1907).

*Pteropus* (Spectrum) *hypomelanus*, Matschie, Megachir. p. 23 (pt.) (1899: Ternate); id., Abh. Senckenb. Ges. xxv. Heft ii. p. 268, pl. xiii. figs. 4, 4a (skull of young) (1900: Gilolo; milk-entition); Trouessart, Cat. Mamm., Suppl. p. 52 (pt.) (1904: Ternate).

*Pteropus tricolor*, Gray, Cat. Monk. &c. p. 108 (1870: Ternate).

"*Pteropus spectrum*, Matschie," Willink, Nat. Tijd. Nederl. Ind. lxx. p. 274, among synonyms of *Pt. hypomelanus* (1905) (probably error for *Pteropus* (*Spectrum*) *hypomelanus*).

*Diagnosis*.—Intermediate in colour between *Pt. h. macassaricus* and the palest race of the species, *Pt. h. luteus* (New Guinea). Size as these races. *Hab.* Gilolo group.

*Colour*.—♀ imm. skin, Ternate, 60.8.26.1, type of *Pt. tricolor*, Gray.—Back and rump pale seal-brown with a few shiny greyish white hairs.—Breast and belly glossy golden buffy: extreme base of hairs dark brown; flanks and anal region dark vandyck-brown.—Mantle ochraceous-buff tinged with ochraceous, passing into a darker shade of ochraceous on sides of neck and foreneck; extreme base of hairs dark brown.—Crown whitish grey slightly sprinkled with blackish hairs (old, somewhat abraded fur), and irregularly blotched with a colour similar to that of the mantle (new fur, on the point of replacing the mixed whitish-grey and blackish hairs); sides of head grizzled greyish and brownish; throat dark brown.

A dealer's skin (Verreaux), labelled Ternate, closely resembles the above in colour, but the crown is light ochraceous without admixture of whitish grey.

*Measurements*. On p. 131. (External measurements omitted, owing to immaturity of specimens examined.)

*Specimens examined*. Seven, in the collections of the Leyden (five) and British Museums, including the cotypes of the species and the type of *Pt. tricolor*, Gray.

*Range*. Ternate; Gilolo.

*Cotypes* in the Leyden Museum.

*Pteropus hypomelanus*, Temminck: 1853.—Based on "plusieurs individus" collected in Ternate, by Forsten. Of these are now in

the Leyden Collection three mounted specimens (Cat. Syst. p. 148, *b*, *c*, *d*) and two skulls (Cat. Ost. p. 261, *a* and *e*). An examination of these specimens has satisfied me that the original material on which Temminck founded *Pt. hypomelanus* consisted of two different species, *Pt. hypomelanus* and *caniceps*. The mounted specimen *b* (♂ ad.) and the skull *a* are *caniceps*; the former is, no doubt, the specimen to which Temminck himself called attention as differing in colour from the others (Esquisses. p. 62). The real cotypes of *hypomelanus* are, therefore, the mounted specimens *c* and *d*, and the skull *e* (not full-grown). Cotype *c* is a ♀ imm., not quite full-grown; cotype *d* is a ♂ yg. ad., quite or nearly full-grown, though with unconsolidated finger-joints. The colour of the fur is in both somewhat bleached, but has undoubtedly been quite similar to that of the British Museum specimens.

*Pteropus tricolor*, Gray; 1870.—Type locality, Ternate; type (skin and skull) in collection. Based on a topotype of *Pt. hypomelanus*. The species called by Gray "*Pt. hypomelas*" (Cat. Monk. &c. p. 110; 1870) is *Pt. aruensis*, Pet.

*a*. ♀ imm. sk.; skull. Ternate.

Dr. A. R. Wallace [C.]. 60.8.26.1.  
(Type of *Pt. tricolor*, Gray.)

*b*. Imm. st.; skull. Ternate.

Tomes Coll. (Verreaux). Not reg.

### 1 *k*. *Pteropus hypomelanus luteus*, *K. And.*

*Pteropus hypomelanus* (*nec* Temm. subsp.), *Dobson*, *Cat. Chir. B. M.* p. 58, specimen *j* (1878: S. of Huon Gulf, New Guinea); *Trouessart*, *Rev. & Mag. Zool.* (3) vi. p. 202 (pt.) (1879: Huon Gulf); *Dobson*, *P. Z. S.* 1878, p. 875 (1879: Amberbaki, New Guinea); *Peters & Doria*, *Ann. Mus. Civ. Genova*, xvi. p. 690 (1881: New Guinea); *Thomas*, *Nor. Zool.* ii. p. 163 (1895: Fergusson I., D'Entrecasteaux Group); *id.*, *op. cit.* iii. p. 526 (1896: Kiriwina I., Trobriand Group); *id.*, *Ann. Mus. Civ. Genova*, (2) xviii. p. 608 (1897: Woodlark I.); *Heller*, *Abh. Mus. Dresden*, vi. no. 8, p. 4 (1897: Amberbaki; Huon Gulf; Trobriand; D'Entrecasteaux); *Trouessart*, *Cat. Mamm.* i. p. 82 (pt.) (1897: New Guinea); *Willink*, *Nat. Tijds. Nederl. Ind.* lxx. p. 274 (pt.) (1905: New Guinea).

*Pteropus* (Spectrum) *hypomelanus*, *Matschie*, *Megachir.* p. 24 (pt.) (1899: Mafur, N.W. New Guinea; Woodlark I.); *Trouessart*, *Cat. Mamm.*, *Suppl.* p. 52 (pt.) (1904: N.W. New Guinea).

*Spectrum hypomelanum*, *Matschie*, in *Krieger's Neu-Guinea*, p. 77 (1899: N. New Guinea); *Jentink*, *Notes Leyden Mus.* xxviii. pp. 164, 209 (1906).

*Pteropus hypomelanus luteus*, *K. Andersen*, *Ann. & Mag. N. H.* (8) ii. p. 362 (1 Oct. 1908: New Guinea; Conflict Is.; Trobriand Is.; Woodlark I.).

*Diagnosis*.—The palest race of the species: back, rump, and flanks some shade of brown (from nearly seal-brown to mars-brown); head, mantle, throat, foreneck, breast, and belly some shade of ochraceous-buff, buff, or cream-buff, with or without a brownish

wash on throat and anal region. Forearm 128.5-135.5 mm.  
*Hab.* New Guinea, as far south-east as Woodlark I.

*Colour* (whole series examined).—Back and rump varying in tinge from a shade of brown approaching seal-brown (two specimens), through vandyck-brown (two), to mars-brown (three), the lighter tinges, viz. vandyck-brown and mars-brown, evidently due to a more or less complete suffusion of a darker shade of brown with russet (as is the case in most races of the species), a slighter suffusion with russet making the general effect of the colour vandyck-brown, a stronger suffusion mars-brown. Colour uniform, or rather paler on rump than on back. The usual admixture of silvery greyish-white hairs in all specimens so slight as not to change the general uniform aspect of the colour.—Breast and belly varying from ochraceous-buff with a peculiar golden hue, to cream-buff, this colour in most specimens extending over the whole of the breast and belly, while in others the hinder part of the belly is more or less (in one strongly) clouded with brown of a shade similar to that of the back. Bright-coloured hairs uniform from tip to base, or with concealed dark brown bases. Flanks brownish, similar to back.—Crown, mantle, sides of neck, and foreneck similar to breast and belly; sides of head often washed with russet or brownish; throat similar to foreneck, or clouded with paler or darker vandyck-brown.

No blackish phase known.

*Measurements.* On pp. 130, 131.

*Specimens examined.* See list below.

*Range.* New Guinea; Conflict Is. (Itamarina); Trobriand Group (Kiriwina); Woodlark I.

*Type* in collection.

*Remarks.*—The difference in colour between *Pt. h. luteus* and any of the western races (*geminus*, *enganus*, *condorensis*, *canus*, *lepidus*, *annectens*, *tomesti*) is great, but the gap is completely over-bridged by those races which, step for step, through the Gilolo group (*hypomelanus*), Celebes (*macassaricus*), and Philippines (*eagayanus*), lead, in colour as in geographical habitat, from *luteus* to the darker-coloured western races. The intimate relationship between all these forms is further shown by the fact that, save in the colour of the fur, they are in all respects (*i. e.* in skull, teeth, ears, quality, distribution and length of fur, and external dimensions) indistinguishable from each other, except *enganus* which averages smaller, and *canus* and *lepidus* in which the teeth average slightly larger.

<i>a, b.</i> ♂ yg. ad., ♂ imm. ad.; skulls.	New Guinea.	Rev. S. Macfarlane [C.].	789.14.1. 2.
<i>c.</i> Ad. sk.; skull.	S. of Huon Gulf, New Guinea.	Dr. P. Comrie [C.].	767.5.7.
<i>d.</i> ♂ imm. sk.	Itamarina, Con- flict Is.: 17 Jan. 1903.	W. Stalker [C.].	Not reg.

e. Imm. sk.; skull.	Kiriwina I., Tro- briand Group; 15 Feb. 1895.	A. S. Meek [C.].	96.11.5.5.
f. ♂ ad. sk.; skull.	Kiriwina I.; 17 Feb. 1895.	A. S. Meek [C.]. (Type of subspecies.)	96.11.5.4.
g. ♀ ad. al.; skull.	Woodlark I.; Mar. 1890 ( <i>Dr. L. Loria</i> ).	Museo Civico, Genoa [P.].	97.8.7.3.

*External measurements of subspecies of  
Pteropus hypomelanus.*

	<i>Pt. hypomelanus</i>			
	<i>luteus.</i> 4 ad. (Incl. type.)		All races, except <i>enganus</i> *. 40 ad.	
	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.
Forearm .....	128.5	135.5	128	145.5
Pollex, total length, c. u. ....	55.5	59	55	62.5
" metacarpal .....	12	13.5	12	14.5
" 1st phalanx .....	29	29	28	33
2nd digit, metacarpal .....	63	68	63	74.5
" 1st phalanx .....	14	16.5	14	18
" 2nd-3rd phalanx, c. u. ....	15	15.5	13	18
3rd digit, metacarpal .....	87	93	87	97.5
" 1st phalanx .....	63.5	65	63	71
" 2nd phalanx .....	93.5	96	92	106
4th digit, metacarpal .....	85.5	89.5	85.5	95
" 1st phalanx .....	51.5	54.5	51.5	58.5
" 2nd phalanx .....	52	55.5	50	60
5th digit, metacarpal .....	89.5	94.5	89.5	102
" 1st phalanx .....	38	39.5	38	43.5
" 2nd phalanx .....	38.5	40	37	46
Ears, length from orifice .....	25.5	27	22	27
" greatest width, flattened .....	18	20	16.5	20
Front of eye to tip of muzzle .....	...	25.5	24	27.5
Interfemoral ....	0	4	0	4
Lower leg .....	57.5	60.5	57.5	66
Foot, c. u. ....	41	42.5	38	50
Calcar .....	17	17.5	14	17.5

\* For comparison with measurements of *Pt. h. enganus* (p. 111), to show smaller average size of that race.

*Measurements of skulls and teeth of subspecies of*  
*Pteropus hypomelanus.*

	<i>Pt. hypomelanus</i>					
	<i>hypomelanus.</i> Skull: 1 ad. Teeth: 1 ad., 2 imm.		<i>luteus.</i> Skulls: 4 ad. Teeth: 3 ad., 2 imm. (Incl. type.)		All races, except <i>canus</i> and <i>lepidus</i> †. Skulls: 35 ad. Teeth: 36 ad., 14 imm.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	.....	.....	63.8	65.5	61.3	68.7
„ palation to incisive foramina .....	.....	.....	30	31.8	30	35
„ front of orbit to tip of nasals .....	21	21	20.2	22.8	19.8	23
„ width of brain-case at zygomata .....	23	23	22.8	23	21.8	23.7
„ zygomatic width .....	35	35	33.7	36.8	31.2	37.5
„ width across m <sup>1</sup> , externally .....	17.5	17.5	17.2	19	16.5	19
„ lachrymal width .....	.....	.....	13.8	14.6	13.2	15.7
„ width across canines externally .....	12.8	12.8	12.7	14	11.6	14
„ postorbital constriction .....	.....	.....	7.6*	9.2	6.8	9.2
„ interorbital constriction .....	.....	.....	8	9.2	8	9.8
„ width of mesopterygoid fossa .....	.....	.....	7.7	8.2	7	8.2
„ between p <sup>1</sup> -p <sup>4</sup> , internally .....	.....	.....	10	11	9	11.7
„ between cingula of canines .....	.....	.....	6.7	7.9	6.4	7.9
„ orbital diameter .....	13	13	12.8	13.1	12.7	13.2
Mandible, length .....	50.5	50.5	47.7	51.5	47.7	53.7
„ coronoid height .....	25.5	25.5	22.5	24.2	20.7	26.2
Upper teeth, c-m <sup>2</sup> .....	23.5	23.5	23.2	24.8	22.8	26.2
Lower teeth, c-m <sub>3</sub> .....	27	27	26.7	27.8	25.7	28.8
Upper incisors, combined width .....	.....	.....	5.9	6.7	5.7	6.8
p <sup>1</sup> , length .....	4.2	4.7	4.2	4.9	3.9	4.9
„ width .....	3.1	3.3	3	3.2	2.9	3.3
p <sup>2</sup> , length .....	4.3	4.7	4.3	4.8	3.7	5
„ width .....	3.2	3.6	3.2	3.7	3	3.7
m <sup>1</sup> , length .....	5.1	5.7	5.2	5.7	4.8	5.7
„ width .....	3	3.1	3	3.5	2.9	3.5
m <sup>2</sup> , length .....	2.7	2.8	2.1	3	2	3
„ width .....	2	2.1	1.9	2.5	1.8	2.5
p <sub>1</sub> , length .....	2.1	2.1	1.8	2.4	1.8	2.5
„ width .....	2	2	1.7	2.1	1.7	2.1
p <sub>2</sub> , length .....	4.6	4.8	4.6	5.1	4.1	5.1
„ width .....	2.8	3	2.8	3	2.5	3
p <sub>3</sub> , length .....	4.5	4.8	4.2	5	4.1	5
„ width .....	3	3.1	3	3.2	2.8	3.2
m <sub>1</sub> , length .....	4.7	5	4.8	5.2	4.2	5.2
„ width .....	2.8	3	3	3.2	2.8	3.2
m <sub>2</sub> , length .....	3.7	3.8	3.7	4	3.2	4
„ width .....	2.8	2.8	2.8	3	2.3	3
m <sub>3</sub> , length .....	2	2.2	1.8	2.2	1.6	2.2
„ width .....	1.8	2	1.6	2	1.6	2

\* Senile specimen.

†. For comparison with measurements of *Pt. h. canus* and *lepidus* (p. 118), to show slightly larger average size of mandible, upper and lower tooth-rows, and some of the cheek-teeth in those races.

## 2. *Pteropus speciosus*, K. Andl.

*Pteropus speciosus*, K. Andersen, *Ann. & Mag. N. H.* (8) ii. p. 364 (1 Oct. 1908: Malanipa I.; Sibutu I.).

*Diagnosis*.—Similar to *Pt. hypomelanus*, but with considerably smaller skull. Back blackish sprinkled with light grey; breast and belly approximately orange tawny. A blackish phase occurs. Forearm about 120–123 mm. *Hab.* Sulu Archipelago.

*Skull and teeth*.—Skull similar to that of *Pt. hypomelanus*, but considerably smaller: total length about 57 mm., against 61–69 in all forms of *hypomelanus*; median palatal length (palation to incisive foramina) 28.5–29, against 30–35; mandible 45.2–46.2, against 48–55.—Individual teeth very nearly of the same size as in small-toothed specimens of the smallest race of *hypomelanus*, *Pt. h. enganus*.

*Colour*.—Light phase: ♂ ad. al., teeth slightly worn, Malanipa I., 90.2.20.4, type.—Back and rump blackish, conspicuously sprinkled all over with shining silvery whitish-grey hairs, producing the general effect of a grizzled blackish and pale grey.—Breast and front of belly orange-tawny, somewhat clouded with chestnut laterally towards the flanks; extreme base of hairs dark brown. Flanks, hinder belly, and anal region similar to back.—Mantle rich hazel, becoming rather lighter and more tinged with ochraceous posteriorly near back, and passing through a darker shade on sides of neck into chestnut on foreneck.—Crown buffy slightly sprinkled with blackish hairs; sides of head seal-brown sprinkled with buffy grey; throat blackish thinly mixed with buffy grey (total aspect similar to that of flanks).

Dark phase: ♀ ad. sk., teeth extremely worn, July, Sibutu I., 93.11.2.3.—Back and rump seal-brown somewhat varied with light grey, particularly on sides of back along membranes. Underparts seal-brown, washed with dull russet on breast. Mantle nearly vandyck-brown, becoming darker on sides of neck, gradually passing into the dark seal-brown of the foreneck. Crown and sides of head grizzled light grey and blackish seal-brown, producing the total impression of a dark hair-brown; throat blackish.

The lighter phase described above is rather similar to that of *Pt. h. tomesi*, though with the colour of the mantle more like that of *Pt. h. cagayanus*; the dark phase is almost indistinguishable in colour from the black-bellied phase of *Pt. h. geminorum*.

*External dimensions*.—As the smallest specimens of *Pt. h. enganus*.

*Measurements*. On pp. 134, 135.

*Specimens examined*. Two, in the collection of the British Museum.

*Range*. Sibutu I., off N.E. Borneo; Malanipa I., off Zamboanga. *Type* in collection.

*Remarks*.—The skulls of the Sibutu and Malanipa specimens, one from each island, are perfectly alike; the teeth in the Sibutu



skull are so excessively worn as to be useless for study; the Sibutu skin is evidently in the blackish, the Malanipa specimen in the light phase.

a. ♂	ad. al. ; skull.	Malanipa I., off Zam- boanga (' Chal- lenger' Exp.).	Lords of the Treasury [P.]	90.2.20.4.
b. ♀	ad. sk. ; skull.	Sibutu I., off N.E. Borneo; July, 1893.	A. Everett [C.]	93.11.2.3.

(Type of species.)

### 3. *Pteropus mimus*, K. And.

*Pteropus hypomelanus* (pt.), Dobson, Cat. Chir. B. M. p. 57.

*Pteropus hypomelanus* (nec Temm.), Dobson, op. s. c. p. 58, specimen e (1878: Luzon); A. B. Meyer, Abh. Mus. Dresden, vii. no. 7, p. 6 (pt.) (1899: Macassar).

*Pteropus mimus*, K. Andersen, Ann. & Mag. N. H. (8) ii. p. 364 (1 Oct. 1908: Macassar).

*Diagnosis*.—Similar to *Pt. speciosus*, but back uniform vandyck-brown and underparts much lighter. A blackish phase occurs. Forearm about 127 mm. *Hab.* Celebes; Philippines.

*Colour*.—♀ ad. skin, teeth much worn, Macassar, 7.1.1.239, type: Back and rump vandyck-brown washed with mars-brown on rump and with seal-brown on interfemoral along inner side of femur and proximal half of tibia.—Breast and belly pale golden ochraceous tinged with orange, heavily clouded with mars-brown on breast and erissum, purer in tinge on belly; concealed base of fur dark brown. Flanks dark Prout's brown, many of the hairs with tawny tips.—Mantle rich ochraceous-buff strongly tinged with orange, palest posteriorly near back, darkest (more tawny) in front; sides of neck and foreneck nearly tawny. Concealed bases of hairs seal-brown.—Crown similar to mantle; forehead and sides of head brownish mixed with buffy hairs or tips to the hairs; throat seal-brown.

A second skin from Macassar (♂ juv., not full-grown, 7.1.1.240) is similar to the foregoing, but mantle considerably darker, between cinnamon and russet. This specimen is of particular interest as showing an initial transitional stage to the dark phase, the faded and abraded pale brownish fur on the rump being replaced by fresh blackish seal-brown hairs.

A specimen from Luzon (♀ ad. al., teeth well worn, colour apparently not deteriorated, 72.8.20.13) is similar to the type, but with breast lighter, more deep golden ochraceous-buff.

The colour of these specimens is much like that of *Pt. hypomelanus macassaricus*.

*Measurements*. On pp. 134, 135.

*Specimens examined*. Three, in the collection of the British Museum.

*Range*. Celebes (Macassar); Philippines (Luzon).

*Type* in collection.

*Remarks.*—This species is similar to *Pt. speciosus* in skull and teeth, but differs considerably in the colour of the fur. I am unable to distinguish the single Luzon from the single adult Macassar specimen.—Of six specimens collected by the Drs. Sarasin in Macassar and mentioned by Dr. A. B. Meyer (*l. s. c.*), one is evidently young (forearm 100 mm.); if the others are adult they probably belong to this species (forearm 120–128 mm.).

a. ♀ ad. al.; skull.	Luzon.	Dr. A. B. Meyer	72.8.20.13.
		[C.]	
b. ♀ ad. sk.; skull.	Macassar (Dr. A. R. Wallace).	Tomes Coll.	7.1.1.239.
		(Type of species.)	
c. ♂ jun. sk.; skull.	Macassar (Dr. A. R. Wallace).	Tomes Coll.	7.1.1.240.

*External measurements of Pteropus speciosus and mimus.*

	<i>Pt. speciosus</i> , 2 ad. (Type and paratype.)		<i>Pt. mimus</i> , 2 ad. (Type and paratype.)	
	♂ ad. Type.	♀ ad. Paratype*.	♀ ad. Type.	♀ ad. Paratype†.
	mm.	mm.	mm.	mm.
Forearm .....	120.5	123	...	127.5
Pollex, total length, c. u. ....	53	50	55	54.5
" metacarpal .....	12	...	13	...
" 1st phalanx .....	28	...	29	...
2nd digit, metacarpal .....	59.5	61	62	65
" 1st phalanx .....	14.5	14.5	15	12.5
" 2nd–3rd phalanx, c. u. ....	13	11.5	13	12
3rd digit, metacarpal .....	81	85.5	83	89
" 1st phalanx .....	57.5	55	58.5	61.5
" 2nd phalanx .....	89	92	84	94
4th digit, metacarpal .....	78	83	80	85
" 1st phalanx .....	49	50.5	48.5	50.5
" 2nd phalanx .....	46	50	...	53
5th digit, metacarpal .....	85	88.5	85	91
" 1st phalanx .....	37	35.5	36	36
" 2nd phalanx .....	36	37	...	40
Ears, length from orifice .....	25.5	...	...	25
" greatest width, flattened ..	16	...	...	17.5
Front of eye to tip of muzzle ...	21.5	...	...	...
Interfemoral .....	0	...	...	5
Lower leg .....	54	...	...	58
Foot, c. u. ....	35	38.5	38.5	36
Calcaneal .....	12	...	...	...

\* B. M. 93.11.23.

† B. M. 72.8.20.13.

*Measurements of skulls and teeth of Pteropus speciosus  
and mimus.*

	<i>Pt. speciosus.</i> Type and paratype.		<i>Pt. mimus.</i> Skulls: 2 ad. Teeth: 2 ad., 1 imm. (Incl. type.)	
	♂ ad. Type.	♀ ad. Paratype.	Min.	Max.
	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	57	...	...	59.8
" palation to incisive foramina.	28.5	28.8	...	29
" front of orbit to tips of nasals	18.7	18.8	19	20.7
" width of brain-case at zygomatica	21.3	21.7	...	22
" zygomatic width .....	31.8	33	...	32.2
" width across m <sup>1</sup> , externally ...	16.2	...	16.5	17.5
" lachrymal width .....	12.8	13.5	13	13.8
" width across canines externally	11.2	12	11.7	12
" postorbital constriction .....	...	7	7.2	7.5
" interorbital constriction .....	...	8.2	7.8	8.8
" width of mesopterygoid fossa.	7	7	...	7.7
" between p <sup>1</sup> -p <sup>1</sup> , internally .....	9.7	...	9.2	10.5
" between cingula of canines ...	6.2	7.2	6.8	6.8
" orbital diameter .....	12.8	12.8	12.2	12.5
Mandible, length .....	45.2	46.2	45	45.2
" coronoid height .....	22.2	22.2	20	22
Upper teeth, c-m <sup>2</sup> .....	22.6	...	20.8	22.7
Lower teeth, c-m <sub>3</sub> .....	24.7	...	23.7	25
Upper incisors, combined width .....	5.7	6.2	5.2	6.1
p <sup>3</sup> , length .....	4	...	3.9	4.2
" width .....	3	...	3	3
p <sup>4</sup> , length .....	4.1	...	4	4.5
" width .....	3.1	...	3	3.2
m <sup>1</sup> , length .....	5.1	...	4.8	5.2
" width .....	2.9	...	2.7	3
m <sup>2</sup> , length .....	2	...	2	2
" width .....	1.9	...	1.7	1.8
p <sub>1</sub> , length .....	2	...	1.7	2
" width .....	1.5	...	1.5	2
p <sub>3</sub> , length .....	4.2	...	4	4.2
" width .....	2.7	...	2.3	2.7
p <sub>4</sub> , length .....	4.1	...	4	4.2
" width .....	2.9	...	2.8	2.8
m <sub>1</sub> , length .....	4.7	...	4	4.7
" width .....	2.8	...	2.7	2.8
m <sub>2</sub> , length .....	3	...	3	3.2
" width .....	2.7	...	2.1	2.7
m <sub>3</sub> , length .....	1.8	...	1.7	1.8
" width .....	1.7	...	1.5	1.8

4. *Pteropus pallidus*, Temm.

*Pteropus griseus* (pt.), Dobson, Cat. Chir. B. M. p. 44.

- Pteropus pallidus*, Temminck, *Mon. Mamm.* i. p. 184, pl. xv. figs. 8, 9 (skull) (1825: Banda Is.); Lesson, *Man. Mamm.* p. 111, no. 288 (1827: Banda); Desmarest, *Dict. Sci. Nat.* xlv. p. 363 (1827: Banda); Is. Geoffroy, *Dict. Class. d'Hist. Nat.* xiv. p. 701 (1828: Banda); J. B. Fischer, *Syn. Mamm.* p. 84, no. 9 (1829: Banda); Lesson, *Hist. Nat. Mamm.* (Compl. Buffon) v. p. 54 (1836: Banda); Temminck, *Mon. Mamm.* ii. p. 77 (1837: Banda; Sumatra and Malacca, errore); Gray, *Griffith's Anim. Kingd.* v. p. 503 (1838: Banda); Oken, *Allg. Naturg.* vii. Abth. ii. p. 990 (1838); Wagner, *Schreber's Säug., Suppl.* i. p. 352 (1839: Banda); S. Müller, in Temminck's *Nat. Gesch. Nederl. Oerz. Bez., Zoogd.* pp. 20, 59 (1839-44: Banda); Lesson, *N. Tabl. R. An., Mamm.* p. 13, no. 182 (1842: Banca, errore); Schinz, *Syst. Verz. Säug.* i. p. 126 (1844: Banda); Gray, *Zool. 'Samarang,' Vert.* p. 12 (1849: Banda); Wagner, *Schreber's Säug., Suppl.* v. p. 600 (1853-55: Banda); Gervais, *Hist. Nat. Mamm.* i. p. 187 (1854: Banca, errore); Giebel, *Säug.* p. 593 (1855: Banda); Finsch, *Neu-Guinea*, p. 150 (1865: Banda); Füzinger, *SB. Akad. Wien*, lx. Abth. i. p. 436 (1870: Banda).
- Pteropus* (Spectrum) *hypomelanus c. pallidus*, Matschie, *Megachir.* p. 24 (1899: Banda). *b. pallidus*, Trouessart, *Cat. Mamm., Suppl.* p. 52 (1904: Banda).
- Pteropus griseus* (nec Geoff.), Peters, *MB. Akad. Berlin*, 1867, p. 326 (pt.) (Banda); Dobson, *Cat. Chir. B. M.* p. 44 (pt.) (1878: Banda); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 205 (pt.) (1879: Banda); Jentink, *Cat. Ost. Mamm.* p. 255 (1887: Banda); id. *Cat. Syst. Mamm.* p. 141 (1888: Banda); Trouessart, *Cat. Mamm.* i. p. 80 (pt.) (1897: Banda); Matschie, *Megachir.* pl. i. figs. 5, 5a, 5b (skull) (1899: Banda).
- Pteropus hypomelanus* (pt., nec Temm.), Jentink, *Cat. Ost. Mamm.* p. 261, specimens *f i* (1887: Banda); id. *Cat. Syst. Mamm.* p. 149, specimens *w-z* (1888: Banda); Trouessart, *Cat. Mamm.* i. p. 82 (1897: Banda).

*Diagnosis*.—Similar in skull and teeth to *Pt. minus*, but breast and belly dark brown (seal-brown) strongly grizzled with pale hairs, external dimensions smaller. Forearm 113.5-119 mm. *Hab.* Banda Is.

*Colour*.—Approximate description from two Leyden cotypes, mounted, somewhat faded (Jentink, *Cat. Syst.* p. 141, *Pt. griseus*, a, b).—Back, rump, breast, belly, and flanks seal-brown or dark brown strongly sprinkled with greyish, or whitish-grey, or buffy-grey hairs, thus producing the "couleur de feuille morte" mentioned by Temminck. Mantle, sides of neck, and foreneck ochraceous-buff (faded?). Head buffy (faded?); chin and throat dark brown like breast and belly (much faded in "a"). Hairs of head, mantle, sides of neck, and foreneck with concealed dark brown bases.

The third Leyden cotype ("c") is more uniform dark brown beneath.

*Méasurements.* On pp. 140, 141.

*Specimens examined.* Nine, viz. five cotypes of species in the Leyden and Berlin Museums, and four mounted specimens with skulls in the Leyden Museum, collected in Pulo Ai, Banda group, by Hoedt (Jentink, Cat. Syst. p. 149, sub *Pt. hypomelanus*, w, x, y, z; Cat. Ost. p. 261, *Pt. hypomelanus*, f, g, h, i).

*Range.* Banda Islands.

Cotypes in the Leyden and Berlin Museums.

*Pteropus pallidus*, Temminck; 1825.—Based on "six individus d'âge et de dimensions différentes," from the Banda Islands, four of which (Temminck writes, *l. s. c.* p. 186) were kept in the Leyden Museum. Of these, three specimens are now in the Leyden collection, all mounted, viz. ♂ ad., skull separate, collected by Reinwardt (Cat. Syst. p. 141, *Pt. griseus*, a; Cat. Ost. p. 255, *Pt. griseus*, a), a very young individual, skull separate, same collector (specimen *b*, skull *b*), and a ♀ ad., skull *in situ*, collected by Forster (specimen *c*). Skull *a* is the original of Temminck's figures, pl. xv. figs. 8, 9.—Two specimens in the Berlin Museum, 2632 (♂ ad.) and 4755 (♀ ad.), mounted, skulls separate, have the original hand-written Leyden label, with the words "*Pteropus pallidus*, Temm. Mon.; Banda; Reis van Reinwardt"; relabelled by Peters (printed label) *Pt. griseus* Geoff., *Pt. pallidus* Temm., with an asterisk after the latter name, indicating them as types. They are undoubtedly cotypes of *pallidus*. Skull 4755 is the original of the figures in 'Megachiroptera des Berliner Museums,' pl. i. figs. 5, 5 a, 5 b ("*Pt. griseus*" on plate).

*Remarks.*—In skull and dentition *Pt. pallidus* is scarcely distinguishable from *Pt. speciosus*, *mimus*, and *griseus*. From its probably nearest relative, *Pt. mimus* (Celebes), it differs by the colour of the underparts and somewhat smaller size, and from *Pt. griseus* by its much darker colour above and below.

## 5. *Pteropus griseus*, E. Geoff.

*Pteropus griseus* (pt.), Dobson, Cat. Chir. B. M. p. 44.

*Pteropus griseus*, E. Geoffroy, *Ann. Mus. d'Hist. Nat.* xv. p. 94, pl. vi. (animal) (1810: Timor); Cuvier, *R. Anim.* i. p. 124, footnote (1817); Desmarest, *Mamm.* i. p. 110, no. 141 (1820: Timor); Schinz, *Thierr.* i. p. 155 (1821: Timor); Temminck, *Mon. Mamm.* i. p. 187, pl. xi. (animal) (1825: Timor); Lesson, *Man. Mamm.* p. 110, no. 282 (1827: Timor); Desmarest, *Dict. Sci. Nat.* xlv. p. 364 (1827: Timor); Gray, *Griffith's Anim. Kingd.* v. p. 55, no. 157 (1827: Timor); Is. Geoffroy, *Dict. Class. d'Hist. Nat.* xiv. p. 701 (1828: Timor); J. B. Fischer, *Syn. Mamm.* p. 85, no. 12 (1829: Timor); Wagler, *Syst. d. Amphib.* p. 9 (1830); Lesson, *Hist. Nat. Mamm.* (Compl. Buffon) v. p. 54 (1836: Timor); Temminck, *Mon. Mamm.* ii. p. 81 (pt.), pl. xxxv. fig. 6 (head), pl. xxxvi. figs. 12, 13 (skull: nec figs. 14, 15) (1837: Samoa, nr. Timor); Gray, *Mag. Zool. & Bot.* ii. p. 503 (1838:

- Timor): *Oken, Allg. Naturg.* vii. Abth. ii. p. 990 (1838); *Wagner, Schreber's Säug., Suppl.* i. p. 355 (1839: Timor and neighbouring islands); *S. Müller, in Temminck's Nat. Gesch. Nederl. Oerz. Bez., Zoogd.* pp. 20, 59 (pt.) (1839-44: Timor); *Lesson, N. Tabl. R. Anim., Mamm.* p. 13, no. 185 (1842: Timor); *Schinz, Syst. Verz. Säug.* i. p. 128 (pt.) (1844: Timor); *E. Desmarest, Dict. Univ. d'Hist. Nat.* xi. p. 249 (1848: Timor); *Gray, Zool. 'Samarang,' Vert.* p. 11 (pt.) (1849: Timor); *Wagner, Schreber's Säug., Suppl.* v. p. 602 (pt.) (1853-55: Timor); *Gervais, Hist. Nat. Mamm.* i. p. 187 (pt.) c. fig. (head) (1854: Timor); *Giebel, Säug.* p. 997 (1855: Timor); *Finsch, Neu-Guinea*, p. 150 (pt.) (1865: Timor); *Peters, MB. Akad. Berlin*, 1867, p. 326 (pt.) (Timor); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 445 (1870: Timor); *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 516 (1872-73: structure of hairs); *Dobson, Cat. Chir. B. M.* p. 44 (pt.) (1878: Timor); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 205 (pt.) (1879: Timor); *Seabra, Jorn. Sci. Math. Lisboa*, (2) v. no. 18, p. 118 (1897: Timor); *Trouessart, Cat. Mamm.* i. p. 80 (pt.) (1897: Timor); *Seabra, Jorn. Sci. Math. Lisboa*, (2) v. no. 19, p. 167, pl. i. fig. 4 (palate-ridges) (1898).
- Pteropus* (Spectrum) *hypomelanus b. griseus*, *Matschie, Megachir.* p. 24 (1899); *Trouessart, Cat. Mamm., Suppl.* p. 52 (1904: Timor).
- Pteropus temminckii* (*nec* *Pet.*), *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 205 (pt.) (1879: Timor; Samao); *Jentink, Cat. Ost. Mamm.* p. 254, specimen *a* (1887: Samao); *id.*, *Cat. Syst. Mamm.* pp. 140, 141 (pt.) (1888: Samao: Timor); *Trouessart, Cat. Mamm.* i. p. 79 (pt.) (1897: Samao; Timor); *Willink, Nat. Tijds. Nederl. Ind.* lxxv. p. 275 (1905: Samao).
- Pteropus* (Sericonycteris) *temminckii*, *Matschie, Megachir.* p. 31 (1899: Samao; Timor); *Trouessart, Cat. Mamm., Suppl.* p. 54 (1904: Samao).
- Pteropus hypomelanus* (pt., *nec* *Temm.*), *A. B. Meyer, Abh. Mus. Dresden*, vii. p. 6 (1893: Bonerato); *Willink, Nat. Tijds. Nederl. Ind.* lxxv. p. 274 (1905: Salayer).

*Diagnosis.*—Similar to *Pt. mimus*, but much paler. Forearm 114.5-118 mm. *Hab.* Timor and Dyampea group.

*Palate-ridges.*—5+5+3; no trace of an additional ridge between the normal ninth and tenth ridges. Arrangement as in *Pt. hypomelanus* (antea, p. 101).

*Colour.*—The darkest extreme approaches in general aspect the palest-coloured individuals of *Pt. mimus*, but the head, mantle, and underparts are considerably lighter and the brownish colour of the back more lightened with greyish. The palest extreme comes rather near in colour to *Pt. temminckii*.

Dark extreme: ♂ yg. ad. al., Bonerato, 97.1.3.17.—Back Prout's brown rather thickly mixed with pale greyish, producing the general effect of an indefinite greyish brown. Sides of back, along membranes, and forearms pale buffy tinged with wood-brown; rump and thighs similar, but tinged with pale cinnamon.—Breast, belly, flanks, and anal region pale buffy, rather yellower (more golden in tinge) on breast and flanks than on belly and anal

region. Concealed bases of hairs everywhere brownish.—Mantle buffy, strongly contrasting with back, palest (cream-buffy) posteriorly on shoulders, tinged with tawny orange-buff on nape of neck and shading into a deeper tawny on sides of neck and foreneck. Short bases of hairs of mantle and sides of neck dark brown; hairs of foreneck uniform to extreme base.—Crown pale cream-buff with concealed brownish bases to the hairs, gradually shading on occiput into the colour of the mantle. Sides of head similar to crown but somewhat blotched with tawny. Throat mixed pale greyish and dark brown.

Intermediate colour phase: ♀ skin, quite or almost full-grown, Dyampea, 97.1.3.4.—Back greyish sprinkled with brownish hairs, the former colour predominant, producing the general effect of a tinge approaching smoke-grey.—Breast, belly, flanks, and anal region light wood-brown with a delicate tinge of pale cinnamon, more distinct on flanks and anal region than on breast and belly. Concealed bases of hairs dark brown.—Mantle pale cinnamon wood-brown, shading into cream-buffy posteriorly, and into a slightly deeper cinnamon wood-brown on sides of neck and foreneck. Base of hairs of mantle and sides of neck dark brown; hairs of foreneck uniform.—Crown and sides of head whitish grey. Throat similar, but somewhat mixed with brownish, particularly in centre.

Pale extreme: ♂ imm. skin, almost full-grown, Bonerato, 97.1.3.3.—Back and rump greyish white with a faint tinge of cream-buffy particularly on rump; base of hairs slightly darker. Head and underparts as in foregoing; mantle somewhat paler.

*Measurements.* On pp. 140, 141.

*Specimens examined.* Ten, in the collections of the Paris, Leyden, and British Museums, including the type of the species.

*Range.* Timor, with Samao; Bonerato; Dyampea; ? Salayer (specimens not examined).

*Type* in the Paris Museum.

*Pteropus griseus*, Geoff.: 1810.—Based, it would seem, on three specimens ("nous en possédons les deux sexes et la femelle, avec de longues tétines"), obtained in Timor, during Péron and Lesueur's voyage. Of these one, or perhaps two, are now in the Paris Museum, viz. (1) a female, not quite full-grown, mounted for front view, wings spread, skull in skin, colour much faded (Reg. no. A. 42); probably not the original of Geoffroy's plate; (2) a young skull, in the Muséum d'anatomie comparée (A. 6745), marked "*Pteropus griseus* (Geoff.); type"; the evidence that this is really the skull of one of Péron and Lesueur's specimens appears to be unsatisfactory.

Temminck's *Pt. griseus*, 1825 (l. s. c.), is Geoffroy's *Pt. griseus* redescribed and refigured by a copy of Geoffroy's plate. His *Pt. griseus*, 1837 (l. s. c.), is a mixture of two species, viz.: (1) the true *Pt. griseus*; of Temminck's original material (1837) are now in the Leyden Museum four mounted specimens, from Samao and Timor (Cat. Syst. pp. 140, 141, sub *Pt. temminckii*, a, b, i, j), and one skeleton, from Samao (Cat. Ost. p. 251, a); the skull of

this latter is the original of Temminck's pl. xxxvi. figs. 12, 13; (2) *Pt. temmincki*, Pet. (see this species, *infra*, p. 318).

*Remarks.*—In skull, dentition, size and shape of ears, distribution and length of fur, and external size, this species is similar to *Pt. minus* and *pallidus*, from which it differs in the much paler colour of the fur. In this latter character it sometimes rather closely resembles *Pt. temmincki*, from which it is at once distinguished by the much heavier skull and dentition, naked tibia, and considerably larger size.

- a. ♀ yg. ad. sk.; skull. Dyampea; end of dry season, Dec. 1895. A. Everett [C]. 97.1.3.4.  
 b. ♂ imm. sk.; skull. Bonerato; beginning of rains, 23 Dec. 1895. A. Everett [C]. 97.1.3.3.  
 c. ♂ yg. ad. al.; skull. Bonerato; Dec. 1895. A. Everett [C]. 97.1.3.17.

*External measurements of Pteropus pallidus and griseus.*

	<i>Pt. pallidus.</i> 5 ad. (Incl. 2 cotypes.)		<i>Pt. griseus.</i> 4 ad.*	
	Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.
Forearm .....	113.5	119	114.5	118
Pollex, total length, c. u. ....	...	...	...	51
" metacarpal .....	...	...	...	9.5
" 1st phalanx .....	...	...	...	27.5
2nd digit, metacarpal .....	58.5	62	60	60.5
" 1st phalanx .....	14	14	13	15
" 2nd-3rd phalanx, c. u. ....	14	16	12.5	13
3rd digit, metacarpal .....	79	83	79	81.5
" 1st phalanx .....	58	62.5	56	61.5
" 2nd phalanx .....	84	88	79.5	82
4th digit, metacarpal .....	78	82.5	77	81
" 1st phalanx .....	47	52.5	46	51
" 2nd phalanx .....	47	52	44	50
5th digit, metacarpal .....	81.5	85	83	86.5
" 1st phalanx .....	34	38	34	37
" 2nd phalanx .....	34	37.5	33	37
Ears, length from orifice .....	...	...	...	25
" greatest width, flattened .....	...	...	...	16
Front of eye to tip of muzzle .....	...	...	...	22.5
Lower leg .....	254.5	...	50	250.5
Foot, c. u. ....	...	...	...	32
Calc. ....	...	...	...	17

\* B. M. 97.1.3.17 (Bonerato); Leyden Museum, mounted specimens a, b, c (Samoa; Timor).



Measurements of skulls and teeth of *Pteropus pallidus* and *griseus*.

	<i>Pt. pallidus</i> . Skulls: 4 ad. Teeth: 3 ad., 1 imm. (Incl. 2 cotypes.)		<i>Pt. griseus</i> . Skull*: 1 yg. ad. Teeth†: 1 yg. ad., 3 imm.	
	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	56	59		
„ front of orbit to tip of nasals ...	18.8	20	19	
„ width of brain-case at zygomata ..	21	22.7		
„ zygomatic width .....	21	32.8		
„ width across m <sup>1</sup> externally .....	15.2	17.2	16.2	
„ lachrymal width .....	13	13.7		
„ width across canines, externally.	11.2	12.2	11	
„ postorbital constriction .....	7.2			
„ interorbital constriction .....	7.8			
„ between p <sup>1</sup> -p <sup>1</sup> , internally .....	8.2	9	9.2	
„ between cingula of canines .....	...	...	5.8	
„ orbital diameter .....	12	12.5	12.2	
Mandible, length .....	44	46.8	44	
„ coronoid height .....	20	22.7	21	
Upper teeth, c-m <sup>2</sup> .....	20.8	22.2	21.2	
Lower teeth, c-m <sub>3</sub> .....	23.8	24.8	23.2	
Upper incisors, combined width .....	...	...	5.8	
p <sup>3</sup> , length .....	3.8	4	3.9	4
„ width .....	2.8	3	2.8	2.9
p <sup>1</sup> , length .....	4	4.2	3.8	4
„ width .....	3	3.2	2.9	3.1
m <sup>1</sup> , length .....	4.7	5	4.5	5
„ width .....	2.8	3	2.8	2.8
m <sup>2</sup> , length .....	1.8	2	2	2.1
„ width .....	1.7	2	1.9	2
p <sub>1</sub> , length .....	1.7	2.1	1.8	2
„ width .....	1.2	2	1.6	1.9
p <sub>3</sub> , length .....	3.6	4	3.8	4.1
„ width .....	2.2	2.7	2.2	2.5
p <sub>4</sub> , length .....	3.7	4.2	4	4.5
„ width .....	2.7	2.9	2.6	2.8
m <sub>1</sub> , length .....	4.1	4.5	4	4.7
„ width .....	2.7	2.8	2.3	2.8
m <sub>2</sub> , length .....	3	3.5	3	3.6
„ width .....	2.3	2.7	2.2	2.2
m <sub>3</sub> , length .....	1.8	...	1.7	1.8
„ width .....	1.8	...	1.6	1.7

\* B. M. 97.1.3.17 (Bonerato).

† B. M. 97.1.3.17 (Bonerato), 97.1.3.3 (Bonerato), 97.1.3.4 (Dyamepa);  
Leyden Museum, skeleton  $\alpha$  (Samoa).

6. *Pteropus satyrus*, K. And.

*Pteropus satyrus*, K. Andersen, *Ann. & Mag. N. H.* (8) ii. p. 362 (1 Oct. 1908: Narcondam).

*Diagnosis*.—Similar to *Pt. hypomelanus*, but with smaller eyes and longer fur. Blackish above and beneath, with brighter-coloured mantle and centre of breast and belly. Forearm about 139 mm. *Hab.* Narcondam.

*Skull and teeth*.—Skull as in *Pt. hypomelanus*, but with equal general size of skull the orbits are slightly smaller; diameter 12.2 mm. against 12.7–13.2 in all races of *Pt. hypomelanus*. Teeth not differing appreciably in structure or size from those of *Pt. hypomelanus*.

*Fur*.—Longer than in *Pt. hypomelanus*: about 18–19 mm. at middle of back. Distribution of fur as in the allied species.

*Colour*.—Type (♂ ad., teeth almost unworn): Back and rump blackish seal-brown, thinly and evenly sprinkled with pale greyish hairs, producing the general effect of a blackish slightly lightened with greyish; greyish admixture rather more conspicuous on back than on rump.—Centre of breast and belly golden buffy, with short concealed seal-brown bases to the hairs; sides of breast and belly, anal region, and flanks blackish very slightly sprinkled with pale greyish. Blackish sides of breast and belly washed with seal-brown and brownish russet before merging into bright colour of centre of breast and belly.—Mantle chocolate with deep chestnut bases to the hairs, lightening posteriorly, in a transverse line across shoulders, to pale chestnut with orange-rufous hair-bases, and darkening on sides of neck to dark chocolate, this again on foreneck to mixed blackish and chocolate.—Crown and sides of head mixed blackish, buffy, and pale greyish; throat blackish somewhat sprinkled with pale greyish.

A young specimen (not full-grown) has the colour of the back similar to that of the type, though less sprinkled with greyish. Bright area on centre of breast and belly paler, almost cream-buff. Mantle lighter, between cinnamon and russet, with short seal-brown bases to the hairs, and darkening to russet on sides of neck and foreneck. Crown and sides of head seal-brown somewhat lightened with russet; throat blackish.

*Measurements*. On pp. 145, 146.

*Specimens examined*. Two, in the collection of the British Museum.

*Range*. Narcondam, N. Andamans.

*Type* in collection.

*Remarks*.—This species is evidently an Andaman representative of *Pt. hypomelanus*, and probably most nearly related to *Pt. h. geminorum*, from the Mergui Archipelago. The general colour of the back is rather similar to that of an average *geminorum*, though on the whole less grizzled with greyish; the colour of the mantle, sides of neck, and foreneck is almost perfectly as in *geminorum*; the

head, at least in some specimens (see type), has the same peculiarly grizzled blackish and greyish colour; in *Pt. satyrus* the centre of breast and belly is bright-coloured, while in the ordinary phase of *geminorum* the underparts are usually uniform blackish (with or without conspicuous greyish sprinkling), but specimens occur with a distinct trace of bright colour in the centre of breast and belly, so that also in this respect there is scarcely more than a difference of degree between *satyrus* and *geminorum*. The only essential differential characters of *Pt. satyrus*, as compared with *Pt. h. geminorum*, would seem to be the conspicuously longer fur, the less amount of greyish admixture in the colour of the fur, the constantly brighter-coloured centre of breast and belly, and the slightly smaller eyes.—In general colour *Pt. satyrus* comes rather near to the Andaman representative of the *Pt. melanotus* group, viz. *Pt. tyleri* (p. 227), from which it is readily distinguished by its smaller size, much smaller skull and teeth, and less developed posterior ledges of pre-molars and molars. In the Nicobars it is replaced by a distinct species, *Pt. faunulus*.

- a. ♂ ad. sk.; skull. Narcondam, Andamans; Oct. 1904. C. G. Rogers, Esq. [P.]. 6.9.1.1.  
(Type of species)  
l. Imm. sk.; skull. Narcondam; Oct. 1904. C. G. Rogers, Esq. [P.]. 6.9.1.2.

## 7. *Pteropus faunulus*, Miller.

*Pteropus faunulus*, Miller, *Proc. U.S. Nat. Mus.* xxiv. p. 785 (28 May, 1902: Car Nicobar); Kloss, *Andamans & Nicobars*, p. 325 (1903: Car Nicobar); Trouessart, *Cat. Mamm., Suppl.* p. 53 (1904: Car Nicobar); Miller, *Fam. & Gen. Bats*, p. 58 (1907); Mason, *Rec. Ind. Mus.* ii. pt. ii. p. 166 (1908).

*Diagnosis*.—Allied to *Pt. hypomelanus*, but smaller, with much smaller teeth and longer fur. Back brownish, lightening to wood-brown on rump; mantle and underparts ochraceous-buff tinged with cinnamon; head similar, but paler and grizzled with greyish. Forearm 118 mm. *Hab.* Nicobars.

*Skull and teeth*.—General characters as in *Pt. hypomelanus*, but size much smaller: total length of skull about 54.5 mm., against 61.5–68.5 in all races of *Pt. hypomelanus*; m<sup>1</sup>, length 4 mm., against 4.8–5.9. Size and other characters of skull very nearly as in *Pt. colonus* (Solomon Is.), but orbits conspicuously larger, and teeth smaller.

*Ears*.—Not differing in shape from those of other typical species of the *Pt. hypomelanus* group.

*Fur*.—Length of fur very nearly as in *Pt. satyrus*, longer than in *Pt. hypomelanus*; longest hairs at middle of back about 16–17 mm. Distribution of fur as in the allied species.

*Colour*.—♀ ad. skin, teeth well worn. General colour of back dark Prout's brown, produced by mixture of seal-brown and mars-brown hairs slightly sprinkled with silvery grey. Rump approximately wood-brown tinged with cinnamon, with long seal-brown

bases to the hairs. Colour of back gradually passing into paler tinge of rump.—Underparts, from foreneck to anal region, including flanks, ochraceous-buffy strongly tinged with pale cinnamon, palest on flanks, anal region, and foreneck, deepest (approaching pale cinnamon) on breast. Base of fur everywhere seal-brown.—Mantle and sides of neck similar to underparts, but rather paler.—Crown and sides of head grizzled greyish and buffy wood-brown, producing a paler and more grizzled tinge than that of mantle; base of hairs seal-brown; throat similar to sides of head, but mixed with blackish.

*Measurements.* On pp. 145, 146.

*Specimen examined.* One, in the collection of the British Museum.

*Range.* Nicobar Islands: Car Nicobar, Nankauri.

*Type* in the U.S. National Museum (no. 111730).

*Pteropus faunulus*, Miller; 1902.—Based on skin and skull of one male, obtained on Car Nicobar by Dr. W. L. Abbott. The measurement of the tibia given by Miller is incorrect ("38 mm.," probably a slip for 48). The skin and skull of the British Museum specimen have been compared with the type by Dr. Marcus W. Lyon, Jr.

*Remarks.*—The complete resemblance in the shape of the skull, the characters of the teeth, the form and relative size of the ears, and the distribution of the fur, are evidence of the close affinities of *Pt. faunulus* and *satyrus* with *Pt. hypomelanus*. In the colour of the fur *Pt. faunulus* is very different from *Pt. satyrus*, but it closely approaches *Pt. hypomelanus enganus*, some eastern races of the same species (*Pt. h. hypomelanus*, *luteus*), and certain small species of the *Pt. hypomelanus* group, viz. *Pt. minus* and *Pt. colonus*. Both *Pt. satyrus* and *Pt. faunulus* are probably offshoots of *Pt. hypomelanus*, but *Pt. satyrus* would seem to be most nearly related to *Pt. h. geminorum*, from the Mergui Archipelago, while *Pt. faunulus* is apparently more intimately connected with *Pt. h. enganus*. From this latter form *Pt. faunulus* differs chiefly in its smaller teeth, longer fur, somewhat paler underparts, and smaller size.

♂. ♀ ad. sk.; skull. Nankauri, Nicobars; C. G. Rogers, Esq. [P.]. 64.13.1. July–Oct. 1904.

### 8. *Pteropus admiralitatum*, Thos.

*Pteropus admiralitatum*, Thomas, *Ann. & Mag. N. H.* (6) xiii. p. 293 (March, 1894: Admiralty Is.); Trouessart, *Cat. Mamm.* i. p. 82 (1897: Admiralty Is.); Miller, *Fam. & Gen. Eats*, p. 58 (1907).

*Pteropus* (Spectrum) *admiralitatum* (pt.), Matschie, *Megachir.* p. 28 (1899: Admiralty Is.); Trouessart, *Cat. Mamm., Suppl.* p. 53 (1904: Admiralty Is.).

*Diagnosis.*—Allied to *Pt. hypomelanus*, but with smaller ears, and longer and differently coloured fur; underparts seal-brown heavily

sprinkled with buffy grey. Forearm 118-126 mm. *Hab.* Admiralty Is.

*Skull and teeth.*—General characters of skull and teeth as in *Pt. hypomelanus*. Size of skull noticeably smaller, nearly exactly as in *Pt. minus*. Size of teeth as in *Pt. minus* or the smallest-toothed individuals of *Pt. hypomelanus*.

*Ears.*—Relatively smaller than in the typical races of *Pt. hypomelanus*, but not differing in shape; length of ear from orifice 21-22 mm., against 25.5-27 mm. in *Pt. hypomelanus latus*; width of ear 15-16, against 18-20.

*Fur.*—Longer than in *Pt. hypomelanus*; approximate length at middle of back 16-18 mm., against 10-14 in the allied species. Distribution of fur as in *Pt. hypomelanus*.

*Colour.*—Four specimens (two skins, two alcoholic), teeth somewhat worn, including type. Back and rump dark Prout's brown approaching seal-brown thickly mixed with shining silvery grey hairs, most of these latter with a peculiar tinge of buff or olive-

*External measurements of Pteropus satyrus, faunulus, and admiralatium.*

	<i>Pt.</i> <i>satyrus</i> . ♂ ad. Type.	<i>Pt.</i> <i>faunulus</i> . ♀ ad.	<i>Pt.</i> <i>admiralatium</i> . 4 ad. (Incl. type.)	
	mm.	mm.	mm.	mm.
Forearm .....	139	118	118	126
Pollex, total length, c. u. ....	59	48.5	50	53
" metacarpal .....	13.5	11	11.5	12
" 1st phalanx .....	31	25	25	28
2nd digit, metacarpal .....	69.5	58	60	63.5
" 1st phalanx .....	15	14	12	14
" 2nd-3rd phalanx, c. u. ....	16	11.5	13	15
3rd digit, metacarpal .....	93.5	79	79	84
" 1st phalanx .....	66.5	58.5	56.5	60.5
" 2nd phalanx .....	97.5	82	86.5	88.5
4th digit, metacarpal .....	92.5	76	75.5	81
" 1st phalanx .....	56	46	46.5	50
" 2nd phalanx .....	...	48	47	51
5th digit, metacarpal .....	98.5	82.5	83	86.5
" 1st phalanx .....	41.5	36	34	37
" 2nd phalanx .....	45	35	33	36
Ears, length from orifice .....	...	...	21	22
" greatest width, flattened .....	...	...	15	16
Interfemoral .....	...	...	0	0
Lower leg .....	63	50	51	57
Foot, c. u. ....	...	36	33.5	38.5
Calcaneal .....	...	13.5*	11	15.5

\* Approximate measurement (skin).

*Measurements of skulls and teeth of Pteropus satyrus,  
faunulus, and admiralitatum.*

	<i>Pt. satyrus.</i> Type and paratype.	<i>Pt. faunulus.</i> ♀ ad. 6.4.13.1.	<i>Pt. admiral- itatum.</i> Skulls & teeth: 4 ad. (Incl. type.)
	♂ ad. Type.	Jun. Para- type*.	Min. Max.
	mm.	mm.	mm. mm.
Skull, total length to gnathion .....	62.5	...	(54.5 †) ... 59.2
„ palation to incisive foramina ...	31.2	...	27 27.8 28.8
„ front of orbit to tip of nasals ...	21.7	...	18 18.8 19.2
„ width of brain-case at zygomata ...	...	...	21 22
„ zygomatic width .....	...	...	31.8 33
„ width across m <sup>1</sup> , externally.....	17.5	...	15 16 17
„ lachrymal width .....	14	...	12.3 12.8 14
„ width across canines, externally.	12	...	12 12.6
„ postorbital constriction .....	7.2	...	7 8
„ interorbital constriction .....	8.7	...	8 8.2
„ width of mesopterygoid fossa ...	7.4	...	7.5 7.2 7.7
„ between p <sup>4</sup> -p <sup>1</sup> , internally .....	10.2	...	9 9.7 10
„ between cingula of canines .....	6.7	...	6.5 7
„ orbital diameter.....	12.2	...	12.2 12 12.5
Mandible, length .....	49.5	...	42.5 45 46.7
„ coronoid height .....	23	...	20 22 22.2
Upper teeth, c-m <sup>2</sup> .....	23.8	...	19.8 21.7 22
Lower teeth, c-m <sub>3</sub> .....	27	...	21.8 23.7 24.8
Upper incisors, combined width.....	6	...	5.3 5.7
p <sup>3</sup> , length .....	3.9	4.1	3.7 4 4.1
„ width .....	3	3.1	2.8 2.8 3
p <sup>1</sup> , length .....	4.2	4.6	3.8 4 4.1
„ width .....	3.2	3.2	2.9 3 3.1
m <sup>1</sup> , length .....	5.1	5	4.1 4.8 5.1
„ width .....	3	2.9	2.5 2.9 3
m <sup>2</sup> , length .....	2.5	2.4	1.8 2.2 2.5
„ width .....	1.9	2.1	1.7 1.8 2.2
p <sub>1</sub> , length .....	1.8	2	1.8 2 2
„ width .....	1.7	1.8	1.8 1.7 2
p <sub>3</sub> , length .....	4.2	4.2	3.9 4 4.1
„ width .....	2.8	2.8	2.2 2.6 2.8
p <sub>4</sub> , length .....	4.2	4.6	3.9 4 4.2
„ width .....	2.8	3	2.5 2.8 3
m <sub>1</sub> , length .....	4.7	4.8	3.9 4.6 4.8
„ width .....	2.8	2.8	2.5 2.6 2.9
m <sub>2</sub> , length .....	3.6	3.9	2.9 3.7 3.9
„ width .....	2.6	2.8	2 2.6 2.7
m <sub>3</sub> , length .....	2	2.2	1.5 1.9 2.1
„ width .....	1.7	1.9	1.2 1.8 1.9

\* B. M. 6.9.12.

† Estimate.

buff, producing the total effect of a hair-brown or olive hair-brown. —Underparts from chin to crissum, except a more or less distinct narrow collar across foreneck, dark seal-brown thickly sprinkled with glossy whitish-grey or buffy-grey hairs; according to the greater or less admixture of greyish, the general colour is whitish-grey or buffy-grey mixed with seal-brown, or seal-brown heavily mixed with whitish-grey or buffy-grey. —Mantle ochraceous-buff (lightest extreme) or approximately ochraceous, or pale hazel tinged with ochraceous, the colour gradually darkening on sides of neck, and continued across foreneck as a narrow collar more or less obscured by admixture of the general colour of the underparts. Base of hairs of mantle and sides of neck seal-brown. —Crown and occiput light buffy hair-brown, becoming gradually darker on sides of head, and shading on throat into the general colour of the underparts. In one specimen, which on the whole represents the lightest extreme in the small series, the crown and occiput are nearly cream-buff, gradually darkening on sides of head, and shading on throat into the general colour of the underparts.

*Measurements.* On pp. 145, 146.

*Specimens examined.* The British Museum material.

*Range.* Admiralty Is.

*Type* in collection.

*Remarks.*—This species probably replaces *Pt. hypomelanus* in the Admiralty Islands. In the colour of the fur it approaches the North Polynesian species of the *Pt. mariannus* type.

- |                                 |   |                       |                   |
|---------------------------------|---|-----------------------|-------------------|
| a. ♂ ad. sk.; skull.            | Admiralty Is.                                 | Lords of the Treasury | 80.11.24.4.       |
|                                 | (Challenger Exp.).                            | [P.].                 | (Type of species) |
| b. ♂ ad. sk.; skull.            | Admiralty Is.                                 | Lords of the Treasury | 80.11.24.5.       |
|                                 | (Challenger Exp.).                            | [P.].                 |                   |
| c. d. ♂ ad., ♀ ad. al.; skulls. | Admiralty Is.; March, 1875 (Challenger Exp.). | Lords of the Treasury | 90.2.20.2, 3.     |
|                                 |   | [P.].                 |                   |

## 9. *Pteropus colonus*. K. Andl.

*Pteropus hypomelanus* (nec Temm.), Thomas, *P. Z. S.* 1887, p. 322 (Alu, Shortland I.); *id.*, *P. Z. S.* 1888, p. 471; Trouessart, *Cat. Mus.* i. p. 82 (pt.) (1897: Solomon Is.).

*Pteropus* (Spectrum) *hypomelanus* (pt.), Matschie, *Megachir.* p. 24 (1899: Alu).

*Pteropus colonus*, K. Andersen, *Ann. & Mag. N. H.* (8) ii. p. 363 (1 Oct. 1908: Shortland I.).

*Diagnosis.*—Similar to *Pt. hypomelanus luteus*, but much smaller, with shorter ears, and much darker breast and belly. Forearm 109.5–114 mm. *Hab.* Shortland I., W. Solomon Is.

*Skull and teeth.*—Essential characters of skull as in *Pt. hypomelanus*, but size markedly smaller: total length 55 mm., against 61–69 in all forms of *Pt. hypomelanus*; mandible 41.8–43.8, against 47.7–54.7; orbital diameter 11.2–11.5, against 12.7–13.2. —

Dentition differing in no important character from that of *Pt. hypomelanus*, except in the slightly smaller size of m<sup>1</sup>.

*Ears*.—Size as in *Pt. admiralitatum*, but tip rather broader and more broadly rounded off.

*Fur*.—Longest hairs at middle of back about 11–13 mm. Distribution of fur as in *Pt. hypomelanus*.

*Colour*.—Type (teeth well worn) and paratype (teeth slightly worn).—Back and rump Prout's brown, rather thinly and inconspicuously sprinkled with greyish-white hairs.—Breast, belly, and flanks dark Prout's brown (type) or mars-brown (paratype), thinly (type) or thickly (paratype) sprinkled with grey and greyish-white hairs.—Mantle and sides of neck cream-buff slightly washed with ochraceous-buff, strongly contrasting with back; foreneck similar to sides of neck, but considerably darkened by admixture of brownish. Base of hairs everywhere dark brown.—Crown and occiput similar to mantle, passing gradually into a darker tinge on sides of head, and this in turn into the dark brownish colour of the throat.

*Measurements*. On pp. 151, 152.

*Specimens examined*. Two, type and paratype of species.

*Range*. Shortland, West Solomon Islands.

*Type* in collection.

*Remarks*.—There can be no doubt that this species is an eastern offshoot of *Pt. hypomelanus*. In the colour of the fur of the upper-side it accords very closely with the New Guinean form of that species (*Pt. h. luteus*), differing chiefly in the smaller size, relatively shorter ears, and darker underside. In the Central Solomon Islands it is replaced by the next following species.

- |                      |                         |                      |                    |
|----------------------|-------------------------|----------------------|--------------------|
| a. ♂ ad. al.; skull. | Shortland I., Solomons. | Dr. H. B. Guppy      | 84.3.25.1.         |
|                      |                         | [C. & P.].           |                    |
| b. ♀ ad. sk.; skull. | Ala, Shortland I.:      | C. M. Woodford, Esq. | 87.1.18.3.         |
|                      | April, 1886.            | [C.].                | (Type of species.) |

#### 10. *Pteropus solomonis*, *Thos.*

*Pteropus solomonis*, *Thomas*, *Nor. Zool.* xi. p. 597 (Sept. 1904: Ghizo I.).

*Diagnosis*.—Allied to *Pt. colonus*, but skull slenderer, m<sup>1</sup> longer, fur richer, tibia thickly haired above, colour of fur darker. Head and back nearly seal-brown, underparts vandyck-brown thinly sprinkled with silvery white, mantle and sides of neck cinnamon mars-brown. Forearm 110 mm. *Hab.* Ghizo, Central Solomon Is.

*Skull and teeth*.—Skull similar in general size to that of *Pt. colonus*, but slenderer, rostrum shorter and considerably more compressed laterally, mesopterygoid fossa and palate narrower. Length of rostrum from front of orbit to tip of nasals 15.5 mm. (17.7–18.2 in *Pt. colonus*), lachrymal width 11 mm. (12.7), width of mesopterygoid fossa 6.2 mm. (7), width of palato between



$p^1-p^1$  8 mm. (9.92). Sagittal crest not fully developed (one individual, with much worn teeth), the temporal ridges being closely approximated but not quite fused posteriorly.—Teeth scarcely differing from those of *Pt. colonus*, except in the much greater length of  $m^1$ : 5.2 mm., against 4.4–4.5 in *Pt. colonus*.

*Ears*.—Shape and size as in *Pt. colonus*.

*Fur*.—Longer and richer than in *Pt. colonus*, and extending thickly along proximal three-fourths of upperside of tibia. Approximate length of hairs, back 15, mantle 16, belly 14 mm. Least width of furred area of back about 43 mm.

*Colour*.—Type (♀ ad. skin, teeth much worn; November). Back seal-brown with a few silvery whitish hairs. Rump, thighs, and furred part of tibia distinctly paler-coloured, owing to presence of short pale mars-brown (almost buffy mars-brown) tips to the hairs.—Entire underside vandyck-brown, sparsely sprinkled with some silvery whitish hairs on breast and belly, darkening to seal-brown along centre of breast, and becoming slightly paler, almost walnut-brown, on foreneck.—Mantle and sides of neck between cinnamon and mars-brown, not very strongly contrasting with back: hairs of mantle seal-brown for basal half, on sides of neck for basal third.—Occiput, crown, interocular space, and sides of face similar to back, but slightly mixed with greyish and buffy russet, owing partly to the presence of paler-coloured tips to the hairs, partly to a slight sprinkling with silvery whitish hairs. Temporal region similar in colour to chin and throat.

*Measurements*. On pp. 151, 152.

*Range*. Ghizo Island, New Georgia group, Central Solomon Islands.

*Type* in collection.

*History in literature*.—Thus far (December, 1908) the type is the only specimen recorded in literature.

*Remarks*.—*Pt. solomonis* is the extreme eastern representative of the *Pt. hypomelanus* group. From its probably nearest living relative, *Pt. colonus* (W. Solomon Is.), it differs in the characters referred to in the diagnosis and description above. From *Pt. brunneus* (E. Queensland), which it approaches rather closely in the distribution and colour of the fur, it is readily distinguished by its small, delicately built skull, much weaker dentition, relatively smaller ears, and somewhat smaller size.

α. ♀ ad. sk.; Ghizo, Solomon Is.: Nov. 10, A. S. Meek [C]. 4.4.11.1.  
skull. 1903. (Type of species.)

## 11. *Pteropus brunneus*, Dobson.

*Pteropus brunneus*. Dobson, Cat. Chir. B. M. p. 37.

*Pteropus brunneus*, Dobson, l. s. c. pl. iii. fig. 4 (ear) (June, 1878: Percy I.); Trouessart, Rev. & Mag. Zool. (3) vi. p. 205 (1879: Percy I.); Ogilby, Cat. Austral. Mamm. p. 79 (1892: Percy I.); Lucas, Proc. R. Soc. Queensl. xii. p. 51 (1897: Australian

coast opposite Percy I.); Trouessart, *Cat. Mamm.* i. p. 79 (1897: Percy I.); Miller, *Fam. & Gen. Bats*, p. 58 (1907).  
*Pteropus* (Spectrum) brunneus, Matschie, *Megachir.* p. 22 (1899);  
 Trouessart, *Cat. Mamm., Suppl.* p. 51 (1904: Percy I.)

*Diagnosis.*—Skull and dentition typical Pteropine. Ears moderate, exposed. Tibia clothed above. Fur above and beneath dark brown (approximately Prout's brown) varied with paler tips to the hairs, mantle russet. Forearm 118 mm. *Hab.* Percy Island.

*Skull and dentition.*—Skull in every respect similar to that of *Pt. hypomelanus*. Dentition as in the large-toothed races of that species (*Pt. h. canus* and *lepidus*).

*Ears* (described from one skin).—Moderate, exposed. Inner margin evenly convex from base to tip; outer margin flatly convex in basal half, almost straight in apical half; tip narrowly rounded off. Basal half of conch clothed with short, very thinly scattered hairs behind, terminal half naked.

*Interfemoral.*—Scarcely detectable in centre.

*Fur.*—Somewhat adpressed on back, spreading on rump. Length of fur moderate: at middle of back about 16, middle of mantle 17, middle of belly 13 mm. Least width of furred space across back about 45 mm.

Above, proximal third of forearm with short, thinly spread, adpressed hair. Tibia clothed, the hair being long and dense on proximal three-fourths, gradually shorter and more scattered on terminal fourth.—Beneath, short dense woolly hair on antebrachial membrane, along outer side of forearm, and on lateral membrane between humerus and femur. Proximal third or half of tibia hairy, distal portion practically naked.

*Colour.*—Type, ♂ ad. skin, Percy I.; teeth slightly worn; perhaps a little faded. Back and rump approximately Prout's brown, paler laterally in a narrow line along membrane. Individual hairs almost seal-brown at base, ochraceous-buffy at tip, the dark colour everywhere, except along membrane, showing through: hence the approximately Prout's brown total impression of the colour.—Entire underside (chin, throat, breast, belly, and flanks) paler than back, between Prout's brown and mars-brown, shading to vandyck-brown along middle of breast and belly, and almost everywhere sprinkled with some glossy buffy hairs.—Mantle russet, becoming paler (nearly clay) on shoulders, and shading to dark russet on sides of neck. Concealed base of fur of mantle and sides of neck seal-brown. A tuft of buffy glandular hairs on each side of neck, nearly covered by surrounding dark fur (probably sexual character).—Crown and sides of head mixed Prout's brown and buffy russet, all the hairs being seal-brown at base, with ochraceous or golden ochraceous tips.

*Measurements.* On pp. 151, 152.

*Specimen examined.* One, the type.

*Range.* Percy I., off E. Queensland, Australia; ? adjacent coast of Australian continent ("a camp of *Pt. brunneus*" is stated to have

been observed, by Mr. Broadbent, flying over the Australian coast opposite Percy I.; see Lucas, *l. s. c.*).

*Type* in collection.

*History in literature*.—Nothing has been added to our knowledge of this species, since Dobson described it, in 1878.

*Remarks*.—The perfectly typical, *hypomelanus*-like skull and dentition of this species leave no doubt that it is an Australian representative of *Pt. hypomelanus*. From the geographically nearest form of that species (*Pt. h. luteus*, New Guinea) it is readily distinguished by its furred tibiae, much darker colour, and smaller size. Externally (colour, size) it bears no small resemblance to *Pt. cognatus* (San Christoval, Solomon Is.), which however differs essentially in skull and dentition.

a. ♂ ad. sk.; Percy I., E. Queens- Voyage H.M.S. 'Herald' 74.3.16.2.  
skull. land. (Capt. Denham).  
(*Type* of species.)

*External measurements of Pteropus colonus, solomonis, and brunneus.*

	<i>Pt. colonus.</i> 2 ad. Type and paratype.	<i>Pt. solo-</i> <i>monis.</i> ♀ ad. Type.	<i>Pt. brun-</i> <i>neus.</i> ♂ ad. Type.
	♀ ad. Type.	♂ ad. Paratype *	
	mm.	mm.	mm.
Forearm .....	109.5	114	110
Pollex, total length, c. u. ....	43.5	49.5	47
" metacarpal .....	11	13	10
" 1st phalanx .....	24	25.5	24
2nd digit, metacarpal .....	56	58.5	55
" 1st phalanx .....	11	12.5	14.5
" 2nd-3rd phalanx, c. u. ....	12	11	12
3rd digit, metacarpal .....	73	78.5	75
" 1st phalanx .....	51.5	55.5	55.5
" 2nd phalanx .....	78	80.5	78.5
4th digit, metacarpal .....	72	75.5	74
" 1st phalanx .....	41	44	43.5
" 2nd phalanx .....	..	45	47
5th digit, metacarpal .....	74.5	80	77.5
" 1st phalanx .....	32	34	32
" 2nd phalanx .....	33	32	33
Ears, length from orifice .....	..	22	..
" greatest width, flattened ....	..	18	..
Interfemoral .....	..	0	..
Lower leg .....	49	53	47.5
Foot, c. u. ....	..	38	37
Calcaneal .....	(12)	11.5	..

\* B. M. 84.3.25.1.

*Measurements of skulls and teeth of Pteropus colonus, solomonis, and brunneus.*

	<i>Pt. colonus.</i> 2 ad. Type and paratype.		<i>Pt. solo-</i> <i>monis.</i> ♀ ad. Type.	<i>Pt. brun-</i> <i>neus.</i> ♂ ad. Type.
	♀ ad. Type.	♂ ad. Paratype.		
	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	...	55	...	...
„ palation to incisive foramina ...	26	27	25	36.8
„ front of orbit to tip of nasals ...	17.7	18.2	15.5	21
„ width of brain-case at zygomata	20.3	20.8	20	23
„ zygomatic width .....	29.5	31	...	34.7
„ width across m <sup>1</sup> , externally .....	15.2	15.8	14.7	17.2
„ lachrymal width .....	...	12.7	11	14.7
„ width across canines, externally.	11.7	11.5	...	...
„ postorbital constriction .....	7.8	9	7	8.2
„ interorbital constriction .....	7.8	7.8	7	8
„ width of mesopterygoid fossa ...	7	7	6.2	7
„ between p <sup>1</sup> -p <sup>1</sup> , internally .....	9	9.2	8	10
„ between cingula of canines .....	6	6	...	6.8
„ orbital diameter .....	11.2	11.5	11	12.8
Mandible, length .....	41.8	43.8	41.5	49.8
„ coronoid height .....	19.5	20	19	23.7
Upper teeth, c-m <sup>2</sup> .....	21	21.2	20.5	23.7
Lower teeth, c-m <sub>3</sub> .....	23.2	24	22.2	26.8
Upper incisors, combined width .....	5.5	5.2	6.2	6
p <sup>3</sup> , length .....	3.9	3.9	4.1	4.8
„ width .....	2.9	3	2.8	3.2
p <sup>4</sup> , length .....	4	4	4.2	4.7
„ width .....	3	3	3	3.7
m <sup>1</sup> , length .....	4.4	4.5	5.2	5.3
„ width .....	2.8	2.9	2.9	3.1
m <sup>2</sup> , length .....	2	2.5	2.2	2.8
„ width .....	1.9	2	1.7	2
p <sub>1</sub> , length .....	1.9	2	2	2.2
„ width .....	1.8	1.8	1.9	2
p <sub>3</sub> , length .....	4.1	4	3.8	4.8
„ width .....	2.3	2.6	2.3	2.9
p <sub>1</sub> , length .....	4	3.9	4.1	4.8
„ width .....	2.9	2.8	2.5	3.2
m <sub>1</sub> , length .....	4.2	4.1	4.1	4.9
„ width .....	2.8	2.8	2.6	3.1
m <sub>2</sub> , length .....	3.1	3.5	3.4	3.8
„ width .....	2.5	2.2	2.1	3
m <sub>3</sub> , length .....	2	1.9	2	2.1
„ width .....	1.8	1.8	1.5	2

12. *Pteropus ornatus*, Gray.

*Pteropus vetulus* (pt.), Dobson, Cat. Chir. B. M. p. 27.

*Pteropus rubricollis* (nec E. Geoff.), Jouan, Mém. Soc. Imp. Sci. Nat. Cherbourg, ix. p. 89 (1863: New Caledonia; habits); *id.*, op. c. x. p. 301 (1864: New Caledonia).

*Pteropus vetulus* (nec Jouan), Peters, MB. Akad. Berlin, 1867, p. 323 (New Caledonia); Dobson, Cat. Chir. B. M. p. 27 (pt.) (1878: New Caledonia); *id.*, P. Z. S. 1878, p. 874 (pt.) (1879: New Caledonia); Trouessart, Rev. & Mag. Zool. (3) vi. p. 204 (pt.) (1879: New Caledonia); *id.*, Ann. Sci. Nat. (6) Zool. viii. Art. 12, pp. 16, 17 (1879: remarks on distr.); Jentink, Cat. Ost. Mamm. p. 253 (1887: New Caledonia); *id.*, Cat. Syst. Mamm. p. 139 (1888: New Caledonia); Trouessart, Cat. Mamm. i. p. 78 (1897: New Caledonia); Seabra, J. Sci. Math. Lisboa, (2) v. no. 19, p. 166 (1898: New Caledonia); Matschie, Megachir. pl. i. figs. 2, 2 a, 2 b (skull) (1899: New Caledonia); Etheridge, Proc. Linn. Soc. N. S. Wales, xxiv. pp. 274, 275 (1899: fur used for the spear-becket of the Caledonians).

*Pteropus* (Spectrum) *vetulus*, Matschie, Megachir. p. 21 (pt.) (1899: New Caledonia); Trouessart, Cat. Mamm., Suppl. p. 51 (pt.) (1904: New Caledonia).

*Pteropus ornatus*, Gray, Cat. Monk. Sc. p. 105 (1870: New Caledonia).

*Diagnosis*.—Allied to *Pt. hypomelanus*, but with somewhat larger teeth, noticeably heavier coronoid process, longer and less adpressed fur extending thickly on upperside of tibia, longer wings and tibia, and different colour of fur. Head, back, and underparts dark brown sparsely sprinkled with white hairs, mantle buffy white, forming a strongly contrasting tippet. Forearm about 150 mm. *Hab.* New Caledonia.

*Skull and teeth*.—Skull similar to that of *Pt. hypomelanus*, but rostrum rather more compressed laterally, crests stronger, coronoid process conspicuously heavier and more steeply ascending.—Teeth averaging decidedly larger, but scarcely differing in structure.

*Ears*.—Somewhat smaller than in *Pt. hypomelanus* (but looking much smaller, owing to longer fur of head), reaching scarcely more than half the distance between base of ear and back of eye, when laid forward; basal half or two-thirds concealed in the long fur of the head. Lower half of inner and outer margins strongly convex; upper half of inner margin nearly straight, of outer margin flatly concave; tip narrowly rounded off. Naked posteriorly, except at base.

*Wings*.—Membranes inserted close together on back, separated by a space of only about 10 mm.

*Interfemoral*.—Extremely short or undeveloped in centre.

*Fur*.—Rather long, straight, directed posteriorly but not closely adpressed on back and rump. Approximate length of hairs at middle of back 20-21, middle of mantle 23-25, middle of belly 20-21 mm. Fur of back extending laterally on membranes about 25 mm. beyond their line of origin from back; least width of hairy space across back about 60 mm.

Above, a thin line of rather long, adpressed hairs along humerus. Proximal half of forearm (excepting basal portion, at and in front of elbow, which is naked) covered with long, distally shortening, thinly spread hairs; on the external side of the forearm the hair can be traced, gradually shortening, to within 45 mm. of the carpal extremity. Tibia densely clothed with long hairs, extending also in a very thin line along metatarsus to base of toes; a few scattered hairs on upperside of toes.

Beneath, antebrachial membrane, lateral membrane along outer side of forearm almost to carpal joint, and between humerus and femur densely clothed with long, woolly, frizzled hairs. Tibia naked, except at base along inner margin.

*Colour*.—♂ imm. skin, 59.4.6.1; type of species:—Back and rump almost chocolate, somewhat sprinkled with silvery greyish-white hairs. Individual hairs seal-brown at base, russet at tip, producing the general chocolate-brown effect; the silvery greyish-white hairs uniform from base to tip.—Entire underside, including sides of neck and flanks, very dark chestnut, slightly but not quite inconspicuously sprinkled with silvery greyish-white hairs. Fur everywhere (the uniform silvery greyish-white hairs excepted) pale russet or almost cinnamon-rufous at base, chestnut or chestnut seal-brown at tip. The general effect of the combined colours is darkest (chestnut vandyck-brown or even chestnut seal-brown) on throat, foreneck, sides of neck, flanks, and anal region, in which the dark hair-tips completely or almost completely conceal the brighter base of the fur; palest (chestnut russet) on breast and front of belly, in which the base of the fur is partially exposed.—Mantle and occiput cream-buff, almost cream-white, forming a well defined tippet, in striking contrast to general dark aspect of fur, washed with a shade of buffy russet in front, laterally, and behind, near surrounding brown fur. Extreme base of hairs of mantle, next to skin, seal-brown.—Crown and sides of head chocolate, coarsely mixed with golden ochraceous and silvery greyish-white hairs. Short adpressed hairs on muzzle greyish, extending backward above eye as an ill-defined superciliary stripe.

A second skin (imm., sex indeterminable, 7.1.1.253) is very similar to the above, but conspicuously paler (russet) on underside; mantle more pure buff in centre, gradually shading to golden ochraceous laterally.

A third skin (♂ imm., 7.1.1.252), in abraded pelage, is considerably darker on head, back, and rump, owing to abrasion of paler-coloured tips of hairs; mantle whitish in centre.

*Measurements*. On pp. 157, 158.

*Specimens examined*. The material in the Paris and British Museums.

*Range*. New Caledonia.

*Type* in collection.

*Technical name*.—Since Peters (1867, *l. s. c.*) identified this species with Jouan's *Pt. vetulus*, it has been referred to in literature under that name by all authors except Gray. On the true *Pt. vetulus*, Jouan, see *infra*.

a. ♂	imm. sk. ;	Pt. de France, New Caledonia ; May 1, 1858.	Purchased (Mr. Cuming). (Type of species.)	59.4.6.1.
b. ♂	imm. sk. ;	Pt. de France, April 20, 1858 (H. N. Turner).	Tomes Coll.	7.1.1.252.
c. Imm.	sk. ; skull.	New Caledonia (H. N. Turner).	Tomes Coll.	7.1.1.253.

## [PTEROPUS VETULUS, Jouan.

*Pteropus Vetula*, Jouan, *Mém. Soc. Imp. Sci. Nat. Cherbourg*, ix. p. 90 (1863: New Caledonia); *id.*, *op. c.* x. p. 301 (1864: New Caledonia).

*Pteropus germaini*, Dobson, *P. Z. S.* 1878, p. 874 (1879: New Caledonia); *Trouessart, Rev. g. Mag. Zool.* (3) vi. p. 204 (1879); *Dobson, Rep. Brit. Assoc.* 1880, p. 172; *Trouessart, Cat. Mamm. i.* p. 78 (1897).

*Pteropus* (Spectrum) *vetulus a. germaini*, *Trouessart, Cat. Mamm., Suppl.* p. 51 (1904).

*Jouan's two species of Pteropus from New Caledonia.*—In his Notes on the Fauna of New Caledonia (1863, *l. c.*) Capt. Jouan distinguished two species of *Pteropus*, viz. "*Pt. rubricollis*, Leith.?" ["Leith." evidently a misprint for Lath.; the correct author's name would be E. Geoff.] and "*Pt. Vetula*, Montrouzier" (*Pt. Vetula* is probably a manuscript name taken up by Jouan; it does not occur in any of Père Montrouzier's published papers, so far as known to me; his article on New Caledonia in the *Revue algérienne et coloniale*, April–May, 1860, has been looked up for me by Professor Trouessart). Probably owing to the facts that Jouan's description of *Pt. vetulus* was very fragmentary and that one of its principal differential characters, as compared with his "*Pt. rubricollis*," was stated to be its considerably smaller size, Peters (MB. Akad. Berlin, 1867, p. 323) regarded "*Pt. rubricollis*" as the adult, *Pt. vetulus* as the young of one species, for which he therefore retained the name *Pt. vetulus*, and this view was apparently accepted by later revisers of the genus (Dobson, Matsebie). But in 1879 Dobson himself described a new species from New Caledonia, *Pt. germaini*, said to differ from *Pt. ornatus*, inter alia, in precisely those two characters which, according to Jouan, distinguish *Pt. vetulus* from "*Pt. rubricollis*," viz., much smaller size and longer fur. This fact certainly greatly strengthens the assumption that Jouan was right in considering his two species perfectly distinct. So far as the available information in literature goes (I have not seen the type of *Pt. vetulus* nor that of *Pt. germaini*), the characters and nomenclature of these two New Caledonian *Pteropi* are as follows:—

The species hesitatingly identified by Jouan with *Pt. rubricollis* will (if, as here presumed, different from his *Pt. Vetula*) have to stand as *Pt. ornatus*, Gray, 1870; synonym, *Pt. vetulus*, Peters, 1867, et auctorum plurimorum, *nec* Jouan, 1863. The only important items in Jouan's description of "*Pt. rubricollis*" are these four: (1) length of head and body 250 mm.; (2) ears very small; (3) fur of head, back, and belly "laineux"; and (4) colour "roux" with mantle "blanc-jaunâtre." All these characters agree with *Pt. ornatus*, and the second, third, and fourth absolutely exclude the only other New Caledonian species of similar size, *Pt. geddis*.—Jouan's second species, "*Pt. Vetula*," was stated to differ from the foregoing: (1) "par sa taille constamment plus petite," the length of the head and body being only 160 mm., and (2) by having the fur "plus long, plutôt soyeux que laineux." This species will have to stand as *Pt. vetulus*, Jouan, 1863, *nec* auctorum plurimorum; synonym *Pt. germaini*, Dobson, 1879.

*Pt. germaini*, Dobson.—Summary of original description:—*Teeth* simple, like those of *Pt. giganteus*. *Ears* shorter than muzzle, concealed by long fur of head. *Fur* long and woolly, like that of *Pt. aetianus*; tibiae clothed with long fur extending to backs of feet. *Colour*: head and whole inferior surface of body dark blackish brown interspersed with several shiny greyish hairs, shoulders and back darker, rump and legs greyer; fur of mantle pale yellow with reddish extremities; muzzle and superciliaries light greyish brown. *Measurements*: of type, a not quite adult female, head and body 150 mm., ear 20.

forearm 120, pollex 58, third digit, metacarpal 76, 1st ph. 63.5, 2nd ph. 89, fifth digit, metacarpal 76, 1st ph. 38, 2nd ph. 34, tibia 56, foot 43. Resembles, Dobson adds, externally to some extent *Pt. anetianus*, "but the very different form of the teeth at once distinguishes it"; from *Pt. ornatus*, "inhabiting the same islands, it is distinguished by the completely different colour of the fur [Dobson had before him specimens of *Pt. ornatus* for comparison], as well as by the absence of transverse basal ridges in the molars and premolars."

*Type specimens*.—The type of *Pt. vetulus* is not in the Paris Museum nor, I am informed by Professor L. Corbière, in the Cherbourg Museum. Dobson's statement, in P. Z. S. 1878, p. 874, that the type [in 1878 or 1879] was in the Paris Museum is erroneous; there is no evidence in the Registers of that Museum that it ever was there; and his description in Cat. Chir. B.M. p. 27, of "a female (type of the species)" is taken from a specimen of *Pt. ornatus*.—*Pt. germaini* was based on a single specimen in the Paris Museum. I have examined all the specimens in that Museum collected by Germain in New Caledonia; none is labelled *Pt. germaini*, and none corresponds to the description and measurements given by Dobson.]

### 13. *Pteropus auratus*, K. And.

*Pteropus vetulus* (pt.), Dobson, Cat. Chir. B. M. p. 28.

*Pteropus vetulus* (pt., *nec Jouan*), Dobson, l. s. c. (1878: Loyalty Is.); *id.*, P. Z. S. 1878, p. 874 (1879: Loyalty Is.); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 204 (1879: Loyalty Is.); var., Trouessart, *Cat. Mamm.* i. p. 78 (1897: Loyalty Is.).

*Pteropus* (Spectrum) *vetulus* (pt.), Matschie, *Megachir.* p. 21 (1899: Loyalty Is.); var., Trouessart, *Cat. Mamm., Suppl.* p. 51 (1904: Loyalty Is.).

*Pteropus auratus*, K. Andersen, *Ann. & Mag. N. H.* (8) iii. p. 233 (1 Feb. 1909: Lifu, Loyalty Is.).

*Diagnosis*.—Similar to *Pt. ornatus* in skull, dentition (though perhaps with slightly smaller cheek-teeth), distribution of fur (tibia clothed above), and general size, but with larger ears and different colour of the fur. Head, mantle, and underparts golden ochraceous, back mixed ochraceous-buff and brown. Forearm about 145 mm. *Hab.* Loyalty Is.

*Teeth*.—General characters as in *Pt. ornatus*. In the single known specimen  $p^1$ ,  $m^1$ ,  $p_3$ ,  $p_1$ , and  $m_1$  are distinctly smaller than in three skulls of *Pt. ornatus*; see measurements p. 158.

*Palate-ridges*.—5+6+3. First ridge terminating laterally at front of canines; second at back of canines; third between canines and  $p^3$ ; fourth at middle of  $p^3$ ; fifth at front of  $p^1$ ; sixth at back of  $p^1$ ; seventh at front of  $m^1$ ; eighth at back of  $m^1$ ; ninth at back of (or closely behind)  $m^2$ ; tenth and eleventh behind  $m^2$ ; twelfth to fourteenth situated at palation border.

*Ears*.—Conspicuously longer and broader than in *Pt. ornatus*; length from base of orifice 24.5 mm., against 20 in the allied species, greatest breadth (flattened) 17 mm., against 12.

*Colour* (type).—Back vandyck-brown with long golden ochraceous-buff tips to the hairs, producing the general effect of golden ochraceous clouded with brown.—Breast and belly rich golden ochraceous, palest (golden ochraceous-buff) at base of hairs, shading to tawny on foreneck, sides of neck, and flanks, and to tawny russet faintly sprinkled with ochraceous on chin, throat, and anal region.—Mantle rich golden ochraceous-buff, this colour confined to tips of hairs, middle portion of individual hairs buff, extreme base



next to skin seal-brown; colour of mantle shading gradually into tawny on occiput and sides of neck.—Crown buff, slightly darkened with brownish, passing gradually into tawny on sides of head.

*Measurements.* Below and on p. 158.

*Specimen examined.* One, the type.

*Range.* Loyalty Islands (Lifu).

*Type* in collection.

*History in literature.*—Some of the differential characters of this species were already pointed out by Dobson (1878, l. s. c.), who, however, considered it only a local variety of *Pt. retulus*. His statement that the ears are shorter than in the New Caledonian species is erroneous.

*Remarks.*—Though strikingly different in general aspect, the colour of *Pt. auratus* is easily derived from that of its closest relative, *Pt. ornatus*. The dark brown of the head and underparts of *Pt. ornatus* is in *Pt. auratus* replaced by golden ochraceous or ochraceous-buff, and the dark brown of the back by mixed golden ochraceous-buff and brownish.

a. ♀ ad. al.; skull. Lifu I., Loyalty Is.

Rev. S. J. Whitmee 77.7.23.1.  
[C.]. (*Type of species.*)

*External measurements of Pteropus ornatus and auratus.*

	<i>Pt. ornatus.</i> ♀ ad.*	<i>Pt. auratus.</i> ♀ ad. Type.
	mm.	mm.
Forearm .....	152	145.5
Pollex, total length, c. n. ....	65	64
" metacarpal .....	...	14.2
" 1st phalanx .....	...	34
2nd digit, metacarpal .....	79	73.8
" 1st phalanx .....	16	16
" 2nd-3rd phalanx, c. n. ....	15	16.5
3rd digit, metacarpal .....	100	100.5
" 1st phalanx .....	75	73
" 2nd phalanx .....	104	107
4th digit, metacarpal .....	102	100.5
" 1st phalanx .....	63	62
" 2nd phalanx .....	59	60
5th digit, metacarpal .....	105	105.5
" 1st phalanx .....	47	46
" 2nd phalanx .....	40	44
Ears, length from orifice .....	20	24.5
" greatest width, flattened .....	12	17
Front of eye to tip of muzzle .....	...	27
Lower leg .....	...	70.5
Foot, c. n. ....	...	45
Calcaneal .....	...	20.5

\* Ile des Pins, New Caledonia, Paris Museum: measured by Professor Dr. E. Trouessart. It should be noted that this individual represents probably very nearly the maximum size of the species ("c'est le plus grand spécimen que nous possédions dans l'alcôol," Trouessart, *in litt.*). The three British Museum specimens are slightly immature.

*Measurements of skull of Pteropus auratus, and teeth of Pt. ornatus and auratus.*

	<i>Pt. ornatus.</i>		<i>Pt. auratus.</i>
	Teeth: 3 mm.		♀ ad. Type.
	Min.	Max.	
	mm.	mm.	mm.
Skull, total length to gnathion .....	.....	.....	67.3
„ palation to incisive foramina .....	.....	.....	34
„ front of orbit to tip of nasals .....	.....	.....	22.2
„ width of brain-case at zygomatic .....	.....	.....	23.8
„ zygomatic width .....	.....	.....	37.2
„ width across $m^1$ , externally .....	.....	.....	18.8
„ lacrymal width .....	.....	.....	14.2
„ width across canines, externally .....	.....	.....	12.8
„ postorbital constriction .....	.....	.....	6.7
„ interorbital constriction .....	.....	.....	8.5
„ width of mesopterygoid fossa .....	.....	.....	7.7
„ between $p^4$ - $p^4$ , internally .....	.....	.....	10.6
„ between cingula of canines .....	.....	.....	7
„ orbital diameter .....	.....	.....	12.8
Mandible, length .....	.....	.....	54.3
„ coronoid height .....	.....	.....	29
Upper teeth, c- $m^2$ .....	.....	.....	26.2
Lower teeth, c- $m_3$ .....	.....	.....	29.7
Upper incisors, combined width.....	6.9	7.5	7
$p^3$ , length .....	4.6	5.1	4.7
„ width .....	3.2	3.3	3
$p^4$ , length .....	4.8	5.7	5
„ width .....	3.7	3.9	3.2
$m^1$ , length .....	6	6.8	5.7
„ width .....	3.2	3.7	3.2
$m^2$ , length .....	2.8	3.2	2.8
„ width .....	2.2	2.3	1.8
$p_1$ , length .....	2.1	2.8	2
„ width .....	2	2.2	2
$p_3$ , length .....	5	5.7	4.8
„ width .....	2.8	3	2.5
$p_4$ , length .....	5.2	5.8	5
„ width .....	2.9	3.5	2.8
$m_1$ , length .....	5.2	6.2	5
„ width .....	2.9	3.2	2.8
$m_2$ , length .....	4.2	4.8	4.1
„ width .....	2.7	3	2.8
$m_3$ , length .....	2.8	3	2.7
„ width .....	2.1	2.2	2.1

14. *Pteropus dasymallus*, Temm.

*Pteropus dasymallus*, Dobson, Cat. Chir. B. M. p. 25.

- Pteropus rubricollis* (*nec E. Geoff.*), G. T. [misprint for *Ph. F.*] Siebold, *De Hist. Nat. in Japonia statu*, p. 13 (1824: Nagasaki; Jeddo).  
*Pteropus dasymallus*, Temminck, *Mon. Mamm.* i. p. 180, pl. x. (animal), pl. xv. figs. 10, 11 (skull of type) (1825: Nagasaki; Jeddo); *Desmarest, Dict. Sci. Nat.* xvi. p. 361 (1827: Nagasaki; Jeddo); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 700 (1828: Japan); *J. B. Fischer, Syn. Mamm.* p. 83, no. 6 (1829: Jeddo; Nagasaki); *Wagler, Syst. Amph.* p. 9 (1830); *Lesson, Hist. Nat. Mamm. (Compl. Buffon)* v. p. 59 (1836: Japan); *Gray, Mag. Zool. & Bot.* ii. p. 503 (1838: Japan); *Oken, Allg. Naturg.* vii. Abth. ii. p. 990 (1838); *Temminck, Tijds. Nat. Gesch.* v. pt. 4, p. 282 (1839: Japan); *Wagner, Schreber's Säug., Suppl.* i. p. 349 (1839: Nagasaki; Jeddo); *Temminck, Fauna Japon., Mamm.* p. 12 (1842: S. Kiushiu; Yakushima); *Lesson, N. Tabl. Règne An., Mamm.* p. 13, no. 176 (1842: Japan); *Schinz, Syst. Verz. Säug.* i. p. 124 (1844: Japan); *id., op. cit.* ii. Nachtrag, p. 14 (1845: S. Kiushiu; Yakushima); *Gray, Zool. Samarang, Vert.* p. 34 (1849: Japan); *Wagner, Schreber's Säug., Suppl.* v. p. 598 (1853-55: Japan); *Gervais, Hist. Nat. Mamm.* i. p. 188 (1854: Japan); *Giebel, Säug.* p. 997 (1855: Japan); *Schlegel, Dierkunde*, i. p. 53 (1857: Japan); *Gerrard, Cat. Boxes Mamm. B. M.* p. 56 (1862: Japan); *Peters, MB. Akad. Berlin*, 1867, p. 323 (Kiushiu; Yakushima); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 428 (1870: Jeddo; Nagasaki); *Schlegel, Dierentuin Nat. Art. Mag., Mamm.* p. 66 (1872: Japan); *Dobson, Mon. Asiat. Chir.* p. 16 (1876: Japan); *id., Cat. Chir. B. M.* p. 25, pl. iii. fig. 1 (ear) (1878: Japan); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 204 (1879: Kiushiu; Hondo); *Jentink, Cat. Ost. Mamm.* p. 252 (1887: Japan); *id., Cat. Syst. Mamm.* p. 138 (1888: Japan); *Ehmann, Mitth. D. Ges. Naturk. Ostasiens*, v. p. 389 (1892: Liu-kius); *Trouessart, Cat. Mamm.* i. p. 77 (1897: Liu-kius); *Matschie, Megachir.* pl. i. figs. 1, 1a, 1b (skull) (1899); *Bangs, Amer. Naturalist*, xxxv. no. 415, p. 561 (1901: Ishigaki); *Bonhote, Nor. Zool.* ix. p. 628 (1902: Liu-kius); *Miller, Fam. & Gen. Bats*, p. 58 (1907).  
*Spectrum dasymallum*, Gray, *Cat. Monk. &c.* p. 101 (1870: Japan).  
*Pteropus rubricollis* (*dasymallus*), Seitz, *Mitth. D. Ges. Naturk. Ostasiens*, v. p. 363 (1892: Kiushiu).  
*Pteropus* (*Spectrum*) *dasymallus*, Matschie, *Megachir.* p. 27 (1899); *Trouessart, Cat. Mamm., Suppl.* p. 53 (1904: Liu-kius).

*Diagnosis*.—Skull and dentition unmodified Pteropine. Ears rather small, half exposed; fur unusually long and spreading; tibia clothed above. Head, back, and underparts dark brown, more or less varied with buffy hair-tips on back; collar buffy or cream-buffy. Forearm 125.5–137 mm. *Hab.* S. Liu-kiu Islands.

*Skull and teeth*.—As in *Pt. hypomelanus*, but rostrum slightly shorter than in specimens of *hypomelanus* of similar size, p<sup>3</sup> and p<sub>3</sub> a little heavier. Compare measurements of skulls and teeth, p. 171, with those of *Pt. hypomelanus*, p. 131.

*Palate-ridges* (several specimens).—5 + 5 + 3; the right and left

half of the sixth ridge only slightly separated, in some individuals completely fused in the median line (formula  $6+4+3$ ). First ridge terminating laterally at front of canine; second at back of canine or between this and  $p^3$ ; third at front of  $p^3$ ; fourth at back of  $p^3$  or between  $p^3$  and  $p^4$ ; fifth at  $p^4$ ; sixth at front of  $m^1$ ; seventh at back of  $m^1$ ; eighth at  $m^2$ ; ninth closely behind  $m^2$ ; tenth far behind  $m^2$ ; eleventh to thirteenth near palation border.

*Ears.*—Rather smaller than in *Pt. hypomelanus* (but looking much smaller, owing to basal half of conch being hidden in the long fur); not nearly reaching hinder corner of eye when laid forward. Inner margin of conch flatly convex from base to tip; lower half of outer margin strongly convex, upper half approximately straight, becoming very flatly concave immediately below tip; tip subacutely rounded. Basal half thinly haired behind, concealed by the fur of the head; distal half naked, exposed.

*Interfemoral.*—Undeveloped in centre.

*Fur.*—Long, dense, spreading, extremely soft and silky. Approximate length of longest hairs at middle of back 24, middle of mantle 25, middle of belly 20 mm.

Above, fur extending on proximal half or two-thirds of forearm, and on lateral membrane almost to a line between elbow and knee. Tibia clothed to ankle, the hair being long and dense on proximal two-thirds or three-fourths, shorter and more thinly spread on distal third or fourth. A few long (blackish or whitish) hairs on feet. Interfemoral completely covered along femur and proximal half of tibia, practically naked laterally along distal half of tibia.—Beneath, basal half of forearm hairy. Antebrachial membrane, lateral membrane along outer side of forearm, and along body between humerus and femur, covered with densely set woolly hair. Proximal half or third of tibia hairy.

*Colour.*—♂ ad. skin, Kobama, S. Liu-kius, July 20th, teeth worn; B. M. 5.11.3.13: Back and rump nearly seal-brown, strongly varied with buffy tips to the hairs. Individual hairs seal-brown for basal five-sixths or three-fourths, buffy or golden ochraceous-buffy at extreme tip, the pale tips becoming longer posteriorly, on rump and thighs. In most places the pale hair-tips are too short to completely cover the seal-brown bases; many of the hairs, particularly on the sides of the back and distal two-thirds of tibia, are seal-brown from base to tip.—Breast, belly, and flanks much more uniform in colour: dark vandyck-brown, approaching seal-brown, in some places (especially on flanks) washed with mars-brown. Concealed base of hair everywhere almost seal-brown. A few silvery greyish-white hairs interspersed between the dark ones.—Mantle and sides of neck buffy (approximately buff-yellow), shading to whitish cream-buff on sides of foreneck. Pale collar interrupted in median portion of foreneck by a narrow line of dark brown connecting the dark throat and breast. Concealed basal half of hairs in central portion of mantle dark brown: at sides of mantle, sides of neck and foreneck the dark brown is confined to the extreme base of the hairs or completely obliterated.—Occiput,

crown, interocular region, and sides of head dark brown (approaching seal-brown), slightly grizzled with pale greyish and buffy; chin and throat almost uniform seal-brown.

Individual variation (skins, S. Liu-kiu):—Not great, chiefly depending on the lesser or greater development of buffy tips to the hairs of the back and rump, the more seal-brown or more mars-brown tinge of the ground-colour of the fur, the amount of grizzling on the head, and the richer or paler colour of the mantle.—In some specimens the buffy hair-tips on back and rump are extremely short, and almost ochraceous in tinge, the general colour of the back and rump therefore seal-brown slightly varied with dull ochraceous. In others, the buffy tips are so long as to almost completely cover the dark base of the fur, making the back and rump approximately pale buffy, with a narrow line of mars-brown along the lateral membrane (♀ ad., Ishigaki, June; 5.11.3.8).—Breast, belly, and flanks varying from seal-brown tinged with vandyck-brown to almost uniform pale mars-brown.—Mantle varying from almost buff-yellow, through pale ochraceous-buff, to pale buff; side of foreneck always much more whitish in tinge than mantle. The collar is never complete below, always interrupted in the median line of the foreneck by a narrower or broader dark longitudinal stripe between throat and breast; in one specimen (♀ ad., Ishigaki, July; 5.11.3.9) this dark area is so broad as to occupy almost the whole width of the foreneck. Not infrequently the collar is partly interrupted also on the back of the neck, owing to the pale tips being too short to completely cover the dark brown bases of the hairs; in this case the "collar" is confined to the sides of the mantle, and sides of the neck and foreneck (compare *Pt. formosus*).—Head varying, like back, from seal-brown to mars-brown, never uniform, but the amount of greyish and buffy admixture variable.

The variations described above are independent of the sex of the individuals.

Young female, scarcely half-grown (Ishigaki; 5.11.3.10): Darker and more uniform in colour than adults. Back, rump, breast, belly, and flanks dark vandyck-brown, approaching seal-brown. Head blackish seal-brown. Mantle and sides of neck ochraceous-buff.

*Measurements.* On pp. 170, 171.

*Specimens examined.* The British Museum material, and the type of the species.

*Range.* S. Liu-kiu Islands: Ishigaki, Iriomoto, Yonakumi, Kobama.

*Type* in the Leyden Museum.

*History in literature.*—In one of the earliest known lists of Japanese mammals (Siebold, 1824) this species was recorded, under the name *Pt. rubricollis* Geoff., from Nagasaki (Kiushiu) and Jeddo (Hondo). One year later (1825), on the strength of a single specimen, acquired by the Leyden Museum from Blomhoff, "ancien résident néerlandais au Japon," Temminck named, described, and figured it as *Pt. dasymallus* (the specific name in allusion to the dense woolly fur). Temminck copied Siebold's statement as to the

range of the species: Nagasaki and Jeddo, "où elle devaste les plantations d'arbres fruitiers"; in 1842 (Fauna Japonica) he wrote, however, that *Pt. dasymallus* occurs "seulement dans les parties méridionales de l'île Kiushiu, dans le district de Satsuma, et plus rarement à Jakunoshima." All records in literature of *dasymallus* from Jeddo, Nagasaki, and Yakushima (see list of references above) are based exclusively on Temminck's statements; in recent times the species has only been obtained in the S. Liu-kiu Islands; one of its Japanese names, "Liukiu-kōmoli," i. e. Liu-kiu bat, would also seem to indicate that it is a native of this group of islands rather than of Japan proper. There can be little doubt, therefore, that Siebold was mistaken as to the habitat of *dasymallus*; very likely he saw and obtained this species in Kiushiu and Hondo; it is frequently brought alive to Japan from the Liu-kiu Islands and kept in captivity by the Japanese.

The type in the Leyden Museum is an immature (not quite full-grown) mounted individual, skull extracted. The surface of the fur, above and beneath, has faded to whitish or creamy whitish; base of hair less bleached. Skull and teeth as in British Museum specimens from the Liu-kiu Islands.

By Gray (1870) this species was placed in the genus *Spectrum*, between *S. rubricolle* and *S. anetianum*. Though very different in skull and dentition, *Pt. dasymallus* and *anetianus* are, in fact, externally so puzzlingly similar to each other as to be sometimes difficult to distinguish by external characters alone.

a. ♀ imm. al.; skull.		Sir E. Belcher	Not reg.
b. ♂ ad. st.; skull.	"Japan."	[C.].	
		Purchased	51.7.10.13.
		(Verreaux).	51.8.30.14.
c-e. 1 ♂ ad., 2 ♂ yg. ad. al.	Liu-kiu Is.	H. Pryer, Esq.	87.12.12.1-3.
		[C.].	
f-i. 1 ♂ ad., 3 ♀ ad. sks.; skulls.	Ishigaki, S. Liu-kiu Is.; June-July, 1904 (native collector).	Purchased	5.11.3.6-9.
		(A. Owston).	
j. ♀ pull. sk.	Ishigaki (native collector).	Purchased	5.11.3.10.
		(A. Owston).	
k, l. ♂ ad., ♀ ad. sks.; skulls.	Iriomoto, S. Liu-kiu Is.; June 19 & 24, 1904 (native collector).	Purchased	5.11.3.11, 12.
		(A. Owston).	
m. ♀ ad. sk.: skull.	Yonakumi, S. Liu-kiu Is.; June 23, 1904 (native collector).	Purchased	5.11.3.14.
		(A. Owston).	
n. ♂ ad. sk.: skull.	Kobama, S. Liu-kiu Is.; July 20, 1904 (native collector).	Purchased	5.11.3.13.
		(A. Owston).	

15. *Pteropus formosus*, P. L. Slater.

*Pteropus formosus*, Dobson, Cat. Chir. B. M. p. 26.

*Pteropus formosus*, P. L. Slater, P. Z. S. 1873 (Feb. 18), p. 193, pl. xxii. (animal) (Taku, Formosa); *Gulliver*, P. Z. S. 1875, p. 493 \* (size of red blood-corpuscles); *Dobson*, l. s. c. (1878: Formosa); *Trouessart*, Rev. & Mag. Zool. (3) vi. p. 204 (1879: Formosa); P. L. Slater, P. Z. S. 1891, p. 677 (Formosa); *id.*, P. Z. S. 1892, p. 1 † (Formosa); *id.*, List An. Zool. Soc. Gard. 9 ed. p. 102 (1896); *Trouessart*, Cat. Mamm. i. p. 78 (1897: Formosa).

*Pteropus* (Spectrum) *formosus*, Matschie, Megachir. p. 27 (1899); *Trouessart*, Cat. Mamm., Suppl. p. 53 (1904: Formosa).

*Diagnosis*.—Similar to *Pt. dasymallus*, but fur somewhat longer, colour almost uniform vandyck-brown above and beneath, with creamy-white mantle and sides of neck. Forearm 130–137 mm. *Hab.* Formosa.

*Skull and teeth*.—Not differing appreciably from those of *Pt. dasymallus*.

*Palate-ridges* (two specimens, cotypes of species).—5 + 5 + 3; sixth ridge in one specimen conspicuously, in the other very slightly interrupted in median line. Arrangement as in *Pt. dasymallus*.

*Fur*.—Longer than in *Pt. dasymallus*: length of hair at middle of back about 29, middle of mantle 30, middle of belly 28 mm. Distribution and character of fur as in *Pt. dasymallus*.

*Colour*.—♀ ad. skin, Formosa, teeth slightly worn; B. M. 92.2.1.1: Back and rump almost uniform vandyck-brown. Concealed bases of hairs vandyck-brown, tips paler, approximately mars-brown, or this colour with a slight touch of buffy.—Breast, belly, and flanks vandyck-brown of a slightly darker tinge than back.—Collar represented by a large well-defined patch of creamy-white hair on either side of neck, and similarly coloured tips to the hair of the mantle. Base of hair of mantle between vandyck-brown and seal-brown, tips of hair creamy white or silvery white, making a total impression of dark brown conspicuously varied and powdered with creamy-white. Hair of creamy-white patch on side of neck seal-brown only at extreme base, next to skin. Broad median portion of foreneck, between side patches, similar to breast.—Occiput, crown, and interocular space dark brown, between vandyck-brown and seal-brown, grizzled or powdered with pale greyish; sides of head more uniform dark brown; chin and throat almost seal-brown.

One of the cotypes of the species, also a female (al.; known to have been living almost seven years in confinement), is similar in colour to the specimen described above. In both of these females the mantle is mixed creamy-white and brownish, not defined by a straight line behind, but passing rather irregularly into the dark brownish colour of the back. In the second cotype, a male (al.; almost seven years in confinement), the whole of the mantle, sides

\* Miswritten *Pt. formosanus*.

† Misprinted *Pt. morsus*.

of neck, and sides of foreneck are unmixed creamy white, forming a collar very sharply defined from and contrasting with the back, and interrupted only for a rather narrow space on the middle of the foreneck; concealed base of hair of mantle, as usual, seal-brown. Similar variations in the colour of the mantle are seen in the closely related *Pt. dasymallus* (above p. 161); in both species they depend on the greater or less length of the pale tips to the hairs; if long, the pale-coloured tips completely cover the dark base of the fur, making the mantle (in *Pt. formosus*) appear pure creamy-white; if short, the dark base of the fur shows more or less through, making the colour of the mantle mixed dark brown and creamy-white, much less contrasting with that of the back. More material is required to decide whether in the present species these differences are merely individual (as is the case in *Pt. dasymallus*), or perhaps sexual.

*Measurements.* On pp. 170, 171.

*Specimens examined.* Three, in the collection of the British Museum.

*Range.* Formosa (Taku).

*Cotypes* in collection.

*History in literature.*—A male and female of this species were presented to the Zoological Society's Gardens, Jan. 9, 1873, by the Rev. Mr. Ritchie, of Taku, Formosa. The male was kept alive till October 4th, 1879, the female died presumably a few months later. A coloured plate of these two specimens was published, in 1873, by Sclater (*l. s. c.*), who named the species *Pt. formosus*, without description; the specific name probably was proposed chiefly on account of its similarity to the name of the habitat of the species. The plate does not give a correct idea of the colour of the fur. The earliest description is that published by Dobson, in 1878. A third specimen, also from Formosa, was presented to the Society's Gardens, Dec. 1, 1891, by Mr. Thos. Perkins. The skin of a female specimen, according to a note on the label, "brought alive, said to have come from Formosa," was presented to the British Museum, in 1892, by Mr. J. de La Touche. So far (December, 1908), these seem to be the only examples on record.

- |                      |               |                             |             |
|----------------------|---------------|-----------------------------|-------------|
| a. ♂ ad. al.; skull. | Taku, Formosa | Zool. Soc. Gardens.         | 80.3.25.7.  |
|                      | (Ritchie).    |                             |             |
| b. ♀ ad. al.; skull. | Taku, Formosa | Zool. Soc. Gardens.         | 80.11.26.1. |
| —                    | (Ritchie).    |                             |             |
|                      |               | (a, b: Cotypes of species.) |             |
| c. ♀ ad. sk.; skull. | Formosa.      | J. de La Touche[P.].        | 92.2.1.1.   |

## 16. *Pteropus subniger*, Kerr.

*Pteropus rubricollis*, Dobson, Cat. Chir. B. M. p. 24.

- La Roussette à col rouge, Brisson, *Regn. Anim.* p. 217 (1756: Reunion); *id.*, *op. cit.* 2 ed. p. 154 (1762: Reunion).  
La Rougette, Buffon, *Hist. Nat.* x. pp. 55, 79, 82, pl. xvii. (animal)



- (1763: Reunion); *id.*, *op. cit. Suppl.* iii. p. 256 (1776: Reunion; habits); *Fouquet d'Obsonville, Essais philosophiques*, p. 77 (1783: Reunion); *G. Cuvier, Tabl. Elém.* p. 104 (1798); *E. Geoffroy, Ann. Mus. d'Hist. Nat.* vii. p. 230 (1806: Mauritius; habits).
- Ternate Bat: The Rougette, *Pennant, Hist. Quadr.* ii. p. 549 (1781); *id.*, *op. cit.* 3 ed. ii. p. 305 (1793).
- Roussette: une autre espèce, *Milbert, Voy. pittor. Ile-de-France*, p. 245 (1812: Mauritius).
- Vespertilio vampyrus* (*nec L.*), *P. L. S. Müller, Vollst. Natursyst.* i. p. 153 (pt.) (1773: Reunion). Var. *B.*, *Schreber, Säug.* i. pp. 153, 155 (1774); *Boddaert, Elench. Anim.* i. p. 68 (pt.) (1785). Var. *β*, *Gmelin, Linn. Syst. Nat.* i. p. 45 (1787). Var. *3*, *Turton, Linn. Syst. Nat.* i. p. 24 (1802).
- Pteropus vampyrus*, var. *β*, *Erxleben, Syst. Regn. Anim.* p. 133 (1777). Var. *β*, *Donndorff, Zool. Beytr.* i. p. 62 (1792). Var. *b*, (Die Rougette), *Bechstein, Pennant's Vierfüß. Thiere*, ii. pp. 617, 733 (1800).
- Vespertilio vampyrus subniger*, *Kerr, Anim. Kingd.* i. pt. i. pp. xvii, 91, no. 107 (1792).
- Spectrum rubidum*, *Daudin, in Buffon, Hist. Nat., Didot ed., Quadr.* xiv. p. 188 (1802\*).
- Pteropus ruber*, *E. Geoffroy, Cat. Mamm. Mus. Nation. d'Hist. Nat.* p. 48 (1803: Madagascar, errore).
- Pteropus fuscus* (*nec E. Geoff.*) *Desmarest, N. Dict. d'Hist. Nat.* xix. p. 544 (1803: Reunion).
- Vespertilio caninus* (*nec Blumenb.*), var. *a*, *Goldfuss, Vergl. Naturbeschr. Säug.* p. 98 (1809).
- Pteropus rubricollis*, *E. Geoffroy, Ann. Mus. d'Hist. Nat.* xv. p. 93 (1810: Reunion); *Oken, Lehrb. Naturg.* iii. Abth. ii. p. 935 (1816: Reunion; Mauritius); *G. Cuvier, Règne Anim.* i. p. 124 (1817: Mauritius; Reunion); *Desmarest, Mamm.* i. p. 110, no. 140 (1820: Mascarenes); *Schinz, Thierr.* i. p. 154 (1821: Mauritius; Reunion); *Temminck, Mon. Mamm.* i. p. 183 (1825: Reunion; Madagascar); *Lesson, Man. Mamm.* p. 109, no. 280 (1827: Reunion); *Gray, Griffith's Anim. Kingd.* v. p. 55, no. 156† (1827: Mauritius); *Desmarest, Dict. Sci. Nat.* xlv. p. 362 (1827: Mauritius; Reunion); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 700 (1828: Reunion); *J. B. Fischer, Syn. Mamm.* p. 84, no. 8 (1829: Reunion); *Temminck, Mon. Mamm.* ii. p. 75 (1837); *Waterhouse, Cat. Mamm. Mus. Zool. Soc. Lond.* p. 13, no. 102 (1838: Mauritius); *Gray, Mag. Zool. & Bot.* ii. p. 503 (1838: Cape of Good Hope; Reunion; Madagascar); *Oken, Allg. Naturg.* vii. Abth. ii. p. 988 (1838: Mauritius; Reunion; Madagascar); *Wagner, Schreber's Säug., Suppl.* i. p. 351 (1839: Reunion; Madagascar); *Lesson, N. Tabl. Règne An., Mamm.* p. 13, no. 178 (1842: Reunion; Madagascar; Caffraria); *Schinz, Syst. Verz. Säug.* i. p. 125 (1844: Reunion; Madagascar; Caffraria); *Wagner, Schreber's Säug., Suppl.* v. p. 602 (1853-55: Reunion; Madagascar); *Gervais, Hist. Nat. Mamm.* i. p. 188 (1854); *Giebel, Säug.* p. 997 (1855: Reunion; Madagascar); *Peters, MB. Akad. Berlin*, 1867, p. 323 (Reunion); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 453 (1870: Reunion);

\* Titlepage dated 1799. On the true year of publication see C. W. Richmond, *The Auk*, xvi. p. 329 (1899).

† Misspelt *Pt. rubicollis*.

- Mauritius): *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 516 (1872-73: structure of hairs); *Dobson, Cat. Chir. B. M.* p. 24 (1878: Mauritius); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 204 (1879: Reunion; Mauritius); *Robin, Ann. Sci. Nat.* (6) Zool. xii. Art. 2, p. 4 *et seq.* pl. ii. fig. 1, pl. iii. fig. 16 (1881: anatomy); *Trouessart, Cat. Mamm.* i. p. 77 (1897: Reunion; Mauritius); *Matschie, Megachir.* pl. viii. figs. 1, 1 a, 1 a [bis], 1 b, 1 c (head, teeth) (1899: Mauritius); *Elliot, Cat. Mamm. Field Col. Mus.* p. 491 (1907: Mauritius); *Miller, Fam. & Gen. Bats*, p. 58 (1907).
- Spectrum rubricolle*, *Gray, Cat. Monk. &c.* p. 101 (1870: Cape of Good Hope; Mauritius).
- Pteropus* (*Sericonycteris*) *rubricollis*, *Matschie, Megachir.* p. 30 (1899: Reunion; Mauritius); *Trouessart, Cat. Mamm., Suppl.* p. 54 (1904: Reunion; Mauritius).
- Pteropus torquatus*, *G. Fischer, Zoognosia*, iii. p. 553 (1814).
- Pteropus collaris*, *Illiger, Abh. Akad. Berlin*, 1804-11, pp. 78, 84 (1815: E. African Islands).

*Diagnosis*.—Teeth much smaller, especially narrower, than usual. Ears small, concealed in the fur. Tibia densely clothed above. Fur of mantle, back, and rump long, semierect. Orange buffy collar contrasting with general dark brownish colour of fur above and below. Size very small: forearm 95-99 mm. *Hab.* Mascarenes.

*Skull*.—Small, delicately built, with short rostrum. Brain-case high, domed, profile-line of skull from top of brain-case to nasals therefore steeper than in *Pt. hypomelanus*. Deflection of brain-case greater than usual, the alveolar line if projected backward passing through middle of vertical portion of supraoccipital. The shortness of the rostrum chiefly due to the reduction of the teeth and the comparatively larger size of the orbits; front of orbit vertically above back of  $p^1$ ; orbital diameter only slightly less than lachrymal width of rostrum. Sagittal crest undeveloped; the temporal crests in fully adults closely approximated to each other, but apparently never fused in the median line to form a sagittal crest. Postorbital processes long, slender, reaching about halfway (or a little more) between frontal and zygoma; corresponding processes on zygoma very small or undeveloped. Coronoid height of mandible much less than length of lower tooth-row,  $c-m_3$ .

*Teeth*.—Chief character: cheek-teeth small and unusually narrow; width of  $p^1$  between one-fourth and one-fifth (in most other species of the genus about one-third) the palatal width between  $p^4-p^4$ .

Cingulum of upper canines strong, shelf-like.  $p^1$  minute, terete, spiculiform, deciduous: in six almost full-grown individuals it is present in five, lost (and alveolus closed) in one; in two adults with unworn teeth present in one, lost in the other. Posterior ledges of  $p^3$  and  $p^4$  feebly developed, without postero-external cusp, or with only an indication of such in  $p^3$ .  $m^1$  not quite twice as long as broad.  $m^2$  nearly equal in size to  $p_1$ , larger than  $m_3$ .— $i_2$  in cross section once and a half or scarcely twice the size of  $i_1$ . Cingulum of lower canines well developed, but narrower than in

upper canines.  $p_1$  rather large, much larger than  $m_3$ , about twice (or a little more) the bulk of  $i_2$ . Posterior ledges of  $p_3$  and  $p_4$  well developed, raised postero-externally into a minute cusp; a similar cusp-like elevation sometimes faintly indicated in  $m_1$ .  $m_3$  small, subequal in bulk to  $i_2$ .

The remarkable reduction in the size of the teeth accounts for the non-development of a sagittal crest in this species.

*Ears*.—Very small, completely hidden in the fur; triangular in shape, outer and inner margins almost evenly converging from base to tip. Densely clothed with long hairs from base to tip, in front and behind.

*Interfemoral*.—Extremely short or scarcely developed in centre.

*Fur*.—Long, very dense, silky, somewhat crinkled; semierect over the whole of the upperside of the body, directed backward but not closely adpressed on underparts. Length of hairs at middle of back about 25, middle of mantle 26, middle of belly 22 mm.

Above, proximal half or third of forearm clothed with long, dense, adpressed hairs. Fur of back extending laterally on the membrane almost to a line between middle of forearm and knee. Tibia long-haired to ankle; upperside of metatarsus and phalanges to base of claws with long, thinly spread hairs. Below, proximal half of tibia covered with long, dense fur.

*Colour*.—Ad. skin, Mauritius, B. M. 66.1.24.2. Back and rump blackish seal-brown; a slight sprinkling with silvery greyish-white hairs detectable only on close examination. In the front of the back, near the mantle, the individual hairs are seal-brown at extreme base, then broadly buff, tip seal-brown; further backward the middle pale-coloured portion of the hair is gradually becoming narrower and more greyish, until at middle of back it is represented only by an indistinct greyish powdering of the middle portion of the hair, which apart from this might be described as uniform seal-brown; on the rump the pale-coloured ring is again becoming more pronounced and broader, passing from approximately mouse-grey to smoke-grey near the interfemoral; all pale-coloured parts of the hairs of the back and rump only detectable on separating the fur. Hair on upperside of tibia pale buffy or cream-buffy.—Breast, belly, and flanks seal-brown, sparsely and inconspicuously sprinkled with some long buffy hairs. Anal region next to interfemoral and fur on underside of tibia buffy or cream-buffy.—Mantle rich orange-buff, all the hairs seal-brown at extreme base. On the sides of the neck and foreneck the colour gradually darkens to tawny; extreme bases of hairs everywhere seal-brown.—Interocular space, crown, occiput, and sides of head grizzled dark brownish and greyish buffy; individual hairs seal-brown at extreme base, then broadly cream-buffy or greyish cream-buffy, seal-brown at extreme tip; the general grizzled aspect of the colour of the head being due to the fact that the seal-brown tips are too short to completely conceal the paler middle portion of the hairs. Chin and throat uniform seal-brown.

Individual variation in colour:—Back and rump in some specimens less blackish (more typical) seal-brown, in others more “powdered” with greyish, chiefly owing to abrasion of the hair-tips, by which the paler middle portion of the hairs gains more influence on the general aspect of the colour. Tibia above and beneath often similar in colour to back, without, or with only an indistinct, tinge of buffy.—Underparts often more conspicuously sprinkled with long pale-coloured hairs.—Colour of mantle varying from ochraceous-buff to orange ochraceous and tawny ochraceous.

*Measurements.* On pp. 170, 171.

*Specimens examined.* The material in the Paris, Berlin, and British Museums.

*Range.* The Mascarenes: Reunion, Mauritius.

*Type* probably not in existence.

*Habits.*—*Pt. subniger* is said to be strictly nocturnal in habits. It hides in holes in trees or in caves, more than four hundred being sometimes found together. It is popularly believed in Reunion that however large is the number of Rougettes found in a cave, there is always only one male; this probably means that, apart from the rutting-season, the sexes of this Fruit-bat, like many other bats, occupy separate resting-places. (De la Nux, in Buffon's Suppl. iii. p. 256, 1776; Roeh, quoted by Geoffroy, Ann. Mus. d'Hist. Nat. vii. p. 230, 1806.)

*Earliest history in literature.*—Owing to its exclusively nocturnal habits and its hiding in hollow trees and caves, this species, though once common in Reunion and Mauritius, was not quite so well known to the French zoologists in the latter half of the eighteenth century as *Pt. niger*. It is perhaps Daubenton's “Roussette” (Mém. Acad. Sci. 1759, p. 385). Brisson's excellent diagnosis (1756 and 1762) of the ‘Roussette à col rouge’ (fuscus, auriculis brevibus acutiusculis, collo superiore rubro) was taken from a Reunion specimen in the Cabinet Réaumur. Buffon's description and figure of the Rougette (1763) were based on a dried specimen in the Royal Cabinet, sent from Reunion by de la Nux, “ancien Conseiller au Conseil royal de cette île,” his later account of its habits (1776) on information from the same observer. Pennant (1781) put the Rougette of French writers down as a variety of Seba's “Ternate Bat.”

Linneé, in his 10th and 12th editions (1758 and 1766), has no reference to the Rougette. The early post-Linnean compilers (P. L. S. Müller, Erxleben, Boddaert, Gmelin, Donndorff) record the species as a variety of the Linnean *Vespertilio* (or *Pteropus*) *vampyrus*. The same view was taken by Schreber (1774), who probably knew the species only from literature.

*Vespertilio vampyrus subniger*, Kerr; 1792.—Based on Brisson's *Pteropus collo rubro*. Kerr's brief description is taken partly from Brisson, partly from Buffon, his notes on its habits from de la Nux's letter to Buffon. Inasmuch as Brisson's *Pt. collo rubro* and Buffon's Rougette were based on a specimen from Reunion, this island must be fixed as the type locality of *Pt. subniger*.

*Spectrum rubidum*, Daudin; 1802.—Name proposed by Daudin (in his revised edition of Lacépède's Tabl. Méth., published in the Didot Buffon) for Buffon's Rougette; type locality therefore Reunion.

*Pteropus ruber*, E. Geoffroy; 1803.—Geoffroy's brief description of *Pt. ruber* leaves no room for doubt as to the identification. The references given by Geoffroy are *Pt. fuscus* Brisson (i. e. *Pt. fuscus*, auriculis brevibus acutiusculis, collo superiore rubro), the Roussette of Daubenton, and the Rougette of Buffon, all of which (or at all events the first and third of which) are *Pt. subniger*. The single specimen of *Pt. ruber* catalogued by Geoffroy (his no. 91) was stated to have been "envoyé de Madagascar par le citoyen Macé." This error as to the locality was repeated, in 1825, by Temminck (who is known to have possessed a copy of the rare "Cat. Mamm. Mus. Nation. d'Hist. Nat.," which was never offered for sale but privately distributed to a good number of zoologists in France and abroad; Temminck's copy is still in the Leyden Museum); all later writers' records of the species from Madagascar rest solely on this mistake.—The Paris Museum does not now possess any specimen which can be identified with the type of *Pt. ruber*.

*Pteropus fuscus*, Desmarest; 1803.—Type locality, Reunion. Only references given by Desmarest: Buffon's Rougette and Brisson's *Pteropus fuscus*, Roussette à cou rouge, both of which are *Pt. subniger*. The name "*fuscus*" was evidently borrowed from Brisson's diagnosis of *Pteropus collo rubro* ("*Pt. fuscus*, auriculis brevibus" &c.).—Desmarest's *Pt. fuscus* should not be confused with *Pt. fuscus*, E. Geoff., 1803, which is *Pt. niger*.

*Pt. rubricollis*, E. Geoffroy; 1810.—Type locality, Reunion. Based on one specimen, in the Paris Museum, formerly in the Cabinet Réaumur, sent by de la Nux. This specimen was no doubt the very type of Brisson's *Pteropus collo rubro* (see above), probably also the example described and figured by Buffon as the "Rougette." It is no longer in existence.

*Pt. torquatus*, G. Fischer; 1814.—A renaming and redescription of Brisson's *Pt. collo rubro*. Type locality therefore Reunion.

*Pteropus collaris*, Illiger; 1815.—Based, without description, on Buffon's Rougette. Type locality therefore Reunion.—In 1823 (Verz. Doubl. Mus. Berlin, p. 3, no. 47), Lichtenstein wrongly identified Illiger's *Pt. collaris* with the S. African Fruit-bat later on (1829) described by A. Smith as *Pteropus leachi* (i. e. *Rousettus leachi* of this Catalogue), giving as habitat of *Pt. collaris* "Terra Caffrorum." Some statements in literature of the occurrence of *Pt. rubricollis* in S. Africa (Lesson, 1842; Schinz, 1844; Gray, 1870; l. s. e.) are undoubtedly based on this error of Lichtenstein.

*Remarks.*—The following three characters taken together are sufficient to distinguish *Pt. subniger* from any other species of the genus: Cheek-teeth much reduced in size; tibia densely haired above; fur dark brownish above and beneath, with orange ochraceous

collar. The first character distinguishes it from all species of *Pteropus* except *molossinus*, *personatus*, *scapulatus*, and *woodfordi*: the second excludes *molossinus*, *scapulatus*, and *woodfordi*; the third, *personatus*.

a. Imm. sk.; skull.		Not reg.
b. ♂ imm. st.		Not reg.
c. Imm. sk.; skull.	Leyden Museum.	37.4.28 31.
d. ♂ yg. ad. sk.; skull.	J. Gould, Esq. [P.].	43.12.30.13.
e. Imm. sk.; skull.	Purchased (Parzudaki).	49.8.23.8.
f, g. 2 imm. sks.; skulls.	Tomes Coll. (Zool. Soc.).	7.1.1.257, 257 bis.
h, i. 1 ad., 1 ♀ imm. sks.; skulls.	Mauritius. H. Whitely, Esq. [P.].	66.1.24.2, 3.

*External measurements of Pteropus dasymallus, formosus, and subniger.*

	<i>Pt. dasymallus.</i> 12 ad.		<i>Pt. formosus.</i> 3 ad. (Incl. cotypes.)		<i>Pt. subniger.</i> 3 ad.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.	mm.	mm.
Forearm .....	125.5	137	130	137	95.2	99
Pollex, total length, c. u. ....	56.2	63	58.5	60.5	38.5	42.5
2nd digit, metacarpal .....	62	72	66	70	49.2	52.8
"    1st phalanx .....	15	18.5	17	18	10.8	12.7
"    2nd-3rd phalanx, c. u. ....	15	18	16	16.2	10.7	11.2
3rd digit, metacarpal .....	87.5	96	88.5	93.5	67.2	74.2
"    1st phalanx .....	63	71.5	67.5	73	46.5	48.2
"    2nd phalanx .....	88	96.5	87.5	95	56	65
4th digit, metacarpal .....	85	93	86	93	66	71.2
"    1st phalanx .....	52	60	55	58.5	38.5	40.8
"    2nd phalanx .....	52	59.5	51.5	60	36.5	39.5
5th digit, metacarpal .....	90	99	91.5	99	69.5	76.2
"    1st phalanx .....	40	45.5	41	45	29.2	31.2
"    2nd phalanx .....	42.5	47.5	43	47	27.8	...
Ear, length from orifice .....	23	24	...	...	...	...
"    greatest width, flattened ...	15.8	17.3	...	...	...	...
Front of eye to tip of muzzle ...	26	26	24.5	25.5	...	...
Lower leg .....	58.5	65.8	63	67	41.5	...
Foot, c. u. ....	44	50	50	50.5	34.5	...
Calcar .....	15	17	16	17	...	...

*Measurements of skulls and teeth of Pteropus dasymallus, formosus, and subniger.*

	<i>Pt. dasymallus.</i> Skulls: 9 ad. Teeth: 9 ad., 1 imm. (Incl. type.)		<i>Pt. formosus.</i> Skulls: 3 ad. Teeth: 3 ad. (Incl. cotypes.)		<i>Pt. subniger.</i> Skulls: 2 ad. Teeth: 2 ad., 6 imm.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	60.5	63.5	60.2	64.2	44.8	46
" palation to incisive foramina .....	29.2	31.3	29.8	31.5	20.8	22.3
" front of orbit to tip of nasals .....	18.2	21	18.2	20	14	14
" width of brain-case at zygomata .....	22	23.5	21.8	22.7	18.7	19
" zygomatic width .....	32.5	34.5	32	34	26.2	...
" width across $m^1$ , externally .....	17	18.2	17.2	18.2	12.5	13
" lachrymal width .....	12.8	14.3	12.8	14	10.2	11
" width across canines, externally .....	11.3	13.7	12.2	13.7	10.5	10.8
" postorbital constriction .....	7	7.8	7.2	8.2	7.8	7.8
" interorbital constriction .....	9	10	8.8	9.6	7	7
" width of mesopterygoid fossa .....	7.8	8.7	7.7	8.2	6.2	...
" between $p^4$ - $p^4$ , internally .....	9.8	11.2	10	11	8.1	8.2
" orbital diameter .....	12.4	12.7	12.5	12.8	9.7	9.8
Mandible, length .....	47	50	47.8	50.2	33.5	35.2
" coronoid height .....	23.8	25	23.7	26.2	16	16.2
Upper teeth, c- $m^2$ .....	23	25	23	24.2	15.8	16.4
Lower teeth, c- $m_3$ .....	25.8	27.7	25.8	26.8	17.6	18.8
Upper incisors, combined width .....	5.8	6.8	...	6.8	...	...
$p^3$ , length .....	4.2	4.8	4.7	4.8	2.8	3
" width .....	3.2	3.5	3.2	3.5	1.9	2
$p^4$ , length .....	4.4	4.8	4.7	4.9	2.8	3
" width .....	3.3	3.6	3.5	3.6	1.8	2
$m^1$ , length .....	5.2	5.7	5.5	5.8	3	3.2
" width .....	3.1	3.2	3.1	3.3	1.8	2
$m^2$ , length .....	2.5	3	2.5	2.8	1.5	1.8
" width .....	2	2.5	2	2.1	1.1	1.2
$p_1$ , length .....	1.9	2	1.8	2	1.8	2
" width .....	1.8	2	1.7	1.9	1.5	1.7
$p_3$ , length .....	4.8	5	4.8	5	3	3.2
" width .....	3	3.1	3	3.1	1.8	1.8
$p_4$ , length .....	4.8	5	4.9	5.1	2.9	3.1
" width .....	3.1	3.2	3.2	3.2	1.8	1.9
$m_1$ , length .....	4.7	5	4.9	5	2.9	3.1
" width .....	2.9	3	2.9	3	1.7	1.8
$m_2$ , length .....	3.5	3.9	3.7	3.8	2.2	2.5
" width .....	2.7	2.8	2.7	2.8	1.6	1.7
$m_3$ , length .....	1.9	2.1	2	2	1.1	1.5
" width .....	1.7	2	1.8	1.9	0.9	1.1

B. THE *PTEROPUS MARIANNUS* GROUP.

*Species*.—Eight, *Pt. pelewensis*, *yapensis*, *ualanus*, *mariannus*, *lochoënsis*, *vanikorensis*, *tonganus*, and *geddiei*.

*Range*.—Polynesia (so far as inhabited by the genus), extending north-west to South Liu-kiu Islands.

*General characters*.—Skull and dentition unmodified Pteropine; posterior basal ledges of premolars slightly more developed than in *Pt. hypomelanus*. General shape of ears and distribution of fur as in *Pt. hypomelanus*; ears moderate, broad, tip rounded off; fur short, adpressed on back; tibia naked above. Colour pattern remarkably constant: in nearly all species, mantle light yellowish strongly contrasting with blackish or dark brownish back, muzzle, and underparts; dark colour often sprinkled with greyish or whitish, especially on underside. Sexual differentiation inconsiderable: males without glandular neck-tufts, but generally with rather heavier canines and fur of mantle more rigid, oily, and uniform buffy (in females softer, more spreading, and with concealed brownish bases to the hairs). Size generally moderate or rather small (forearm 113–154 mm.).

*Differentiation of species*.—The eight species are separable into two sections: a series of relatively smaller-eyed North Pacific forms (*Pt. pelewensis*, *yapensis*, *ualanus*, *mariannus*, and *lochoënsis*), distributed over the Pelew, Caroline (two species), Marianne, and South Liu-kiu islands; and a series of relatively larger-eyed South Pacific forms (*Pt. vanikorensis*, *tonganus*, and *geddiei*), ranging over the Santa Cruz, New Hebrides, New Caledonia, Fiji, Tonga, and Samoa islands. *Pt. pelewensis* is a peculiarly small and small-toothed species, in the colour of the fur rather closely approaching *Pt. admiralitatum*. The four other North Pacific species are closely interrelated; from *Pt. pelewensis* they differ chiefly in their larger size, from each other in the size of the teeth and length of the fur; the teeth are smallest in *Pt. ualanus* (East Carolines), heavier in *Pt. yapensis* (West Carolines) and *Pt. lochoënsis*, rather heavier still in *Pt. mariannus*; the fur is longer than usual in the extreme north-western species, *Pt. lochoënsis*.—Also the three species of the South Pacific section are closely related. *Pt. vanikorensis* (known from Vanikoro only) is chiefly characterized by its shorter, *Pt. tonganus* (Fiji, Tonga, and Samoa islands) by its longer wings; *Pt. geddiei* (New Hebrides and New Caledonia) is the largest form of the group.

*Affinities of group*.—The *Pt. mariannus* replaces the *Pt. hypomelanus* group in Polynesia; there can be little doubt that it is a Polynesian modification of the *hypomelanus* type. Taken as a whole it differs from this latter only in characters of trivial importance: the slightly heavier posterior basal ledges of the premolars and the style of colour. The former character indicates scarcely more than a slight difference of degree; the style of colour is closely approached by a species of the *hypomelanus* group, *Pt. admiralitatum*; and both characters are less conspicuous or, as it were, less definitely fixed in the species which geographically are neighbours to the area of



the *hypomelanus* group. It is, in fact, open to question whether *Pt. admiralitatum* ought to be considered a peripheral species of the *hypomelanus* type with strong leanings to the Polynesian group, or rather incorporated in this latter.—The species of the Austro-Malayan and Australian *Pt. conspicillatus* group (*P. chrysauchen*, *conspicillatus*, *ocularis*) are almost precisely similar in colour to the typical members of the *mariannus* group (compare e.g. *Pt. chrysauchen* with *Pt. tonganus*); any close relationship between these two sections of the genus is, in view of the difference in dentition, altogether improbable.

### 17. *Pteropus pelewensis*, K. And.

*Pteropus keraudreni* (pt.), Dobson, Cat. Chir. B. M. p. 63.

*Pteropus keraudreni* (nec *Pt. keraudren*, Q. & G.), var. *a* (pt.), Dobson, Cat. Chir. B. M. p. 65 (1878: Pelew Is.). Var. *aa* (pt.), Trouessart, Rev. & Mag. Zool. (3) vi. p. 203 (1879: Pelew Is.).

*Pteropus insularis* (pt., nec *Hombr. & Jacq.*), Trouessart, Cat. Mamm. i. p. 83 (1897: Pelew Is.).

? *Pteropus* (Spectrum) *mariannus* (pt., nec *Desm.*), Matschie, Megachir. p. 27 (excl. figs.) (1899: Pelew Is.); Trouessart, Cat. Mamm., Suppl. p. 53 (1904: Pelew Is.).

*Pteropus pelewensis*, K. Andersen, Ann. & Mag. N. H. (8) ii. p. 364 (1 Oct. 1908: Pelew Is.).

*Diagnosis*.—Allied to *Pt. admiralitatum* (supra p. 144), but with much smaller orbits, narrower rostrum, weaker dentition, and shorter fur. Colour of fur approaching that of *Pt. admiralitatum*. Forearm shorter: 113.5 mm. *Hab.* Pelew Is.

*Skull and teeth*.—General size of skull nearly as in *Pt. admiralitatum*, but rostrum considerably narrower and orbits smaller: maxillary width externally across  $m^1$ – $m^1$  14.8 mm., against 16–17 in *Pt. admiralitatum*; orbital diameter 11 mm., against 12–12.5.—Structure of teeth as in the allied species, but dentition on the whole slightly weaker,  $p_4$  and  $m_1$  markedly smaller; see measurements, p. 176.

*Fur*.—Length of fur as in *Pt. hypomelanus*, much shorter than in *Pt. admiralitatum*: on back 9–11, mantle 12–14, belly 13–14 mm. Distribution of fur as in the allied species.

*Colour*.—Type, ♂ ad. skin, teeth much worn.—Back and rump dark brown approaching seal-brown, conspicuously washed with vandyck-brown on sides of back, humeri, and thighs, and thinly sprinkled with silvery greyish-white hairs.—Breast, belly, and flanks a dark shade of Prout's brown, everywhere thickly mixed with shiny silvery white or buffy-white hairs.—Mantle and sides of neck light yellowish buff, individual hairs uniform from base to tip or, in shoulder region, with extreme base blackish. Foreneck similar to breast.—Occiput similar to mantle, but somewhat clouded with brownish. Crown and sides of head mixed buffy and brownish, sprinkled with some highly glossy silvery grey hairs. Chin and throat blackish thinly sprinkled with silvery grey.

A young female (not full-grown, skin, 74.10.5.9) differs conspicuously from the type in colour. Back and rump blackish thickly mixed with shiny silvery grey hairs or tips to the hairs.—Breast, belly, and flanks blackish seal-brown heavily sprinkled with shiny silvery grey.—Mantle pale buffy cinnamon, shading into deep mars-brown on sides of neck, and into dark chocolate on foreneck; base of hairs everywhere blackish.—Crown darker than mantle and sprinkled with glossy silvery grey; colour gradually darkening on sides of head into the blackish seal-brown of throat.

It appears probable (judging from allied species) that the difference in the colour of the base of the fur of the mantle (yellowish buff like tips of hairs in the above-described male, blackish in female) is not dependent on age, but sexual. The hairs of the mantle are rather rigid in the single male examined, soft and spreading in the single female.

*Measurements.* On pp. 175, 176.

*Specimens examined.* Two, as registered below.

*Range.* Pelew Islands.

*Type* in collection.

- a.* ♂ ad. skin; skull. Pelew Is.; 1870 (*Capt. Godeffroy Museum.* 74.10.5.8.  
*Heinsohn*). (*Type of species.*)  
*b.* ♀ jun. skin; skull. Pelew Is.; 1870 (*Capt. Godeffroy Museum.* 74.10.5.9.  
*Heinsohn*).

## 18. *Pteropus yapensis*, *K. And.*

*Pteropus keraudreni* (pt.), Dobson, *Cat. Chir. B. M.* p. 63.

*Pteropus keraudreni* (*nec* *Pt. keraudreni*, *Q. & G.*), *Tetens & Kubary*, *Journ. Mus. Godeffroy*, i. pt. ii. p. 50 (122) (1873: Yap).

*Pteropus keraudreni*, var. *a* (pt.), *Dobson, Cat. Chir. B. M.* p. 65 (1878: Yap; Mackenzie). Var. *aa* (pt.), *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 203 (1879: Mackenzie).

*Pteropus insularis* (pt., *nec* *Hombr. & Jacq.*), *Trouessart, Cat. Mamm.* i. p. 83 (1897: Yap; Mackenzie).

*Pteropus* (*Spectrum*) *marianus* (pt., *nec* *Desm.*), *Matschie, Megachir.* p. 27 (excl. figs.) (1899: Yap; Mackenzie); *Trouessart, Cat. Mamm., Suppl.* p. 53 (1904: Yap; Mackenzie).

*Pteropus yapensis*, *K. Andersen, Ann. & Mag. N. H.* (8) ii. p. 365 (1 Oct. 1908: Yap; Mackenzie).

*Diagnosis.*—Similar to *Pt. admiralitatum*, but somewhat larger, with broader skull, smaller orbits, more strongly developed posterior ledges of cheek-teeth, longer ears, and shorter fur. Blackish above and beneath, sprinkled with whitish; mantle and sides of neck strongly contrasting, yellowish buff; foreneck washed with russet. Forearm about 130 mm. *Hab.* W. Carolines.

*Skull and teeth.*—Size of skull as in *Pt. admiralitatum*, if not slightly larger, but temporal fossa much broader, zygomatic arches therefore much more flaring posteriorly, sagittal crest stronger, frontal region between orbits broader, orbits smaller; zygomatic width about 36 mm., against 32.33 in *Pt. admiralitatum*: orbital

diameter 11.7 mm., against 12-12.5; coronoid process markedly higher, coronoid height of mandible larger than  $c-m^2$ , but smaller than  $c-m_2$ , in *Pt. admiralitatum* subequal to  $c-m^2$ .—Size of teeth nearly as in *Pt. admiralitatum*, though  $p^3$  and  $p^4$  distinctly heavier (see measurements, p. 176), but posterior ledges of  $p^3$ ,  $p^4$ ,  $p_3$ ,  $p_4$ , and  $m_1$  somewhat longer and more sharply marked off from teeth postero-externally; cingulum of canines somewhat broader.

*Ears*.—Larger than in *Pt. admiralitatum*, very nearly as in *Pt. hypomelanus*; shape as in these species.

*Interfemoral*.—Short or undeveloped in centre.

*Fur*.—Short and closely adpressed on back. Approximate length, back 9-11, mantle 12-14, belly 13 mm. Least width of furred area of back about 40-43 mm. Distribution of fur as in *Pt. hypomelanus*.

*Colour*.—Type, ♂ ad. skin, teeth slightly worn, Yap I.—Back and rump blackish, moderately sprinkled with glossy silvery-white hairs.—Breast, belly, and flanks seal-brown, darkest in middle line, slightly washed with a somewhat paler shade of brown on sides of breast and belly, everywhere conspicuously sprinkled with glossy greyish-white or buffy-white hairs.—Mantle and sides of neck golden yellowish buff, in some places approaching buff-yellow, in others distinctly washed with orange-buff, strongly contrasting with

*External measurements of Pteropus pelewensis and yapensis.*

	<i>Pt. pelewensis.</i> ♂ ad. Type.	<i>Pt. yapensis.</i> ♂ ad. Type.
	mm.	mm.
Forearm .....	113.5	130
Pollex, total length, c. u. ....	53.5	58
" metacarpal .....	12	14
" 1st phalanx .....	26.5	29.5
2nd digit, metacarpal .....	62.5	65
" 1st phalanx .....	14.8	17
" 2nd-3rd phalanx, c. u. ....	13	15.5
3rd digit, metacarpal .....	81	91
" 1st phalanx .....	57	65
" 2nd phalanx .....	87	98.5
4th digit, metacarpal .....	79.5	90.5
" 1st phalanx .....	47	52.5
" 2nd phalanx .....	49	...
5th digit, metacarpal .....	83.5	95
" 1st phalanx .....	35.5	41
" 2nd phalanx .....	37	43.5
Ears, length from orifice .....	...	25*
Interfemoral .....	0	0
Lower leg .....	52	54.5
Foot, c. u. ....	...	47
Calcar .....	...	17*

\* Estimate (skin).

*Measurements of skulls and teeth of Pteropus pelewensis  
and yapensis.*

	<i>Pt. pelewensis.</i> Type * and paratype.		<i>Pt. yapensis.</i> Type and paratype.	
	♂ ad. Type.*	♀ jun. mm.	♂ ad. Type.	♀ jun. mm.
Skull, palation to incisive foramina ...	27.7	...	28.7	...
„ front of orbit to tip of nasals ...	18.5	...	20	...
„ width of brain-case at zygomata.	...	...	21.8	...
„ zygomatic width .....	...	...	36.2	...
„ width across m <sup>1</sup> , externally.....	14.8	...	17	...
„ lachrymal width .....	12	...	13.8	...
„ width across canines, externally.	11.8	...	12.8	...
„ postorbital constriction .....	...	...	7.3	...
„ interorbital constriction .....	8	...	9	...
„ width of mesopterygoid fossa ...	...	...	7.7	...
„ between p <sup>1</sup> -p <sup>4</sup> , internally .....	9	...	9.8	...
„ between cingula of canines .....	6	...	7.2	...
„ orbital diameter .....	11	...	11.7	...
Mandible, length .....	43.2	...	47.5	...
„ coronoid height .....	21.2	...	24.2	...
Upper teeth, c-m <sup>2</sup> .....	21.5	...	22.2	...
Lower teeth, c-m <sub>3</sub> .....	23.7	...	25.7	...
Upper incisors, combined width .....	...	...	5.8	...
p <sup>3</sup> , length .....	4.2	4	4.5	4.5
„ width .....	2.8	2.8	3	3.1
p <sup>4</sup> , length .....	...	3.9	4.5	4.3
„ width .....	...	3	3.2	3.2
m <sup>1</sup> , length .....	...	4.7	5	5.2
„ width .....	...	2.7	2.9	2.8
m <sup>2</sup> , length .....	2.1	2.2	2.1	2.1
„ width .....	1.7	1.8	2	2
p <sub>1</sub> , length .....	1.8	1.9	2	2.1
„ width .....	1.7	1.8	1.8	1.8
p <sub>3</sub> , length .....	4.2	4	4	4.1
„ width .....	2.7	2.6	2.8	2.7
p <sub>4</sub> , length .....	4	3.8	3.9	4.1
„ width .....	2.7	2.8	3	2.8
m <sub>1</sub> , length .....	...	4.1	4.4	4.5
„ width .....	...	2.7	3	2.8
m <sub>2</sub> , length .....	3.2	3.1	3.7	3.5
„ width .....	2.2	2.2	2.8	2.7
m <sub>3</sub> , length .....	...	...	2.1	1.8
„ width .....	...	...	2.1	1.7

\* Teeth much worn.

and sharply marked off from blackish back; on the foreneck the yellowish colour is considerably clouded with pale russet. Base of fur of mantle yellowish buff like tips of hairs, except posteriorly near shoulders where the hairs have short blackish bases.—Occiput, as far forward as a line between ears, similar to mantle, but washed with russet at base of ears. Crown and interocular space mixed buffy and dark brown with blackish bases to the hairs and thinly sprinkled with silvery whitish. Colour gradually darkening on sides of head, and passing on throat into blackish thinly sprinkled with silvery whitish.

An immature female (skin, Mackenzie I., 74.10.5.10) is on the whole similar in colour to the type, but with the general tinge of the back and rump more approaching seal-brown than blackish; mantle and sides of neck unusually pale, cream-buff with long seal-brown bases to the hairs; foreneck much clouded with seal-brown.

*Sexual differentiation*.—Probably as in *Pt. tonganus*. The only male examined of *Pt. yapensis* has the hairs of the mantle somewhat rigid and uniform yellowish buff from base to tip (except posteriorly, near line of demarcation between bright mantle and blackish back). The only female is immature; fur of mantle soft and spreading, everywhere with long dark brown bases to the hairs.

*Measurements*. On pp. 175, 176.

*Specimens examined*. Two, as registered below.

*Range*. Western Carolines: Yap, Mackenzie.

*Type* in collection.

- a. ♂ ad. skin; Yap, W. Carolines (*Capt. Godeffroy Museum*. 74.10.5.11.  
skull. *Peters*). (*Type of species*.)  
b. ♀ juv. skin; Mackenzie, W. Carolines *Godeffroy Museum*. 74.10.5.10.  
skull. (*Capt. Peters*).

### 19. *Pteropus ualanus*, *Pt.*

*Pteropus keraudren* (pt., *nec* Q. & G.), *Lesson, Man. Mamm.* p. 109, no. 281 (1827: E. Carolines); *id.*, *N. Tabl. R. Anim., Mamm.* p. 13, no. 183 (1842: Ualan); *Jentink, Cat. Ost. Mamm.* p. 262 (specimen *d*) (1887: Ualan); *id.*, *Cat. Syst. Mamm.* p. 149 (1888: Ualan).

*Pteropus keraudrenius* (pt., *nec* Temm. 1825), *Temminck, Mon. Mamm.* ii. p. 77 (1837: Ualan); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 437 (1870: Carolines).

*Pteropus ualensis*, *Fiasch, Ibis*, 1881, p. 107 (Ualan) (nom. nud.).

*Pteropus ualanus*, *Peters, SB. Ges. nat. Fr.* 1883, no. 1 (16 Jan.) p. 1 (Ualan); *Jentink, Cat. Syst. Mamm.* p. 149 (1888: Ualan); *Trouessart, Cat. Mamm.* i. p. 78 (1897: Carolines); ? *Elliot, Cat. Mamm. Field Col. Mus.* p. 492 (1907: Carolines); *G. M. Allen, Bull. Mus. Comp. Zool. Harr. Coll.* lii. no. 3, p. 29 (1908: Ualan).

*Pteropus* (Spectrum) *ualanus*, *Matschie, Megachir.* p. 28, pl. v. figs. 17-22 (skull) (1899: Ualan); *Trouessart, Cat. Mamm., Suppl.* p. 53 (1904: Ualan).

*Diagnosis*.—Similar to *Pt. yapensis*, but with much smaller teeth. Forearm 130.5-133.5 mm. *Hab.* E. Carolines.

*Skull and teeth.*—Skull as in *Pt. yapensis*. Cheek-teeth on the whole much shorter (antero-posteriorly) than in *Pt. yapensis*, but very nearly of the same width; length of  $p^3$  3·8–4 mm. (against 4·5 in the allied species), of  $p^1$  3·8–4 (against 4·3–4·5), of  $m^1$  4·2–4·5 (5–5·2), of  $m_1$  4–4·1 (4·4–4·5), of  $m_2$  3·3–3·2 (3·5–3·7). Structure of teeth as in *Pt. yapensis*.

*Colour.*—Series, cotypes of species: Back and rump blackish, slightly sprinkled with silvery greyish hairs.—Underparts blackish seal-brown, similarly sprinkled. Foreneck sometimes slightly washed with dark russet.—Mantle, sides of neck, and occiput (as far as back of ears) buffy, pure in tinge or more or less clouded with russet; base of hairs dark brown everywhere (females) or only in posterior portion of mantle and on occiput (males).—Crown approaching vandyck-brown, with or without a slight wash of russet, gradually darkening on sides of head into the blackish seal-brown of chin and throat.

*Measurements.* On pp. 182, 183.

*Specimens examined.* Ten, cotypes of species.

*Range.* Eastern Carolines: Ualan (Kushai).

*Cotypes* in the Berlin Museum.

*Pteropus ualanus*, Peters; 1883.—Based on ten specimens obtained by Dr. O. Finsch in Ualan, viz., mounted specimens 5798, 5808, 5809, with skulls separate, and alcoholic specimens 5788 (two), 5791 (two), 5792 (two), and ? 5799 (one). Seven specimens are more or less young, two young adults (apparently full-grown), one adult. Skull of cotype 5808 figured in 'Megachiroptera des Berliner Museums' (l. s. c.).

*Remarks.*—This species is the Ualan representative of *Pt. yapensis*. It is scarcely distinguishable, with certainty, from this latter by any other character than the much smaller size of the teeth.

## 20. *Pteropus mariannus*, Desm.

*Pteropus keraudreni* (pt.), Dobson, Cat. Chir. B. M. p. 63.

*Pteropus mariannus*, Desmarest, *Mamm.* ii., *Suppl.* p. 547, footnote (1822: Mariannes).

*Pteropus mariannus*, Giebel, *Saug.* p. 998 (1855: Mariannes).

*Pteropus* (Spectrum) *mariannus*, Matschie, *Megachir.* p. 27, pl. v. figs. 15, 16 (skull) (1899: Guam); Trouessart, *Cat. Mamm.* *Suppl.* p. 53 (pt.) (1904: Mariannes).

*Pteropus keraudreni*, Quoy & Gaimard, *Voy. Uranie*, *Zool.* pt. 2, p. 51, pl. iii. fig. 1 (animal), fig. 2 (skull) (1824: Guam); Lesson, *Man. Mamm.* p. 109, no. 281 (pt.) (1827); Desmarest, *Diet. Sci. Nat.* xvi. p. 364 (1827: Mariannes); Is. Geoffroy, *Diet. Class. d'Hist. Nat.* xiv. p. 701 (1828: Mariannes); J. B. Fischer, *Syn. Mamm.* p. 84, no. 10 (1829: Guam); Lesson, *Hist. Nat. Mamm.* (Compl. Buffon) v. p. 56 (1836: Mariannes); Oken, *Allg. Naturgesch.* vii. Abth. ii. p. 990 (1838); Lesson, *N. Tabl. R. Anim.*, *Mamm.* p. 13, no. 183 (pt.) (1842: Mariannes); E. Desmarest, *Diet. Univ. d'Hist. Nat.* xi. p. 248 (1848: Guam);

*Jentink, Cat. Ost. Mamm.*, p. 262, specimen *b.* (1887: Guam); *id.*, *Cat. Syst. Mamm.*, p. 149 (pt.) (1888: Guam); *Miller, Fam. & Gen. Bats*, p. 58 (pt.) (1907).

*Pteropus keraudrenius*, *Temminck, Mon. Mamm.*, i. p. 186, pl. xv. fig. 7 (skull, copy from Quoy & Gaimard) (1825: Guam); *id.*, *op. cit.*, ii. p. 77 (pt.) (1837: Guam); *Wagner, Schreber's Säug., Suppl.*, i. p. 353 (1839: Mariannes); *Schinz, Syst. Verz. Säug.*, i. p. 126 (1844: Mariannes); *Wagner, Schreber's Säug., Suppl.*, v. p. 600 (1853-55: Mariannes); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 437 (pt.) (1870: Guam).

*Pteropus keraudreni*, *Gray, Mag. Zool. & Bot.*, ii. p. 503 (1838: Guam); *Gervais, Hist. Nat. Mamm.*, i. p. 188, c. fig. (head) (1854: Guam); *Peters, MB. Akad. Berlin*, 1857, p. 331 (pt.); *Dobson, Cat. Chir. B. M.*, p. 63 (pt.) (1878: Mariannes); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 203 (pt.) (1879: Samoa, errore); *Elera, Cat. Sist. Faun. Filipinas*, p. 6 (pt.) (1895: Mariannes); *Oustalet, N. Arch. Mus. d'Hist. Nat.* (3) vii. p. 149 (1895: Guam; Rota; Saypan); *Trouessart, Cat. Mamm.*, i. p. 82 (pt.) (1897: Mariannes).

*Pteropus keraudrensis*, *Oken, Allg. Naturgesch.*, vii. Abth. ii. p. 990 (1838).

Roussette Kéraudren, *Quoy & Gaimard, Ann. Sci. Nat.*, vi. p. 146 (1825: Guam; "la petite île aux Cocos"); *id.*, *Voy. 'Astrolabe'*, *Zool.*, i. p. 80, pl. x. (1830: anatomy).

*Diagnosis*.—Similar to *Pt. yapensis*, but slightly larger and with considerably heavier dentition. Forearm 134-136.5 mm. *Hab.* Mariannes.

*Skull and teeth*.—General characters of skull as in *Pt. yapensis*, but size slightly larger. Dentition on the whole decidedly heavier, the increase in size being especially noticeable in  $p^3$ ,  $p^1$ , and all lower cheek-teeth except  $p_2$  and  $m_3$ ; see measurements, p. 183.

*Colour*.—Cotype no. 50, ♂ ad., Guam, and twelve specimens collected by Marche in the islands of Guam, Rota, and Saypan (Paris Museum).—Back and rump blackish seal-brown, slightly sprinkled with silvery greyish-white hairs.—Breast, belly, and flanks seal-brown (in cotype faded to chocolate), slightly mixed with silvery hairs.—Mantle and sides of neck ochraceous-buff; foreneck often as pale as sides of neck, but in some specimens more or less heavily clouded with dark brownish.—Crown dark brown mixed with buffy hairs, the dark element becoming more predominant on sides of head, and darkened to seal-brown on chin and throat.

*Measurements*. On pp. 182, 183.

*Specimens examined*. Fifteen, in the collections of the Paris (fourteen: Guam, Rota, Saypan) and Berlin Museums (one: Guam), including two eotypes of *Pt. mariannus* and *Pt. keraudren*.

*Range*. Marianne Islands: Guam, Rota, Saypan.

*Cotypes* in the Paris and Leyden Museums.

*Pteropus mariannus*, Desmarest; 1822.—Type locality, Guam (voyage of the 'Uranie'); eotypes the same as these of *Pt. keraudren*, Q. & G.

*Pteropus keraudren*, Quoy & Gaimard; 1824.—Based on four

specimens, obtained in Guam during the voyage of the 'Uranie,' being the same series briefly diagnosed and named *Pt. mariannus* two years before by Desmarest. Two of these cotypes are in the Paris Museum, an adult female (A. 49, old catalogue 751) and an adult male (A. 50, old catalogue 753 A), both mounted and somewhat faded; skull of A. 49 extracted in 1907; the skull of A. 50, which is not in the skin, is probably skull no. 6765 of the Muséum d'anatomie comparée, which is marked "Mariannes, Quoy & Gaimard, Uranie." The two other cotypes were given in exchange to the Leyden Museum very soon after the arrival of the 'Uranie' collection (see Temminck, Mon. Mamm. i. pp. 186-187, 1825, and Oustalet, l. s. c. 1895); they are the mounted specimens *b* and *d*, and skull *b* (of specimen *d*), of Jentink's Catalogues. Temminck's "*Pt. keraudrenius*," of 1825 (l. s. c.), is a redescription of these cotypes, accompanied by a copy of Quoy and Gaimard's figure of the skull; in 1837 (Mon. Mamm. ii. pp. 77-78) Temminck mentions two additional specimens of "*Pt. keraudrenius*" collected by Kittlitz and acquired by the Leyden Museum; the one, from Guam, is *Pt. mariannus*, but the other, from Ualan, is *Pt. ualanus*.—A topotype collected by Kittlitz is in the Berlin Museum (no. 344, ♀ juv., not full-grown); the skull of this specimen is the original of pl. v. figs. 15, 16 of the 'Megachiroptera des Berliner Museums.'

*Remarks*.—This species can apparently only be discriminated, with certainty, from the allied Pacific forms by the characters of the skull and teeth. In the size of the orbits (diameter 11·8 mm.) it accords with the N. Pacific *Pt. yapensis*, *ulanus*, and *lochoënsis* (11·5-11·8), and differs from the S. Pacific *Pt. vanikorensis* and *tonganus* (12·5-13·2). The dentition is on the whole heavier than in the other N. Pacific forms, and as heavy as in *Pt. vanikorensis* and *tonganus*. The external dimensions (forearm 134-136·5 mm.) may average slightly larger than in *Pt. yapensis* and *ulanus* (130-133·5), of which, however, only a few adult specimens have been available for comparison, and are apparently equal to those of *Pt. lochoënsis* and *vanikorensis* (135-142·5). In some specimens of *Pt. mariannus*, including the Paris cotypes and the Berlin topotype, the pale yellowish colour of the mantle and sides of neck extends over the whole of the foreneck, forming a complete collar, while in some Paris topotypes collected by Marche the collar is interrupted in front by a more or less considerable admixture of dark brownish in the centre of the foreneck (as is constantly the case in *Pt. vanikorensis* and *tonganus*); the foreneck of *Pt. mariannus* no doubt averages paler (more unmixed yellowish buff) than in the S. Pacific forms, but the character, as being in all species of this group subject to a good deal of individual variation, is of little practical use for diagnostic purposes.



21. *Pteropus loochoënsis*, Gray.

*Pteropus keraudreni* (pt.), Dobson, Cat. Chir. B. M. p. 63.

*Pteropus loochoënsis*, Gray, Cat. Monk. &c. p. 106 (1870: Liu-kin Is.); Miller, Fam. & Gen. Bats, p. 58 \* (1907).

*Pselaphon luchuensis*, Seitz, Mitth. D. Ges. Naturk. Ostasiens, v. p. 364 (1892: Liu-kius).

*Pteropus keraudreni*, var. *loochoënsis*, Fritze, Zool. Jahrb., Syst. vii. p. 854 (1894: Okinawa).

*Pteropus* (Spectrum) *loochoënsis*, Matschie, Megachir. p. 27 (1899: Liu-kius); Trouessart, Cat. Mamm., Suppl. p. 53 (1904: Liu-kius).

*Pteropus keraudreni loochoënsis*, Bonhote, Nov. Zool. ix. p. 628 (1902: Liu-kius).

*Pteropus keraudreni* (nec *Pt. keraudreni*, Q. & G.), var.  $\beta$ , Dobson, Cat. Chir. B. M. p. 65 (1878: Liu-kius). Var.  $\gamma$ , Trouessart, Rev. & Mag. Zool. (3) vi. p. 203 (1879: Liu-kius). Var.  $\alpha$ , Trouessart, Cat. Mamm. i. p. 83 (1897: Liu-kius).

*Diagnosis*.—Similar to *Pt. mariannus*, but with smaller premolars and conspicuously longer fur. Forearm 135–142.5 mm. Hab. Liu-kin Is.

*Skull and teeth*.—Skull as in *Pt. mariannus*. Premolars above and below larger than in *Pt. yapensis*, but smaller than in *Pt. mariannus*; see measurements. p. 183.

*Fur*.—Longer than in the allied species; approximate length, back 14–17, mantle and belly 15–18 mm.; compare *Pt. yapensis* and *pelowensis*. Least width of furred area of back about 42 mm.

*Colour* (type, ♂ yg. ad.).—Back and rump glossy blackish seal-brown thinly sprinkled all over with greyish-white.—Breast, belly, and flanks glossy seal-brown sprinkled with silvery greyish and buffy hairs.—Mantle buffy, palest (nearly cream-buff) posteriorly, tinged with orange ochraceous in middle, and passing into ochraceous-buff on sides of neck; median line of foreneck much clouded with mars-brown and seal-brown. Concealed seal-brown bases of buffy hairs very short in centre of mantle, somewhat longer posteriorly in shoulder region, wanting on sides of neck.—Occiput similar to mantle or somewhat tinged with tawny; crown mottled dark brown, russet, and buffy; circumocular region conspicuously paler (owing to predominance of buffy element) than centre of crown; cheeks seal-brown sprinkled with buffy; chin and throat blackish seal-brown with some trace of paler admixture.

A second specimen (♀ ad., teeth somewhat worn, 49.1.5.1; Gray's "variety" of *Pt. loochoënsis*, l. s. c. p. 106) is lighter in colour, chiefly owing to a stronger admixture of whitish-grey and buffy hairs on back and underparts and a considerably paler colour of mantle and head.—Back blackish heavily mixed with buffy and greyish along median line, much less so on sides of back and rump.—Breast, belly, and flanks a little paler than seal-brown, heavily mixed with light greyish on sides of breast and belly, and with buffy on centre of breast; anal region slightly washed with mars-

\* Spelt *Pt. loochoënsis*.

brown.—Mantle cream-buffy, tinged with buffy in centre and on sides of neck; foreneck somewhat clouded with pale russet. Fur of mantle, sides of neck, and foreneck with rather long seal-brown bases (probably sexual character).—Occiput similar to mantle: crown and circumocular region slightly darker: temporal region, chin, and throat seal-brown sprinkled with pale buffy.

*Measurements.* Below and on p. 183.

*Specimens examined.* Two, as registered below.

*Range.* Liu-kiu Islands (Okinawa).

*Type* in collection.

*Remarks.*—This species is readily discriminated from *Pt. mariannus* by the characters given in the diagnosis above. From *Pt. tonganus* it differs chiefly in its weaker dentition, smaller skull with relatively smaller orbits, and longer fur; the external dimensions average smaller.

a. ♀ ad. sk.; skull.	Liu-kiu Is.	Purchased (Warwick).	49.1.5.1.
b. ♂ yg. ad. sk.: skull	Liu-kiu Is.	Purchased (Warwick).	{ 49.1.5.2. 49.1.16.3.

(Type of species.)

*External measurements of Pteropus ualanus, mariannus, and loochoënsis.*

	<i>Pt. ualanus.</i> 3 ad. Cotypes.*		<i>Pt. mariannus.</i> 2 ad. Cotypes.†		<i>Pt. loochoënsis.</i> 2 ad. (Incl. type.)	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.	mm.	mm.
Forearm .....	130.5	133.5	134	136.5	135	142.5
Pollex, total length, c. u. ....	57	58.5	...	...	59.5	60
„ metacarpal .....	13.5	14	...	...	13.5	14.5
„ 1st phalanx .....	26.5	28.5	...	...	30.5	32
2nd digit, metacarpal .....	62	67	67.5	...	71.5	73.5
„ 1st phalanx .....	14.5	17	16	17	14	17
„ 2nd-3rd phalanx, c. u. ....	15	16.5	15	15.5	15.5	17
3rd digit, metacarpal .....	87	91.5	90	96	...	96.5
„ 1st phalanx .....	63	65.5	66.5	69	68.5	69.5
„ 2nd phalanx .....	94	100	...	100	96.5	...
4th digit, metacarpal .....	85	89	88	93	92	94.5
„ 1st phalanx .....	51.5	54	54.5	55	56.5	58.5
„ 2nd phalanx .....	55	59	...	...	...	...
5th digit, metacarpal .....	90.5	93	95.5	97	96.5	97.5
„ 1st phalanx .....	38	41.5	...	41.5	42.5	44
„ 2nd phalanx .....	39.5	42.5	...	45.5	46	47.5
Ears, length from orifice .....	23	23	...	...	...	...
„ greatest width, flattened ...	15	15	...	...	...	...
Front of eye to tip of muzzle .....	...	25	...	...	...	...
Interfemoral .....	1	2	...	...	0 †	0 †
Lower leg .....	59	59.5	...	...	60	61.5
Foot, c. u. ....	42	43.5	...	...	45	45.5
Calcaneal .....	16	16	...	...	16 †	18 †

\* Reg. nos. 5788 (2 ♂ yg. ad. ad.), 5808 (♂ ad. mounted): Berlin Museum.

† Reg. nos. A. 49 (♀ ad. mounted), A. 50 (♂ ad. mounted): Paris Museum.

‡ Estimate (skins).

*Measurements of skulls and teeth of Pt. ualanus, mariannus,  
and lochoënsis.*

	<i>Pt. ualanus.</i> Skull: 1 ad. Teeth: 1 ad., 2 imm. (Cotypes.*)		<i>Pt. mariannus.</i> Skulls: 2 ad.† Teeth: 2 ad.†, 1 imm.‡		<i>Pt. lochoënsis.</i> Type and topotype.	
	MIN.	MAX.	MIN.	MAX.	♂ yg.ad. Type.	♀ ad. mm.
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	61	...	...	...	61.2	...
„ palation to incisive foramina ...	28.7	...	...	30.7	...	31
„ front of orbit to tip of nasals ...	19	...	20.8	21	21	20.2
„ width of brain-case at zygomata ...	23.5	...	...	23	...	22.8
„ zygomatic width .....	35.8	...	...	37	...	36.2
„ width across m <sup>1</sup> , externally .....	16.5	...	17.7	18	17.2	17.5
„ lachrymal width .....	13	...	...	14.5	12.7	13.5
„ width across canines, externally ..	12.8	...	13.2	13.5	12.8	12.7
„ postorbital constriction .....	7.8	...	...	7.8	...	6.7
„ interorbital constriction .....	8.8	...	...	9	8.8	8.7
„ width of mesopterygoid fossa ...	6.8	...	...	7.2	7.2	7
„ between p <sup>4</sup> -p <sup>4</sup> , internally .....	9.8	...	10.2	10.5	9.8	10
„ between cingula of canines .....	7	...	6.8	7	6.2	6.7
„ orbital diameter .....	11.8	...	11.8	11.8	11.5	11.8
Mandible, length .....	48.2	...	...	50	49	50
„ coronoid height .....	25	...	...	25.2	24.2	25.5
Upper teeth, c-m <sup>2</sup> .....	22.2	...	23	24	23.5	24
Lower teeth, c-m <sub>1</sub> .....	24.5	...	26	27.2	26.8	26.8
Upper incisors, combined width .....	5.8	...	...	...	6.7	...
p <sup>1</sup> , length .....	3.8	4	4.8	5	4.7	4.8
„ width .....	3.1	3.5	3.5	3.6	3.2	3.3
p <sup>4</sup> , length .....	3.8	4	4.7	4.9	4.4	4.3
„ width .....	3.2	3.4	3.7	3.8	3.7	3.7
m <sup>1</sup> , length .....	4.2	4.5	5	5.1	5	5
„ width .....	2.7	2.8	3	3.5	3.1	3
m <sup>2</sup> , length .....	1.8	2.2	2.1	2.8	2.8	2.7
„ width .....	1.2	1.8	2	2.5	2.6	2.1
p <sub>1</sub> , length .....	1.7	1.8	2.2	2.5	2.2	2
„ width .....	1.8	1.9	2	2.2	2.1	2
p <sub>2</sub> , length .....	4.2	4.5	5	5.1	4.7	4.8
„ width .....	2.8	3	3	3	3	3
p <sub>3</sub> , length .....	4	4.1	4.8	5	4.7	4.6
„ width .....	3.1	3.2	3.3	3.5	3.2	3.2
m <sub>1</sub> , length .....	4	4.1	4.8	5.2	4.8	4.9
„ width .....	2.8	2.9	3	3.1	2.9	3
m <sub>2</sub> , length .....	3	3.2	3.7	4	3.8	3.7
„ width .....	2.2	2.5	2.7	3	2.8	2.7
m <sub>3</sub> , length .....	1.5	1.6	2	2.2	2.7	2.2
„ width .....	1.5	1.5	2	2.2	2.2	2

\* Reg. nos. 5808 (♂ ad.), 5798 (♀ imm.), 5809 (♀ imm.); Berlin Museum.

† Reg. nos. A. 49 (cotype), A. 6765 (topotype, collected by Marche); Paris Museum.

‡ Reg. no. 344 (topotype, collected by Kittlitz); Berlin Museum.

22. *Pteropus vanikorensis*, Q. & G.

*Pteropus keraudreni* (pt.), Dobson, Cat. Chir. B. M. p. 63.

♀ *Pteropus dussumieri*, Is. Geoffroy, Dict. Class. d'Hist. Nat. xiv. p. 701 (1828: India; Amboina); J. B. Fischer, Syn. Mamm. p. 85, no. 11 (1829: India; Amboina); Is. Geoffroy, in Belanger's Voy. Indes Orient., Zool. p. 98 (1834: India; Amboina); Lesson, Hist. Nat. Mamm. (Compl. Buffon) v. p. 48 (1836: India; Amboina); Temminck, Mon. Mamm. ii. p. 76 (1837: Indian continent; not Amboina); Gray, Mag. Zool. & Bot. ii. p. 503 (1838: India; Amboina); Wagner, Schreber's Säug., Suppl. i. p. 355 (1839: India; Amboina); Ogilby, Madras Journ. Lit. & Sci. xii. p. 146 (1840); Lesson, N. Tabl. R. Anim., Mamm. p. 13, no. 181 (India); Schinz, Syst. Verz. Säug. i. p. 127 (1844: Indian Peninsula); E. Desmarest, Dict. Univ. d'Hist. Nat. xi. p. 248 (1848: India; Amboina); Wagner, Schreber's Säug., Suppl. v. p. 601 (1853-55: ? Indian continent; ? Amboina); Gervais, Hist. Nat. Mamm. i. p. 188 (1854: India); Giebel, Säug. p. 988, footnote (1855: India; Amboina); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 442 (1870: Indian Peninsula).

*Pteropus vanikorensis*, Quoy & Gaimard, Voy. 'Astrolabe,' Zool. i. p. 77 (specimens, not skull), pl. ix. (animal) (1830: Vanikoro); Lesson, Hist. Nat. Mamm. (Compl. Buffon) v. p. 58 (1836: Vanikoro); Temminck, Mon. Mamm. ii. p. 78 (specimens, not skull) (1837: Vanikoro); Wagner, Schreber's Säug., Suppl. i. p. 354 (1839: Vanikoro); E. Desmarest, Dict. Univ. d'Hist. Nat. xi. p. 250 (1848: Vanikoro); Gervais, Hist. Nat. Mamm. i. p. 188, c. fig. (head) (1854: Vanikoro); Giebel, Säug. p. 998, footnote (1855: Vanikoro).

*Pteropus vanicorensis*, Oken, Allg. Naturg. vii. Abth. ii. p. 990 (1838); Schinz, Syst. Verz. Säug. i. p. 127 (1844: Vanikoro); Wagner, Schreber's Säug., Suppl. v. p. 601 (1853-55: Vanikoro); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 441 (1870: Vanikoro).

*Acerodon vanikorensis* (pt.), Lesson, N. Tabl. R. Anim., Mamm. p. 14, no. 194 (1842: Vanikoro).

*Pteropus keraudreni* (pt., nec Pt. keraudren, Q. & G.), Peters, MB. Akad. Berlin, 1867, p. 331; Dobson, Cat. Chir. B. M. p. 63 (1878); Trouessart, Rev. & Mag. Zool. (3) vi. p. 203 (1879: Vanikoro); id., Cat. Mamm. i. p. 82 (1897: Vanikoro).

*Pteropus tonganus* (pt., nec Q. & G.), Matschie, Megachir. p. 19 (1899: Vanikoro); Trouessart, Cat. Mamm., Suppl. p. 51 (1904: Vanikoro).

*Diagnosis*.—Similar to *Pt. mariannus*, but with slightly larger skull and relatively much larger orbits. Forearm about 136-137 mm. *Hab.* Sta. Cruz Is.

*Skull and teeth*.—Skull averaging rather heavier than in *Pt. mariannus* and *lochoënsis*; orbital diameter 13 mm., against 11.5-11.8 in the allied species.

*Fur*.—As in *Pt. tonganus*.

*Colour*.—Cotype. ♂ ad. (Reg. no. A. 58).—Back and rump dark seal-brown, thinly sprinkled with greyish-white hairs.—Breast, belly, and flanks similar, but flanks rather darker than centre of

breast and belly.—Mantle ochraceous-buff, lightening to buffy or cream-buffy posteriorly; occiput and sides of neck similar to mantle, but rather more tinged with ochraceous; fur of foreneck ochraceous at base, seal-brown at tip, making colour of foreneck superficially like that of breast.—Forehead, crown as far back as front of ears, sides of head, chin, and throat seal-brown.

Cotype A. 57 (♂ ad.) is in poor condition, but has apparently not differed in any noteworthy respect from foregoing.

*Measurements.* On pp. 190, 191.

*Specimens examined.* Four, in the collection of the Paris Museum, including the two cotypes of the species and one cotype of *Pt. dussumieri*.

*Range.* The island of Vanikoro.

*Cotypes* in the Paris Museum.

*Pteropus dussumieri*, Is. Geoffroy; 1828.—Based on two specimens, the one stated to have been brought by Dussumier from the continent of India, the other supposed to be from Amboina. The former is in the Paris Museum (Reg. no. A. 61; ♀ ad. mounted, skull *in situ*); it has been acquired through Verreaux and is ticketed "Bengale?"; the latter I have not been able to find in the Paris collection, nor in the manuscript register of Chiroptera of that Museum. Both of the localities given by Is. Geoffroy are undoubtedly incorrect. The cotype examined by me is externally indistinguishable from *Pt. vanikorensis*, but the characters of the skull and teeth are in this group of the genus of such decisive importance that the identification of *Pt. dussumieri* remains uncertain so long as its skull has not been made available for examination.

*Pteropus vanikorensis*, Quoy and Gaimard; 1830.—Original description based on two specimens obtained in Vanikoro during the voyage of the 'Astrolabe' (Paris Museum, Reg. nos. A. 57 and A. 58), both males, mounted, skull of A. 58 *in situ*, of A. 57 extracted in 1907; cotype A. 58 is probably the original of Quoy and Gaimard's pl. ix. A third mounted specimen in the Paris collection (A. 59, not full-grown), though marked "*P. vanikorensis*, Q. & G.; type; Vanikoro; Quoy & Gaimard, Astrolabe," cannot technically be considered a cotype, since it is not referred to in the original description.—The skull described by Quoy and Gaimard as being that of *Pt. vanikorensis* (Paris Museum, no. 6746) belongs to a totally different species, *Pt. tuberculatus*, Peters.

*Remarks.*—This species is readily distinguished from *Pt. mariannus* by its larger orbits. From the closely allied *Pt. tonganus* it differs by its slightly smaller size (forearm 136–137, against 139–150 mm.) and relatively shorter metacarpals (third metacarpal 88·5, against 93·5–102·5 mm.).

23. *Pteropus tonganus*, Q. & G.

*Pteropus keraudreni* (pt.), Dobson, Cat. Chir. B. M. p. 63.

*Pteropus tonganus*, Quoy & Gaimard, *Voy. 'Astrolabe,' Zool.* i. p. 74, pl. viii. fig. 1 (col. fig. of young), figs. 2, 3 (skull), fig. 4 (col. fig. of pale variety, young) (1830: Tonga-Tabu); Lesson, *Hist. Nat. Mamm. (Compl. Buffon)* v. p. 57 (1836: Tonga-Tabu); Temminck, *Mon. Mamm.* ii. p. 79 (1837: Tonga-Tabu); Oken, *Allg. Naturg.* vii. Abth. ii. p. 990 (1838); Wagner, *Schreber's Säug., Suppl.* i. p. 353 (1839: Tonga-Tabu); Lesson, *N. Tabl. R. Anim., Manon.* p. 13, no. 184 (1842: Tonga); Schinz, *Syst. Verz. Säug.* i. p. 126 (1844: Tonga-Tabu); E. Desmarest, *Dict. Univ. d'Hist. Nat.* xi. p. 248 (1848: Tonga); Wagner, *Schreber's Säug., Suppl.* v. p. 600 (1853-55: Tonga-Tabu); Gervais, *Hist. Nat. Mamm.* i. p. 188 (1854: Tonga); Giebel, *Säug.* p. 998, footnote (1855: Tonga); Fitzinger, *SB. Akad. Wien*, lx. Abth. i. p. 439 (1870: Tonga-Tabu); Marchi, *Atti Soc. Ital. Sci. Nat.* xv. p. 516 (1872-73: structure of hairs); Günther, *P. Z. S.* 1874, p. 295 (Savage I.); Matschie, *Megachir.* p. 19 (pt.) (1899: Tonga; Wallis Is.; Samoa); Trouessart, *Cat. Mamm., Suppl.* p. 51 (pt.) (1904: Fiji; Tonga; Wallis Is.; Samoa).

*Pteropus keraudrenius* (nec Temm.), Peale, *U.S. Expl. Exp.* viii., *Mamm.* p. 18 (1848: Fiji); Cassin, *op. cit.* viii. (sec. ed.) p. 10 (1858: Fiji).

*Pteropus keraudreni* (nec Pt. keraudren, Q. & G.), Schmeltz, *Cat.* iii. *Doubl. Godeffroy*, p. 1 (1866: Fiji); Peters, *MB. Akad. Berlin*, 1867, p. 331 (pt.); Dobson, *Cat. Chir. B. M.* p. 63 (pt.), p. 552 (1878: Fiji; Samoa; Savage I.); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 203 (pt.) (1879: Fiji; Samoa; Savage I.); Moseley, *Notes Naturalist 'Challenger,'* p. 291 (1879: Tonga-Tabu; habits); Trouessart, *Ann. Sci. Nat.* (6) *Zool.* viii. Art. 12, pp. 6, 17 (1879: remarks on distribution); J. Anderson, *Cat. Mamm. Ind. Mus.* i. p. 103 (1881: Samoa); Lydekker, *R. Nat. Hist.* i. p. 256 (1893-94: Tonga); Trouessart, *Cat. Mamm.* i. p. 82 (pt.) (1897: Fiji; Tonga; Samoa).

? *Pteropus funereus*, Krefft, *Cat. Mamm. Austral. Mus.* p. 4 (1864: Fiji).

*Pteropus flavicollis*, Gray, *Cat. Monk. &c.* p. 107 (1870: Moala; Totoya; Ovalau); Alston, *P. Z. S.* 1874, p. 96 (Samoa).

*Diagnosis.*—Similar to *Pt. vanikorensis*, but rather larger and with relatively longer wings. Forearm 139-150 mm. *Hab.* Fiji, Tonga, and Samoa Is.

*Differential characters.*—This species is scarcely distinguishable from *Pt. vanikorensis* by other characters than those given in the diagnosis: forearm 139-150 mm., against 136-137 mm. in the cotypes of *Pt. vanikorensis*; third metacarpal 93.5-102.5 mm., against 88.5; compare measurements p. 190. Size of orbits (12.5-13.2 mm.) as in *Pt. vanikorensis* (13 mm.).

*Palate-ridges.*—5+5+3, but not rarely with a more or less incomplete additional ridge between the normal ninth and tenth (formula approaching 5+6+3). Arrangement of ridges as in *Pt. hypomelanus* (above p. 101).

*Fur.*—Longest hairs of back approximately 10-13 mm., of mantle

12-13 in males, 16-17 in females, of belly 13-15. Distribution of fur as in the allied species.

*Colour*.—British Museum series, males and females, adults and immatures (see list below):—Back, rump, breast, belly, and flanks blackish or seal-brown, generally slightly darker and more glossy on back and rump than on breast and belly, everywhere thinly sprinkled with whitish hairs.—Mantle buffy, sometimes very pale (approaching cream-buff), sometimes distinctly washed with ochraceous-buff or pale orange-ochraceous; sides of neck similar or slightly deeper in tinge. Base of fur of mantle and sides of neck varying in colour according to sex of individuals (see below). Foreneck ochraceous-buffy more or less strongly clouded with pale russet and blackish seal-brown; in many specimens the buffy colour is purest (less mixed with darker tinges) on posterior portion of foreneck, producing a more or less distinct narrow transverse band separating dark breast from dark centre of foreneck; in other specimens the dark admixture extends over the whole of the foreneck.—Occiput, as far as a line between middle or front of ears, similar to mantle or slightly mixed with brownish. Crown mottled dark brown and buffy, in some specimens nearly uniform seal-brown like back. Temporal region and cheeks similar to crown or more uniform dark brown; circumocular space in dark-headed specimens often more or less strongly suffused with pale russet or buffy russet, forming more or less distinct "spectacles" (cf. *Pt. conspicillatus*). Chin and throat blackish or seal-brown.

*Sexual differentiation*.—Hairs of mantle in adult males shorter, more rigid and oily, in adult females longer, softer, more spreading. In all males examined the hairs of the mantle and sides of neck are uniform buffy to extreme base, or with short blackish bases only posteriorly in shoulder region; in females the fur of the mantle and sides of neck has long concealed seal-brown bases.

*Measurements*. On pp. 190, 191.

*Specimens examined*. Twenty-two, in the collections of the Paris (three), U.S. National (two \*), and British Museums, including the cotypes of the species and of *Pt. flavicollis*.

*Range*. Fiji Is. (Taviuni, Ovalau, Moala, Totoya); Tonga Is. (Uea, Namouka, Tonga Tabu); Samoa Is. (Savage I.). The Tonga and Samoa groups form the extreme south-eastern limits of the range of the genus in the Polynesian region.

*Cotypes* in the Paris Museum.

*Habits*.—Like many other species of the genus, *Pt. tonganus* appears sometimes on the wing in the early afternoon in full sunlight, but as dusk comes on it becomes more and more plentiful, and it is probably only those accidentally disturbed or specially driven by hunger that come out before dusk. At the time of the visit of the 'Challenger' to Tonga Tabu (July, 1874) these Fruit-bats were feeding on the bright red flowers of one of the indigenous trees, and flowers would seem on the whole to form an important proportion of the food of the species of *Pteropus*; they probably

\* Nos. 142472, 142475, Namouka, Tonga Is.

often act as fertilizers by carrying pollen from tree to tree, adherent to their fur. (Moseley, *l. s. c.*)

*Pteropus tonganus*, Quoy & Gaimard; 1830.—Original description based on three specimens, obtained in Tonga Tabu (voyage of the 'Astrolabe'), viz. nos. A. 54, A. 55, and A. 56, all mounted with skulls *in situ*. No. 54 (old catalogue no. 754) is an adult male; no. 55 (775) is a young female, no doubt the original of the coloured figure pl. viii. fig. 1 (drawing and coloration bad); no. 56 (755 B), also young, is the yellowish individual figured pl. viii. fig. 4. Colour and other external characters of cotype 54 (♂ ad.) quite as in the British Museum series. Topotypes ('Challenger' Expedition) are in the collection of the British Museum.

*Pteropus flavicollis*, Gray; 1870.—Based on specimens from Moala, Totoya, and Ovalau Islands, Fijis (voyage of the 'Herald'). Moala may be fixed as the type locality; cotypes, ♂ ad., ♀ ad., skins with skulls, in collection.

a.	Ad. skull.	Fijis (Voy. H.M.S. 'Herald'; <i>J. MacGillivray</i> ).	Museum of Economic Geology [P.].	55.11.7.4.
b.	♂ ad. al.	Fijis.	Museum Godeffroy.	74.10.5.5.
c, d.	[♀] ad., juv. sks.; skulls.	Taviumi, Fijis.	E. A. Liardet, Esq. [P.].	75.12.29.2,3.
e-g.	♂ ad., ♀ ad. sks., skulls; pull. skull.	Ovalau, Fijis; Aug. 1856 (Voy. H.M.S. 'Herald'; <i>Dr. F. M. Rayer</i> ).	Lords of the Admiralty [P.].	{ 58.12.27.1. 59.7.14.2. 58.12.27.2. 58.12.27.115.
h.	[♂] ad. sk.; skull.	Moala, Fijis; Sept. 1854 (Voy. H.M.S. 'Herald'; <i>J. MacGillivray</i> ).	Museum of Economic Geology [P.].	55.11.7.8.
i.	♀ ad. sk.; skull.	Moala; Sept. 1854 (Voy. H.M.S. 'Herald'; <i>Dr. F. M. R.</i> ).	Lords of the Admiralty [P.]. (h, i, <i>cotypes</i> of <i>Pt. flavicollis</i> , Gray.)	56.7.7.8.
j.	Pull. sk.	Moala; Sept. 1854 (Voy. H.M.S. 'Herald'; <i>Dr. F. M. R.</i> ).	Lords of the Admiralty [P.].	Not reg.
k.	♂ ad. sk.; skull.	Totoya, Fijis; Aug. 1855 (Voy. H.M.S. 'Herald'; <i>Dr. F. M. R.</i> ).	Lords of the Admiralty [P.].	56.9.4.1.
l, m.	[♂] ad. sk., ♀ ad. al.; skulls.	Tonga Tabu (Voy. H.M.S. 'Challenger').	Lords of the Treasury [P.].	80.11.24.3. 90.2.20.1.
n-p.	♂ ad., ♀ ad., ♀ juv. al.; skulls of	Samoa.	Museum Godeffroy.	74.10.5.1,2,6.
q, r.	♀ juv., ♀ ad. al.	Samoa.	Rev. J. S. Whitmee [P.].	75.2.4.1. 75.10.5.1.
s.	♀ juv. al.; skull.	Savage I., Samoa.	Dr. A. Günther [P.].	74.3.31.1.



24. *Pteropus geddiei*, MacGillivray.

*Pteropus kerandreni* (pt.), Dobson, *Cat. Chir. B. M.* p. 63.

*Pteropus geddiei*, MacGillivray, *Zoologist*, xviii, p. 7134 (Sept. 1860: Aneiteum; habits); *Peters, MB. Akad. Berlin*, 1867, p. 326 (New Hebrides); *Gray, Cat. Monk. &c.* p. 107 (1870: Aneiteum); *Matschie, Megachir.* pl. vii. figs. 3, 3a, 3b (skull) (1899: New Caledonia).

*Pteropus kerandreni* (nec *Pt. kerandren*, Q. & G.), Dobson, *Cat. Chir. B. M.* p. 63 (pt.) (1878: Aneiteum); *id.*, *P. Z. S.* 1878, p. 875 (1879: New Caledonia); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 203 (pt.) (1879: Aneiteum); *Dobson, Rep. Brit. Assoc.* 1880, p. 173 (New Caledonia); *Trouessart, Cat. Mamm.* i. p. 82 (1897: Aneiteum; New Caledonia).

*Pteropus kerandren* (pt.), *Jentink, Cat. Syst. Mamm.* p. 149 (1888: Aneiteum).

*Pteropus tonganus* (pt., nec Q. & G.), Matschie, *Megachir.* p. 19 (1899: New Caledonia; New Hebrides); *Trouessart, Cat. Mamm., Suppl.* p. 51 (1904: New Caledonia; New Hebrides).

*Diagnosis*.—Similar to *Pt. tonganus*, but skull, teeth, and external dimensions larger. Forearm 153.5 mm. *Hab.* New Hebrides; New Caledonia.

*Colour*.—Two skins. ♂ ad. (type). ♀ ad.—Scarcely different from that of *Pt. tonganus*, except perhaps in the more uniform blackish colour of the head. In both specimens the crown and sides of head are as blackish as chin and throat, very sharply marked off from buffy occiput and mantle; rostrum and superciliaries distinctly washed with mars-brown or buffy mars-brown. The darkest-headed specimens of *Pt. tonganus* are, however, practically indistinguishable in colour from the type of *Pt. geddiei*.

*Sexual differentiation*.—As in *Pt. tonganus*.

*Measurements*. On pp. 190, 191.

*Specimens examined*. Four, in the collections of the Berlin (two, New Caledonia) and British Museums, including the type of the species.

*Range*. Aneiteum; New Caledonia.

*Type* in collection.

*Habits*.—On a thickly wooded bank near the sea, on the leeward side of Aneiteum, behind a grove of bread-fruit and other trees, *Pt. geddiei* was found in great numbers by John MacGillivray, in 1854 and 1859, while for weeks and even months together there were none in the neighbourhood. At this locality their arrival and departure were apparently connected with the ripening of the two annual crops of bread-fruit, to which they are very destructive. Like most other Pteropi, they are gregarious, but the sexes generally keep apart; MacGillivray never shot any but males at the camp referred to above, nor did he ever meet with the female. They have their favourite trees for roosting on during the day, generally some wide-spreading fig or banyan, sometimes an Acacia. During the day time and while suspended from the tree, they are readily roused by any unusual noise, such as the crackling of a stick under foot, and are not very easily approached. Like other large bats they are very tenacious of life, and cling to the branches as

long as they possess the requisite strength, and sometimes remain suspended even after death. The males seem to be very pugnacious; they may be seen fighting among themselves on the trees, and a wounded one will furiously attack anything brought in contact with it. With their formidable canines they inflict severe bites, and retain their hold with great tenacity. The Aneiteumese are fond of these bats as food, and spin the fur into cordage used in ornamenting the person. Besides occasionally killing them with stones and short sticks, they sometimes catch them in traps similar to those used for fishing—circular, flat-bottomed buckets made of *Flagellaria indica*, with a hole at the top for entrance, and some papaw-apple for bait. The Aneiteumese generic name for *Pteropus* is Nekrei; *Pt. geddiei* is called Nawathelgan, in contradistinction to *Pt. anetianus*, which is called Nalivatan. (MacGillivray, l. s. c.)

- a. ♂ ad. sk.; Aneiteum, New Hebrides; J. MacGillivray, Not reg.  
skull. 23 June, 1859. Esq. [C].  
(Type of species.)  
b. [♀] ad. sk.; Aneiteum. Canon H. B. 93.11.29.2.  
skull. Tristram [E].

*External measurements of Pteropus vanikorensis, tonganus, geddiei.*

	<i>Pt. vanikorensis.</i> 3 ad. (Two cotypes of species, one of <i>Pt. dussumieri</i> .)			<i>Pt. tonganus.</i> 15 ad. (Incl. one cotype.)		<i>Pt. geddiei.</i> 2 ad. (Incl. type.)	
	♂ ad.* mm.	♂ ad.† mm.	♀ ad.‡ mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Forearm .....	137	136	...	139	150	153.5	...
Pollex, total length, c. u. ....	...	60.5	...	58	66	67	67.5
„ metacarpal .....	14.5	...	...	13	15	15	15
„ 1st phalanx .....	30.5	...	...	31	35	35	35.5
2nd digit, metacarpal .....	...	69	65	69.5	76.5	72.5	79
„ 1st phalanx .....	...	17	16.5	14	19.5	17.5	17.5
„ 2nd-3rd phalanx, c. u. ....	...	17	...	13	18	17.5	18
3rd digit, metacarpal .....	...	88.5	88	93.5	102.5	104.5	109.5
„ 1st phalanx .....	66	67.5	63.5	67	76.5	75	78
„ 2nd phalanx .....	...	...	...	97.5	114.5	110.5	111.5
4th digit, metacarpal .....	...	87	86	90.5	100	102.5	105.5
„ 1st phalanx .....	...	55	53.5	55	62	63	63.5
„ 2nd phalanx .....	...	53	50	55	62	60	...
5th digit, metacarpal .....	...	93	91	94	105	105.5	113
„ 1st phalanx .....	40	41	39	40	47.5	45	46
„ 2nd phalanx .....	40	40	38	40.5	46	46.5	48.5
Ears, length from orifice .....	...	...	...	25	26.5	...	...
„ greatest width, flattened ...	...	...	...	14	15.5	...	...
Front of eye to tip of muzzle .....	...	...	...	24	26.5	...	...
Interfemoral .....	...	...	...	0	5	0§	...
Lower leg .....	62	...	61	62.5	70	...	...
Foot, c. u. ....	...	...	...	40.5	50	50.5	51.5
Calcaneal .....	...	...	...	18	19	18.5§	20§

\* Cotype of *Pt. vanikorensis* (A. 57).

† Cotype of *Pt. vanikorensis* (A. 58).

‡ Cotype of *Pt. dussumieri* (A. 61).

§ Estimate (skins).

Measurements of skulls and teeth of *Pteropus vanikorensis*, *tonganus*,  
and *geddiei*.

	<i>Pt. vanikorensis</i> . Cotype (♂ ad., Reg. no. A. 57).	<i>Pt. tonganus</i> . Skulls: 13 ad. Teeth: 12 ad., 2 imm. (Incl. cotypes of <i>Pt. flavicollis</i> .)		<i>Pt. geddiei</i> . Skulls and teeth: 2 ad. (Incl. type.)	
		Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	67	63.2	67	...	...
„ palation to incisive foramina ...	...	30.8	33	35.8	...
„ front of orbit to tip of nasals ...	21.8	21.2	23	23	25.5
„ width of brain-case at zygomata ...	23.8	22	24.5	...	...
„ zygomatic width .....	38.2	34	38.7	...	...
„ width across $m^1$ , externally .....	18	17.5	18.8	19	19.2
„ lacrymal width .....	14	13	14.8	14.2	14.4
„ width across canines, externally ...	14	13	14.3	13.7	...
„ postorbital constriction .....	6	6.5	7.8	7.3	...
„ interorbital constriction .....	8.8	7.7	8.8	9.8	9.8
„ width of mesopterygoid fossa ...	...	6.8	7.8	...	...
„ between $p^1$ - $p^1$ , internally .....	10	9.5	11	10.8	10.8
„ between cingula of canines .....	7.8	7	8.7	7.6	...
„ orbital diameter .....	13	12.5	13.2	13.8	13.8
Mandible, length .....	52.3	49.7	53.8	56.5	...
„ coronoid height .....	26.7	23.5	25.8	27	...
Upper teeth, $c-m^2$ .....	24.8	24.5	26	27.8	30
Lower teeth, $c-m_3$ .....	27.5	27	29	30.7	33
Upper incisors, combined width .....	6.8	6.2	7.2	6.7	7.5
$p^3$ , length .....	4.9	4.7	5	5.2	5.5
„ width .....	3.2	3.2	3.7	3.7	3.9
$p^1$ , length .....	4.8	4.7	5.1	4.9	5.5
„ width .....	3.7	3.7	4	4	4.1
$m^1$ , length .....	5.7	5.1	5.8	5.7	...
„ width .....	3.7	3.3	3.7	3.9	...
$m^2$ , length .....	2.7	2.2	2.9	2.8	3
„ width .....	2	2	2.6	...	2.7
$p_1$ , length .....	2.2	2	2.3	2.6	2.7
„ width .....	2.1	2	2.2	2.5	2.5
$p_3$ , length .....	4.7	4.7	5.1	5	5.7
„ width .....	3	3	3.2	3.5	3.5
$p^1$ , length .....	4.7	4.7	5.1	5.1	5.5
„ width .....	3.5	3.3	3.7	3.9	4
$m_1$ , length .....	5	5	5.2	5.2	5.2
„ width .....	3.6	3.2	3.7	3.7	3.8
$m_2$ , length .....	4	3.7	4	4.2	4.2
„ width .....	3.1	2.9	3.4	3.2	3.2
$m_3$ , length .....	2	2	2.5	2.1	2.7
„ width .....	1.8	1.8	2.1	2.1	2.5

C. THE *PTEROPUS CANICEPS* GROUP.

*Species*.—*Pt. dobsoni*, *caniceps*, and *argentatus*.

*Range*.—North-western Austro-Malaya: Celebes, Sanghir, Gilolo group, Sula Islands, ? Amboina group.

*General characters*.—In all essential respects similar to *Pt. hypomelanus* and allies, but skull and dentition heavier, ears generally longer and distinctly attenuated above, colour of body characterized by a heavy sprinkling of dark fur with longer pale greyish or straw-yellow hairs, the pale element occasionally predominant, particularly on underside; at least in one species a uniform mars-brown phase occurs. Sexual differentiation inconspicuous (canines heavier in males). Size below medium (forearm 135–145 mm.).

*Differentiation of species*.—In the size and shape of the ears *Pt. dobsoni* (Celebes) comes nearest to *Pt. hypomelanus*, but the colour of the back is peculiar, sepia suffused with golden buffy. In *Pt. caniceps* (Gilolo group, Sanghir, Sula Islands) the ears are longer, more attenuated above and narrowly rounded off at tip; colour, in the ordinary grizzled phase, much paler. *Pt. argentatus* (? Amboina) is similar to *Pt. caniceps* in the size and form of the ears, but much smaller-toothed, with longer and differently coloured fur.

*Affinities of group*.—Probably closely allied to the *Pt. hypomelanus* group, with which it accords in the general characters of the skull and teeth, distribution of fur, narrowness of central interfemoral, and non-development of conspicuous secondary sexual characters.

25. *Pteropus dobsoni*, K. And.

*Pteropus fuscus*, Dobson, Cat. Chir. B. M. p. 59.

*Pteropus fuscus* (nec E. Geoff., nec Desm., nec Blainv.). Dobson, l. s. c. pp. 59, 552, pl. iv. fig. 5 (teeth) (June, 1878: Celebes); Trouessart, Rev. & Mag. Zool. (3) vi. p. 202 (1879: Celebes); id., Cat. Mamm. i. p. 82 (1897: Celebes); Miller, Fam. & Gen. Bats, p. 58 (1907).

*Pteropus* (Spectrum) *hypomelanus* h. *fuscus*, Matschie, Megachir. p. 25 (1899). *g. fuscus*, Trouessart, Cat. Mamm., Suppl. p. 52 (1904: Celebes).

*Pteropus dobsoni*, K. Andersen, Ann. & Mag. N. II. (8) ii. p. 370 (1 Oct. 1908).

*Diagnosis*.—Similar to *Pt. hypomelanus*, but with broader rostrum, larger teeth, relatively larger  $p_1$ , longer wings and tibia, and different colour of the fur. Back sepia suffused with golden buffy; sides of head and entire underside dark vandyck-brown or seal-brown; mantle burnt-umber, strongly contrasting with back, but not with underparts. Forearm 144.5 mm. *Hab.* Celebes.

*Skull*.—Similar in characters and general size to that of the larger races of *Pt. hypomelanus*, but rostrum slightly broader; lachrymal width in type, a young adult male, 16 mm. (13.2–15.7

in all races of *Pt. hypomelanus*); maxillary width externally across  $m^1$ - $m^1$  19.5 mm. (16.5-19).

*Teeth*.—Scarcely differing in structure from those of *Pt. hypomelanus*, but cheek-teeth conspicuously larger, particularly broader;  $m^1$ , length (longitudinal diameter) 6.2 mm., against 4.8-5.9 in all forms of *Pt. hypomelanus*, width 3.7, against 2.9-3.5;  $m_1$ , length 5.8 mm., against 4.2-5.2, width 3.8, against 2.8-3.2. The increase in the size of  $m_1$ , as compared with *Pt. hypomelanus*, appears to be relatively larger than of the other cheek-teeth. For further details compare measurements, p. 199, with those of *Pt. hypomelanus*, pp. 118 and 131.—Cingulum of upper canines well defined but narrow. Posterior ledge of  $p^3$  and  $p^4$  short but distinctly marked off from tooth postero-externally.  $i_2$  fully twice the size of  $i_1$ ,  $p_1$  about twice the size of  $i_2$ , larger than  $m_3$ . Posterior ledge of  $p_3$  and  $p_4$  quite short and rather ill-defined.—The peculiar shape and position of  $m^2$  described and figured by Dobson (*l. s. c.*) is, no doubt, an individual abnormality in the single specimen known.

*Ears*.—As in *Pt. hypomelanus*; scarcely attenuated above, tip rather narrowly rounded off.

*Wings and tibia*.—Membranes arising about 15 mm. apart from sides of back. Length of forearm (144.5 mm.) in a slightly immature specimen as in the largest specimens of *Pt. hypomelanus* (maximum 145.5 mm.), but metacarpals and phalanges decidedly longer; compare measurements, p. 198, with those of *Pt. hypomelanus*, p. 130.—Lower leg 68.5 mm., against 54.5-66 in all races of *Pt. hypomelanus*.

*Interfemoral*.—Practically undeveloped in centre.

*Fur*.—Closely adpressed on back. Length, back about 11, mantle 13, belly 12 mm. Least width of furred area of back about 37 mm. Forearm and tibia naked above.

*Colour* (type).—Back and rump sepia, strongly and uniformly suffused with a peculiar tinge of golden buffy approaching isabella; seal-brown base of fur concealed on back, partly exposed on posterior portion of rump.—Breast, belly, and flanks dark vandyck-brown thinly sprinkled with pale golden buffy hairs.—Mantle burnt-umber with mars-brown bases to the hairs, darkening to seal-brown with vandyck-brown hair-bases on sides of neck and foreneck.—Occiput and crown similar to mantle, passing into seal-brown on sides of head, throat, and chin.

*Measurements*. On pp. 198, 199.

*Specimen examined*. One, the type.

*Range*. The single specimen on record is ticketed Celebes.

*Type* in collection.

*Nomenclature*.—The name proposed by Dobson for this species is preoccupied by *Pt. fuscus*, E. Geoff., 1803 (= *Pt. niger*, Kerr, 1792), *Pt. fuscus*, Desm., 1803 (= *Pt. subniger*, Kerr, 1792), and *Pt. fuscus*, Blainville, 1840 (= *Pt. vampyrus malaccensis*, K. And., 1908).

$\alpha$ . ♂ yg. ad. sk.; skull. Celebes. Purchased (Frank). 41.4.4.5.  
(Type of species and of *Pt. fuscus*, Dobson.)

26. *Pteropus caniceps*, Gray.

*Pteropus caniceps*, Dobson, Cat. Chir. B. M. p. 68.

*Pteropus mackloti* (pt.), Dobson, *op. cit.* p. 67.

*Pteropus hypomelanus* (pt.), Temminck, Esq. Zool. p. 62 (1853: Ternate); Jentink, Cat. Ost. Mamm. pp. 261-262, specimens *a*, *j*, *k*, *m*, *n* (1887: Ternate; Gilolo; Morotai; Siao); *id.*, Cat. Syst. Mamm. pp. 148-149, specimens *a*, *b*, *c*, *j*, *m*, *o*, *p*, *s*, *t*, *u*, *v* (1888: Ternate; Gilolo; Morotai; Siao; Sula Bessi).

*Pteropus caniceps*, Gray, Cat. Monk. &c. p. 107 (1870: Batchian); Dobson, Cat. Chir. B. M. p. 68 (1878: Batchian; Gilolo); Trouessart, Rev. & Mag. Zool. (3) vi. p. 203 (1879: Batchian; Gilolo); Jentink, Cat. Syst. Mamm. p. 150 (1888: Batchian); Trouessart, Cat. Mamm. i. p. 83 (1897: Batchian; Gilolo); Matschie, Megachir. pl. v. figs. 13, 14 (skull: Batchian) (1899).

*Pteropus affinis*, Gray, Cat. Monk. &c. p. 108 (1870: Gilolo).

*Pteropus mackloti* var. *batchiana*, Gray, Cat. Monk. &c. p. 110 (1870: Batchian).

*Pteropus* (Acerodon) *mackloti* b. *batchianus*, Matschie, Megachir. p. 10 (1899: Batchian); Trouessart, Cat. Mamm., Suppl. p. 49 (1904: Batchian; Gilolo).

*Pteropus mackloti* (pt., *nec* Temm.), Dobson, Cat. Chir. B. M. p. 67, specimen *a* (1878: Batchian).

*Diagnosis*.—Allied to *Pt. dobsoni*, but orbits larger,  $i_2$  and  $p_1$  smaller, cheek-teeth slightly smaller, ears longer and more distinctly attenuated above, general size slightly smaller, tibia much shorter, and colour of head, mantle, and underparts much paler. Back and underside of body dark brownish thickly varied with silvery buffy or buffy straw-yellow, the pale hairs sometimes nearly concealing dark colour on underparts; head and neck ochraceous or ochraceous-buffy; a mars-brown phase occurs. Forearm 135-139.5 mm. *Hab.* Gilolo group; Sula Is.; Sanghir Is.

*Skull*.—Similar in size and other characters to that of *Pt. dobsoni*, but with conspicuously larger orbits; orbital diameter 14.2-14.7 mm., against 13 in *Pt. dobsoni*.—In size the skull of *Pt. caniceps* equals that of the largest races of *Pt. hypomelanus*, from which it differs chiefly in the heavier, particularly broader, rostrum, broader palate, and larger orbits; maxillary width across external sides of  $m^1$ - $m^1$  20.2-20.8 mm., against 16.5-19 in all races of *Pt. hypomelanus*; width of mesopterygoid fossa 8.2-8.7 mm., against 7-8.2; width of palate between  $p^1$ - $p^1$  12 mm., against 9-11.7; orbital diameter 14.2-14.7 mm., against 12.7-13.2.

*Teeth*.—Not quite as heavy as in *Pt. dobsoni*, and with conspicuously smaller  $i_2$  and  $p_1$ . Similar in structure to those of *Pt. hypomelanus*, but canines longer, cheek-teeth markedly broader (compare measurements, p. 199, with those of *Pt. hypomelanus*, pp. 118 and 131).—Cingulum of upper and lower canines narrow. Posterior ledges of upper and lower premolars short and ill-defined, though a minute postero-external basal notch is occasionally detectable in  $p^3$  and  $p_3$ .  $m^2$  larger than  $m_2$ ,  $i_2$  once and a half or nearly twice the size of  $i_1$ ,  $p_1$  once and a half the size of  $i_1$ , subequal to  $m_2$ .

*Ears*.—Longer than in *Pt. hypomelanus* and *dobsoni*; upper third distinctly attenuated, owing to flatly concave emargination of outer margin; tip narrowly rounded off.

*Interfemoral*.—Scarcely developed in centre.

*Fur*.—Short, silky; closely adpressed on back. Approximate length, back 10–12, mantle 12·5–14·5, belly 11·5–13·5 mm. Width of hairy space of back about 41–47 mm.

Fur of back extending as a narrow line of short and closely adpressed hairs along upperside of humerus and proximal fourth or third of forearm. Tibia naked above, except for a few scattered hairs on proximal third.

*Colour*.—Two colour phases occur; in both, the head, mantle, sides of neck, and foreneck are ochraceous or ochraceous-buff or cream-buff, generally with extreme base of hair dark brown; in one phase the dark brown colour of back, rump, breast, and belly is strongly mixed with, sometimes more or less completely concealed or replaced by, glossy silvery buffy or buffy straw-yellow; in the other phase the back, rump, breast, and belly are uniform dark mars-brown or russet mars-brown.

(1) Grizzled phase: ♀ yg. ad. skin, Batchian, type of species (60.1.10.1).—Back and rump glossy silvery buffy heavily mixed with seal-brown and blackish hairs. On front half of dorsum the dark and pale hairs are nearly equal in number, on posterior portion of dorsum and on rump the pale is largely in excess of the dark element.—Breast, belly, and flanks pale silvery greyish with a faint tinge of cream-buff; base of fur slightly darker.—Mantle and sides of neck buffy, shading to cream-buff on occiput and to ochraceous-buff in shoulder region; foreneck slightly darker than sides of neck and suffused with pale wood-brown. Hairs of mantle and sides of neck seal-brown at base.—Crown and forehead similar to mantle, all hairs dark brown at base. Sides of head and throat mixed cream-buffy and dark brown.

A second skin (♀ ad. skin, teeth much worn, Batchian, 7.1.1.243) is similar to the type in the general style of coloration, but differing in many details:—While the dark-coloured hairs of back and rump are seal-brown or dark vandyck-brown as in the type, the pale hairs are different in tinge, buffy straw-yellow, and rather more thinly spread, nowhere completely covering the dark fur.—Breast, belly, and flanks dark vandyck-brown, approaching seal-brown, thickly mixed with hairs similar in colour to pale hairs of back, making general aspect of underside of body much darker than in type of species.—Mantle, occiput, and sides of neck darker than in type, between ochraceous-buff and ochraceous, shading almost to russet in shoulder region; extreme base of fur dark brown. Foreneck similar to sides of neck, but thickly mixed with dark brown hairs.—Crown somewhat darker than mantle, approaching clay, with dark brown bases to the hairs. Sides of head and throat similar to foreneck.

The type of *Pt. affinis* Gray (♂ juv. skin, Gilolo, 62.10.21.4) is on the whole similar to the second example described above, but

pale-coloured hairs of back, rump, and underparts more similar in tinge to those of the type of the species.

(2) Mars-brown phase: ♂ ad. skin, teeth almost unworn, Batchian, type of *Pt. mackloti* var. *batchiana*, Gray (60.1.10.2).—Back and rump uniform dark mars-brown without any appreciable admixture of pale hairs. Breast, belly, and flanks uniform russet mars-brown, with a few silvery white hairs. Head, mantle, sides of neck, and foreneck as in the grizzled phase.

*Sexual differentiation*.—Canines conspicuously longer and heavier in males than in females. Measurements taken on one male and two females: upper canines, vertical extent from alveolar border 11 mm. (male) and 9 (females), antero-posterior basal diameter 4.8 (male) and 3.7–3.8 (females); lower canines, vertical extent 9.5 (male) and approximately 6.5–7.5 (females, tips slightly worn), antero-posterior basal diameter 3.8 (male) and 3 (females).

*Measurements*. On pp. 198, 199.

*Specimens examined*. Sixteen, in the collections of the Leyden (eleven, list under synonyms above), Berlin (one), and British Museums, including the types of the species and of *Pt. affinis* and *Pt. mackloti* var. *batchiana*, Gray.

*Range*. Gilolo group: Morotai, Gilolo, Ternate, Batchian; Sula Islands: Sula Bessi; Sanghir Islands: Siao.

*Type* in collection.

*Nomenclature and history in literature*.—Chiefly two facts have influenced the history of this species in literature, viz., the unusually great individual variation in the colour of the fur, and the strong external resemblance of the species, even in size and colour of fur, to certain forms of the *Acerodon mackloti* group. The former fact explains that this species was described by Gray under three different names, the latter its confusion, by Gray and other authors, with *Acerodon mackloti*.—The type of *Pt. caniceps*, Gray (1870), is a young adult female (practically full-grown, forearm 135 mm.) of the grizzled phase, collected in Batchian by Dr. Wallace. The type of *Pt. affinis*, Gray (1870), is a young, not nearly full-grown male (forearm 112 mm.) of the grizzled phase, collected in Gilolo by Wallace, and differing from foregoing only in its much smaller size (entirely due to immaturity) and rather darker colour, owing to a slight predominance of the darker over the paler hairs, especially on the underside of the body. The type of *Pt. mackloti* var. *batchiana*, Gray (1870), is an adult male of the mars-brown phase, collected in Batchian (type locality of *Pt. caniceps*) by Wallace, and externally not unlike the Timor specimen rightly referred by Gray to *Pt. mackloti*.—By Dobson (1878, l. s. c.) *Pt. caniceps*, though catalogued as a distinct species, was considered "probably a hybrid between *Pt. hypomelanus* and *Pt. mackloti*"; *Pt. affinis* he rightly put down as a synonym of *Pt. caniceps*, but the type of *Pt. mackloti* var. *batchiana* he referred to *Pt. mackloti* (specimen *a*).—Matschie considered *Pt. mackloti* var. *batchiana* a local form ("Abart") of "*Pteropus* (*Acerodon*) *mackloti*," with which he united, with a query, *Pt. caniceps*, "Dobson" (really



Gray), while the name *Pt. affinis*, Gray, appears to have escaped his attention. The skull figured by Matschie (*l. s. c.*) under the name *Pt. caniceps* is that of a young female of this species collected in Batchian by Prof. E. v. Martens (Berlin Museum, no. 3472).—The name *Pt. hypomelanus* in Jentink's 'Catalogue ostéologique' and 'Catalogue systématique' (*l. s. c.*) covers three species, *Pt. hypomelanus*, *caniceps*, and *pallidus*.

*Remarks.*—*Pt. caniceps* is readily distinguished from *Pt. hypomelanus* by its heavier rostrum, broader palate, larger orbits, heavier cheek-teeth, and much larger and more narrowly pointed ears. The colour of the fur, though very variable individually, never (so far as the available material goes) closely approaches that of any form of *Pt. hypomelanus*.—From the species of the *Acerodon mackloti* group, to which it bears much external resemblance, *Pt. caniceps* differs widely in the structure of the cheek-teeth (no trace of inner basal ledge).—Its differences from *Pt. dobsoni* have been summed up in the diagnosis above.

- |                          |              |                     |   |
|--------------------------|--------------|---------------------|---|
| a. ♂ juv. sk.; skull.    | Gilolo.      | Dr. A. R. Wallace   | 62.10.21.4.   |
|                          |              | [C.]                | (Type of <i>Pt. affinis</i> , Gray.)                        |
| b. ♀ yg. ad. sk.; skull. | Batchian.    | Dr. A. R. Wallace   | 60.1.10.1.  |
|                          |              | [C.]                | (Type of species.)  |
| c. ♂ ad. sk.; skull.     | Batchian.    | Dr. A. R. Wallace   | 60.1.10.2.  |
|                          |              | [C.]                | (Type of <i>Pt. mackloti</i> var. <i>batchiana</i> , Gray.) |
| d. ♀ ad. sk.; skull.     | Batchian     | (Dr. A. Tomes Coll. | 7.1.1.243.  |
|                          | R. Wallace). |                     |   |

## 27. *Pteropus argentatus*, Gray.

*Pteropus chrysoproctus* (pt.), Dobson, Cat. Chir. B. M. p. 48.

*Pteropus argentatus*, Gray, *List Mamm. B. M.* p. 194 (1843) (nomen nudum); *id.*, *Voy. 'Sulphur'* i. p. 30 (1844: ? Amboina); *Schinz, Syst. Verz. Säug.* ii. Nachtr. p. 15 (1845: Amboina); *Wayner, Schreiber's Säug., Suppl.* v. p. 596 (1853-55: ? Amboina); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 412 (1870: ? Amboina); *Gray, Cat. Monk. &c.* p. 106 (1870: ? Amboina).

*Pteropus chrysoproctus* (pt., nec Temm.), Dobson, Cat. Chir. B. M. p. 48, specimen *a* (1878: Moluccas); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 205 (1879); *Trouessart, Cat. Mamm.* i. p. 80 (1897); *Matschie, Megachir.* p. 14 (1899).

*Diagnosis.*—Similar to *Pt. caniceps*, but orbits smaller, cheek-teeth much smaller, fur longer. Upper side of body dark brown heavily sprinkled with longer yellowish hairs, under side russet mixed with longer buffy hairs; mantle and head buffy or ochraceous-buffy, foreneck tawny. Probably rather larger than *Pt. caniceps*. *Hab.* Uncertain (? Amboina).

*Skull and teeth.*—Type skull defective and not full-grown; orbits smaller, palate relatively narrower than in *Pt. caniceps*.—Cheek-teeth much smaller than in *Pt. caniceps*, but not differing

in structure, except perhaps in the slightly stronger posterior ledge of  $p_3$ . Cingulum of upper and lower canines well defined.  $m^2$  larger than  $m_3$ .  $i_2$  twice the size of  $i_1$ .  $p_1$  once and a half the size of  $i_2$ , subequal to  $m_3$ .

*Ears*.—Rather long (about 31 mm. from notch to tip), reaching hinder corner of eye; distinctly attenuated above, tips rather narrowly pointed.

*Wings*.—Membranes arising about 20 mm. apart from sides of back.

*Interfemoral*.—Depth in centre about 3 mm.

*Fur*.—Longer than in *Pt. caniceps*. Longest hairs, back about 16, mantle and belly 20 mm. Least width of furred area of back 40 mm. Distribution of fur as in *Pt. caniceps*.

*Colour* (type, al.).—Back and rump seal-brown thickly mixed with buffy straw-yellow hairs, producing the impression of a dark brown fur heavily sprinkled with longer yellowish hairs.—Breast, belly, and flanks rich russet sprinkled with buffy hairs; extreme base of fur seal-brown. Anal region seal-brown thickly mixed with buffy.—Mantle, occiput, and crown buffy, washed with ochraceous-buff in centre of mantle and on crown, and shading through ochraceous on sides of neck and head, to tawny on foreneck and

*External measurements of Pteropus dobsoni and caniceps.*

	<i>Pt. dobsoni</i> . ♂ yg. ad. Type.	<i>Pt. caniceps</i> . 3 ad.*	
		MIN.	MAX.
	mm.	mm.	mm.
Forearm .....	144.5	135	139.5
Pollex, total length, c. u. ....	63.5	57	60
" metacarpal .....	15	13	13.5
" 1st phalanx .....	34	29	30.5
2nd digit, metacarpal .....	73	71	74
" 1st phalanx .....	20	15	16
" 2nd-3rd phalanx, c. u. ....	15.5	15	16
3rd digit, metacarpal .....	99.5	92.5	96.5
" 1st phalanx .....	73	66	68
" 2nd phalanx .....	...	93.5	96.5
4th digit, metacarpal .....	97	92.5	94.5
" 1st phalanx .....	61	55	56.5
5th digit, metacarpal .....	101	95	99.5
" 1st phalanx .....	43	39.5	41.5
" 2nd phalanx .....	...	34.5	36
Interfemoral in centre, depth .....	(? 1 †)	(0 †)	
Lower leg .....	68.5	58	61.5
Foot, c. u. ....	? 49	45.5	50.5
Calcaneal .....	...	(12 †)	(15 †)

\* Type of species (young adult, but practically full-grown); type of *Pt. machloti* var. *batchiana* (adult); and no. 7.1.1.243 (aged).

† Estimate (skins).

*Measurements of skulls and teeth of Pteropus dobsoni, caniceps, and argentatus.*

	<i>Pt. dobsoni</i> , ♂ yg. ad. Type.	<i>Pt. caniceps</i> , Skulls: 2 ad.* Teeth: 2 ad., 2 imm.*	<i>Pt. argentatus</i> , ♂ imm. Type.
	mm.	Min.    Max. mm.    mm.	mm.
Skull, total length to gnathion .....	33.3	33    34.8	
„ palation to incisive foramina ...	22.8	22.5    22.8	
„ front of orbit to tip of nasals ...	23.7	24    24.2	
„ width of brain-case at zygomata ...	33.8	37    37.5	
„ zygomatic width .....	19.5	20.2    20.8	
„ width across $m^1$ , externally.....	16	14.2    14.5	
„ lachrymal width .....	13.2	13.7    14	
„ width across canines, externally...	8.5	7.3    7.8	
„ postorbital constriction .....	9.2	9.2    9.8	
„ interorbital constriction .....	8.7	8.2    8.7	
„ width of mesopterygoid fossa ...	11.2	12    12	
„ between $p^1$ - $p^1$ , internally.....	7	8    8	
„ between cingula of canines .....	13	14.2    14.7	
„ orbital diameter .....	52.8	53.8    55	
Mandible, length .....	23	25.5    26.2	
„ coronoid height .....	26.6	26.7    27	
Upper teeth, c- $m^2$ .....	29.7	29.2    30.5	
Lower teeth, c- $m_3$ .....	7	6.7    6.7	
Upper incisors, combined width .....	5.2	4.8    5	4.2
$p^3$ , length .....	3.8	3.5    3.8	3.2
„ width .....	5.4	5    5.2	4.2
$p^1$ , length .....	3.8	3.8    4	3.2
„ width .....	6.2	5.8    6	4.8
$m^1$ , length .....	3.7	3.6    4	3
„ width .....	3	2.5    2.9	2.4
$m^2$ , length.....	1.7†	2    2	2.2
„ width .....	2.7	1.9    2	2.1
$p_1$ , length .....	2.2	1.7    2.1	1.9
„ width .....	5.7	4.8    5	4.7
$p_3$ , length .....	3.2	2.7    3	3
„ width .....	5.5	4.8    5.2	4.7
$p_1$ , length .....	3.7	3.1    3.1	3
„ width .....	5.8	5.1    5.5	4.7
$m_1$ , length .....	3.8	3    3.2	3
„ width .....	4	4    4.5	3.8
$m_2$ , length.....	3	2.9    3	2.8
„ width .....	2	1.8    2.1	2
$m_3$ , length.....	2.2	1.7    1.7	2
„ width .....			

\* Skulls: type of *Pt. mackloti* var. *batchiana*, and no. 7.1.1.243 (skull measurements of type of species excluded, owing to slight immaturity of specimen). Teeth: the same specimens, and type of species, and type of *Pt. affinis*.

† Abnormal in shape.

throat. Base of fur of mantle, sides of neck, and head seal-brown; fur of foreneck scarcely darker at base.

*Measurements* of teeth on p. 199. Measurements of skull and external dimensions omitted, owing to immaturity of specimen; the actual length of the forearm of the type is 135.5 mm. (in the adult *Pt. caniceps* 135–139.5); as the fronto-parietal sutures of the type skull are unobliterated, the fully adult *Pt. argentatus* is probably slightly larger than *Pt. caniceps*.

*Specimen examined.* One, the type.

*Range.* Type presumed by Gray to have been obtained in Amboina (Voyage of the 'Sulphur'). In his Catalogue of 1870 (p. 106) Gray gives as habitat of the species "Amboyna? Island of Gobie; New Guinea." The British Museum does not possess any specimen of *Pteropus* from Gobie.

*Type* in collection.

*Remarks.*—A full description of this species cannot be given, the only specimen known being not full-grown and in a not quite satisfactory state of preservation. It is certain, however, that Dobson was mistaken in putting it down as a young *Pt. chrysoproctus*. Judging from the characters of the teeth, the shape and size of the ears, the quality and distribution of the fur, and the general style of the colour, *Pt. argentatus* appears to be related to *Pt. caniceps*.

a. ♂ imm. al.; skull.	" ? Amboina " (Voy. of the 'Sulphur').	Sir E. Belcher [P.]	42.11.22.26. (Type of species.)
--------------------------	---	------------------------	------------------------------------

#### D. THE *PTEROPUS RUFUS* GROUP.

*Species.*—Five species (six forms): *Pt. rufus* (*rufus* and *princeps*), *comorensis*, *seychellensis*, *aldabrensis*, and *niger*.

*Range.*—The Malagasy region. This is the only group of the genus distributed over the whole of the Malagasy region; three other groups are represented by single species of very restricted range, viz., the *melanopogon* in Johanna Island, Comoros (*Pt. livingstonei*), the *hypomelanus* in the Mascarenes (*Pt. subniger*), and the *lombocensis* group in Rodriguez (*Pt. rodricensis*).

*General characters* (compare fig. 12, p. 217, skull and dentition of *Pt. niger*).—Skull typical Pteropine. Dentition without special modifications; cingulum of canines rather broad; posterior ledges of premolars well developed but not particularly strong,  $i_2$  and  $p_1$  not enlarged,  $m_3$  and  $m^2$  not more reduced than usual. Ears long (much reduced in the single Mascarene species), attenuated at tip, subacutely pointed; interfemoral distinct in centre, neither very deep (as in *Pt. vampyrus*) nor quite obliterated. Colour in all except the Mascarene species characterized by the light mantle, crown, and underparts contrasting with dark back and muzzle. Males without glandular neck-tufts. Size generally rather large, sometimes below medium (forearm 124–171 mm.).

*Subdivisions of group.*—The five species fall into two, rather

sharply separated subsections, the one ranging over the whole of the Malagasy region exclusive of the Mascarenes, the other confined to Mauritius and Reunion:—

*Malagasy type*.—*Pt. rufus* (Madagascar), *comorensis*, *seychellensis*, *aldabrensis*. Chief characters (in contradistinction to Mascarene type): ears very similar in shape to those of *Pt. giganteus*, tibia naked or thinly haired above, general style of colour as in *Pt. giganteus*. It is noteworthy that the Malagasy species (*rufus*) is relatively sharply differentiated from the Comoro and Seychelles species (*comorensis*, *seychellensis*), and these again from the Aldabra species (*aldabrensis*), so that, in spite of the geography of the islands, the Comoro species is closer to the Seychelles than to the Malagasy species, and the Aldabra form the most peculiar of the four. The Malagasy species (*rufus*) is the largest and largest-eared form; colour pure *giganteus* style; differentiated into two races, a northern and central (*rufus*), and a south-eastern (*princeps*). The Comoro and Seychelles species differ from *Pt. rufus* in rather smaller size and markedly smaller ears; *Pt. seychellensis* is closely similar to *Pt. comorensis*, except in the much stronger admixture of greyish white in the colour of the back and rump. *Pt. aldabrensis* is chiefly characterized by its much smaller size and by having the colour of the back conspicuously lightened with broccoli-brown or wood-brown.

*Mascarene type*.—One species only, *Pt. niger* (Mauritius, Reunion). Principal characters (as compared with Malagasy type): ears extremely small, nearly concealed in the fur; tibia thickly clothed above; fur longer; underparts dark-coloured. *Pt. niger* is unique in the genus in its style of colour: light sides of back contrasting with dark mantle and spinal tract. Owing to its small ears, hairy legs, and rather rich fur, this species has hitherto always been widely, by some authors generically or subgenerically, separated from *Pt. rufus*, and associated with the other hairy-legged Pteropi (*dasymallus*, *formosus*, *anetianus*, *pselaphon*, *poliocephalus*, &c.); its skull and teeth are, however, in every respect, even to trivial details, similar to those of *Pt. rufus* and *comorensis*.

*Affinities of group*.—The *Pt. rufus* accords with the *Pt. hypomelanus* group in all essential characters of skull and dentition, and, so far as its typical members are concerned, also in the quality and distribution of the fur; it differs chiefly in the shape of the ears and rather more distinct development of the interfemoral. In the shape of the ears and general style of colour the Malagasy *Pt. rufus* bears much resemblance to the Indian *Pt. giganteus*; this (together with the neighbouring, though widely separated, habitats of these species) accounts for the fact that for many years they were kept together as one species under the name *Pt. edwardsi*. The *rufus* and *vampyrus* groups differ, however, so essentially in dentition that any close relationship between the groups would seem to be excluded.

28. *Pteropus rufus*, E. Geoff.*Pteropus edwardsi* (pt.), Dobson, Cat. Chir. B. M. p. 53.

(Synonyms under the subspecies.)

*Diagnosis*.—Rostrum of skull long. Posterior ledges of  $p^3$ ,  $p_3$ , and  $p_4$  distinctly marked off from teeth. Ears long, exposed, attenuated at tip, subacutely pointed. Tibia naked or very thinly haired above. Mantle, crown, and underparts buffy, orange buffy, or yellowish buffy, strongly contrasting with seal-brownish muzzle, back, and rump. Size above medium: forearm 158.5–170.5 mm. *Hab.* Madagascar.

*Skull*.—Typical Pteropine. Deflection of brain-case moderate, alveolar line if projected backward passing through base of par-occipital processes and upper margin of occipital condyle. Rostrum long, slightly compressed; anterior margin of orbit above front, or some point of front half, of  $m^1$ . Orbits rather large, diameter greater than width of rostrum across alveolar borders of  $p^1$ – $p^1$ ; postorbital processes long, strong, in aged individuals often separated by a minute space from corresponding processes on zygoma; base of postorbital processes raised considerably above level of frontal plateau, making this latter between orbits deeply concave. Zygomatic arches flaring posteriorly; sagittal crest strong or even very strong. Coronoid process rather high, but somewhat sloping; coronoid height of mandible distinctly less than length of lower tooth-row,  $c$ – $m_3$ .

*Teeth*.—No special modifications. Upper canines slightly recurved; cingulum broad, forming a sharply defined shelf at inner and posterior base of tooth.  $p^1$  a minute terete spicule, early deciduous. Posterior basal ledge of  $p^3$  short, postero-externally raised into a small tubercle separated by distinct notch from base of outer main cusp; ledge of  $p^4$  more or less obsolescent, though the postero-external notch is generally detectable; hinder border of  $p^4$  vertical on longitudinal axis of tooth.  $m^2$  subcircular or subsquarish, usually slightly larger than  $m_3$ .— $i_2$  twice or twice and a half the bulk of  $i_1$ . Canines recurved, cingulum well developed but narrower than in upper ones.  $p_1$  about twice the bulk of  $i_2$ . Posterior ledges of  $p_3$  and  $p_4$  long (longest in  $p_3$ ), marked off postero-externally by a rather deep notch from base of outer main-cusp, and usually developing a more or less distinct postero-external tubercle; in  $m_1$  and  $m_2$  the ledge is shorter, but postero-external notch almost always easily detectable.  $m_3$  slightly larger than  $p_1$ .

*Palate-ridges*.—5+6+3. First ridge terminating laterally at front of canine; second at back of canine; third at front of  $p^3$ ; fourth at back of  $p^3$ ; fifth at front of  $p^4$ ; sixth at front of  $m^1$ ; seventh at middle of  $m^1$ ; eighth at  $m^2$ ; ninth to eleventh behind  $m^2$ ; twelfth to fourteenth situated at palation border.

*Ears*.—Long, exposed, quite or almost reaching hinder corner of eye when laid forward. Inner margin flatly and almost evenly convex from base to tip; outer margin flatly convex in lower

two-thirds, deeply concave in upper third; tip strongly attenuated, subacutely pointed. Naked on both surfaces, except at base posteriorly and anteriorly and along basal half of outer and inner margins.

*Wings*.—About 30 mm. apart at origin from sides of back.

*Interfemoral*.—Well developed in centre (depth about 15 mm.), but generally completely covered by overhanging hairs of rump.

*Fur*.—Somewhat adpressed on back and rump, semierect on nape of neck. Length moderate, 19–22 mm. on back, mantle, and belly. Width of furred area of back about 58 mm.

Above, humerus and proximal third or half of forearm (except region round elbow, which is naked) covered with closely adpressed hairs. Fur of back extending on lateral membrane for about 14 mm. beyond line of origin of membrane. Femur long-haired. Short, thinly spread hairs along outer side of tibia almost to ankle; median upper surface of tibia naked on distal half, very thinly haired or almost naked on proximal half. Interfemoral long-haired in centre and laterally along proximal half of tibia; inner margin and region above calcar naked.

Below, antibrachial membrane, lateral membrane along outer side of forearm almost to carpus and between humerus and femur covered with rather long, woolly hair. Tibia and interfemoral (its central portion excepted) naked.

*Colour*.—♂ ad. al., N. Madagascar, teeth almost unworn; 91.11.20.1:—Back and rump a shade of dark brown approaching seal-brown, though with a touch of vandyck-brown, chiefly owing to the very short paler brown (almost russet) tips to the hairs, these paler hair-tips rather more conspicuous on rump and inner side of tibia than on back.—Breast and belly yellowish-buff; individual hairs with long seal-brown bases and shorter yellowish-buff tips; dark base of fur quite or almost completely concealed on breast and belly, more or less showing through in anal region, giving this latter a conspicuous brownish tinge; flanks dark brown varied with yellowish-buff tips to the hairs.—Mantle buff-yellow, shading into deep orange-buff on sides of neck and foreneck; short concealed base of hair everywhere seal-brown.—Buff-yellow colour of mantle shading gradually into yellowish buff on occiput, crown, interocular space, and temporal region; base of fur seal-brown. Muzzle, as far back as region immediately above and behind eyes, lower jaw, chin, and throat seal-brown, strongly contrasting with yellowish-buff crown.

Individual variation in colour.—Not great, chiefly dependent on the greater or less intensity of the colours. Back and rump sometimes almost pure seal-brown (short brownish hair-tips completely absent), sometimes distinctly “powdered” with a paler brown (brownish hair-tips more conspicuous); an extremely thin sprinkling with silvery whitish hairs occasionally detectable on close inspection.—Bright colour of breast, belly, and crown varying from pale glossy yellowish buff (almost buff) to a deep ochraceous-buff, approaching ochraceous.—Mantle varying from buff-yellow through ochraceous-buff to tawny.

The two subspecies described below do not differ appreciably in colour.

*Range.* Madagascar.

*Habits.*—Bats of this species are particularly common in the coast regions of Madagascar. They usually pass the day in the thickets of isolated islets near the coasts, suspended from the upper branches of tall trees; observers agree that even in broad daylight a colony of *Pt. rufus* is difficult to approach, they generally become restless, many taking to flight with shrill cries, others climbing about from branch to branch, using the long claw on their wings as well as their hind feet. Early in the evening they may be seen passing at considerable heights, flock upon flock with short intervals, on their way from the sleeping-places to the feeding-grounds. Their flight is straight, steady, somewhat crow-like, though rather heavier and with more frequent flappings of the wings. Skimming over water they often dip down to touch the surface. They feed chiefly on wild dates, on which they grow immensely fat. Large numbers are killed by the natives for food.

*Subspecies.*—Two, differing in size only; the one (*rufus*) distributed over North and Central Madagascar, the other (*princeps*) known from the extreme south of the island.

#### *Key to the Subspecies of Pteropus rufus.*

- a. Averaging smaller: skull, total length 69–74, forearm 158.5–165.5 mm. (N. and C. Madagascar) . . . . . *Pt. r. rufus*, p. 204.
- b. Averaging larger: skull about 77, forearm 170.5 mm. (S. Madagascar) . . . . . *Pt. r. princeps*, p. 208.

#### 28 a. *Pteropus rufus rufus*, E. Geoff.

- Fany, *Flacourt, Hist. de Madagascar*, p. 166 c. fig. (animal) (1658).  
 Great Bat from Madagascar, *Edwards, Nat. Hist. Birds*, pt. iv. p. 180, pl. 180 (head, life size; animal, much reduced) (1751).  
*Vespertilio facie canina*, *Klein, Quadr. Dispositio*, p. 62 (1751).  
*Vespertilio vampyrus* (pt.), *Linn. Syst. Nat.* 10 ed. i. p. 31 (1758); *id.*, *op. cit.* 12 ed. i. p. 46 (1766); *Boddart, Elench. Anim.* i. p. 68 (1785).  
*Pteropus vampyrus*, *Illiger, Abh. Akad. Berlin*, 1804–11, pp. 78, 84 (1815: E. African Islands).  
 Ternate Bat (pt.), *Pennant, Syn. Quadr.* p. 359 (1781).  
*Vespertilio caninus* (pt.), *Blumenbach, Handb. Naturg.* 5 ed. p. 73 (1797).  
*Pteropus rufus*, *E. Geoffroy, Cat. Mamm. Mus. Nation. d'Hist. Nat.* p. 47 (1803: Madagascar).  
*Pteropus edwardsi*, *E. Geoffroy, Ann. Mus. d'Hist. Nat.* xv. p. 92 (1810: Madagascar); *Cuvier, Règne Anim.* i. p. 123 (1817: Madagascar); *Desmarest, Mamm.* i. p. 109, no. 138 (1820: Madagascar); *Schinz, Thierr.* i. p. 154 (1821: Madagascar); *Lesson, Man. Mamm.* p. 109, no. 278 (1827: Madagascar); *Desmarest, Dict. Sci. Nat.* xlv. p. 359 (1827: Madagascar); *Gray, in Griffith's Anim. Kingd.* v. p. 55, no. 154 (1827: Madagascar); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 699 (pt.)



- (1828: Madagascar); *Temminck, Mon. Mamm.* ii. p. 61 (pt.) (1837: Madagascar); *Wagner, Schreber's Säug., Suppl.* i. p. 345 (pt.) (1839: Madagascar); *Lesson, N. Tabl. R. Anim., Mamm.* p. 12, no. 169 (pt.) (1842: Madagascar); *Schinz, Syst. Verz. Säug.* i. p. 121 (pt.) (1844: Madagascar); *E. Desmarest, Dict. Univ. d'Hist. Nat.* xi. p. 247 \* (pt.) (1848: Madagascar); *Gruy, Zool. 'Samarang,' Vert.* p. 11 (pt.) (1849: Madagascar); *Wagner, Schreber's Säug., Suppl.* v. p. 595 (pt.) (1853-55: Madagascar); *Giebel, Säug.* p. 995 (pt.) (1855: Madagascar); *A. Newton, P. Z. S.* 1865, p. 833 (Mohambo); *Ferrcaux, Vinson's Voy. à Madagascar, Annexe A,* p. 1 \* (1865); *Schlegel, P. Z. S.* 1866, p. 419 (pt.) (Madagascar); *Peters, M.B. Akad. Berlin,* 1867, p. 325 (pt.) (Madagascar); *Pollen, in Pollen & v. Dam, Rech. Faune Madagascar,* ii. pp. 25, 164, 167, 172 (pt.) (1868: Madagascar; habits); *Fitzinger, SB. Akad. Wien,* lx. Abth. i. p. 416 (pt.) (1870: Madagascar); *Grainge, Antananarivo Ann.* i. pt. 1, p. 25 (1875: Majunga, N.W. Madagascar; habits); *Dobson, Cat. Chir. B.M.* pp. 53, 55 (pt.) (1878: Vohemar, N.E. Madagascar); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 202 (pt.) (1879: Madagascar); *Dobson, Rep. Brit. Assoc.* 1878, pp. 162, 165 (1879: remarks on distr.); *Trouessart, Ann. Sci. Nat.* (6) *Zool.* viii. Art. 12, p. 15 (1879: remarks on distr.); *Gill, Stand. Nat. Hist.* v. fig. opposite p. 162 (1884); *Oliver, Madagascar,* i. p. 520 (1866); *Jentink, Cat. Ost. Mamm.* p. 259 (pt.) (1887: Madagascar); *id., Cat. Syst. Mamm.* p. 146 (pt.) (1888: Madagascar); *Trouessart, Cat. Mamm.* i. p. 81 (pt.) (1897: Madagascar); *Sibree, Antananarivo Ann.* vi. pt. 21. pp. 33, 47 (1897: Madagascar; habits); *Lorenz-Liburnau, Abh. Senck.nat. Ges.* xxi. pt. 3, p. 455, pl. xxxii. figs. 1 a, 1 b, 2 (skull) (1898: Amburvi, N. of Majunga); *Keller, Ostaf. Inseln,* pp. 32, 121 (1898: Madagascar; Nossi Bé); *Matschie, Megachir.* p. 15 (pt.) (1899: Madagascar); *Grandidier, in Blanchard, Madagascar,* p. 172, fig. 84 (animal) (1902); *Trouessart, Cat. Mamm., Suppl.* p. 50 (pt.) (1904: Madagascar); *Miller, Fam. & Gen. Bats,* p. 58 (1907); *Grandidier, Noms Malgaches d'animaux,* p. 9, c. fig. p. 15 (animal) (1908).
- Pteropus madagascariensis*, *Oken, Lehrb. Naturg.* iii. Abth. ii. p. 936 (1816: Madagascar).
- Pteropus phaiops*, *Temminck, Mon. Mamm.* i. p. 178 (1825: Madagascar); *Lesson, Mun. Mamm.* p. 110, no. 285 (1827: Madagascar); *Desmarest, Dict. Sci. Nat.* xlv. p. 360 (1827: Madagascar); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 700 (1828: Madagascar); *Anonymous* [? *Vigors & Gould*], *Cat. Mamm. Mus. Zool. Soc.* p. 10, no. 162 (1828: Madagascar); *id., Cat. Anim. Mus. Zool. Soc.* p. 11, no. 162 (1829: Madagascar); *J. B. Fischer, Syn. Mamm.* p. 82, no. 4 (1829: Madagascar); *Lesson, Hist. Nat. Mamm. (Compl. Buffon)* v. p. 52 (1836: Madagascar); *Temminck, Mon. Mamm.* ii. p. 66 (pt.) (1837: "Macassar," really Madagascar); *Waterhouse, Cat. Mamm. Mus. Zool. Soc.* p. 13, no. 100 (1838: Madagascar); *Gray, Mag. Zool. & Bot.* ii. p. 502 (1838: Madagascar); *S. Müller, in Temminck, Nat. Gesch. Nederl. Overz. Bez., Zoogd.* pp. 20, 59 (pt.) (1839-44: "Celebes," really Madagascar); *Lesson, N. Tabl. R. Anim., Mamm.* p. 13, no. 171 (pt.) (1842: "Macassar," really Madagascar); *E. Desmarest, Dict. Univ. d'Hist. Nat.* xi.

\* Misspelt *Pteropus edwardsii*.

- p. 247 \* (1848: "Macassar," really Madagascar); *Gervais, Hist. Nat. Mamm.* i. p. 187 (1854: "Macassar," really Madagascar).  
*Pteropus phaeops*, *Oken, Allg. Naturg.* vii. Abth. ii. p. 990 (1838);  
*Peters, MB. Akad. Berlin*, 1867, p. 325 ("Macassar," really Madagascar); *Matschie, Megachir.* pl. i. figs. 4, 4a, 4b (skull) (1899).  
*La Grande Rousseite* (Famii), *Sganzin, Mém. Soc. Mus. d'Hist. Nat. Strassbourg*, iii. pt. i. Mém. MM. p. 11 (1840: habits).  
*Grosse chauve-souris noire et jaune*, *Laillet, Madagascar*, p. 29 (1884).

*Diagnosis*.—Skull and external dimensions smaller (see measurements on pp. 210, 211). Forearm 158.5–165.5 mm. *Hab.* N. and Central Madagascar.

*Specimens examined*.—Eight, in the collections of the Leyden and British Museums, including the cotypes of *Pt. phaeops*, Temm.

*Range*.—North and Central Madagascar: Majunga, Amburvi, Nossi Bé, Vohemar, Fianarantsoa.

*Type* probably not in existence.

*Earliest history in literature*.—The records of this species in literature date back at least to the first French attempts at a colonisation of Madagascar, about the middle of the seventeenth century; thus it was briefly described and figured by Flacourt (1658, *op. s. c.*, chapter "Oyseaux de nuit") under its native name "Fany" (by later writers usually spelt Fani, Fanny, Famii, or Fanihy); Flacourt's illustration is probably the most imaginative figure ever given of a bat. A tolerably good coloured figure of the head of this species was published, nearly a century later, by George Edwards in his 'Natural History of Birds' (1751, *l. s. c.*). It is one of the three species covered by the Linnean name *Vespertilio vampyrus* (1758 and 1766, see *infra*, pp. 219, 351).

*Pteropus rufus*, E. Geoff.; 1803.—Type locality, Madagascar. Based on an "individu envoyé par le citoyen Macé, naturaliste" (no. 90 of Geoffroy's Catalogue). I have been unable to find this specimen in the Paris Museum, but Geoffroy's brief description of its colour leaves no doubt whatever as to the identification of the species. Only reference given by Geoffroy: Edwards, Great Bat from Madagascar.

*Pteropus edwardsi*, E. Geoff.; 1810.—Type locality, Madagascar. In reality a renaming and redescription of the same author's *Pt. rufus*, based on an example "dont nous sommes redevables à l'estimable naturaliste M. Macé," therefore most probably a redescription of the very type of *Pt. rufus* (see above). Only references: Edwards and Linnæus (*V. vampyrus*).—Temminck, in 1825 (*Mon. Mamm. i.*), put *Pt. edwardsi* down as a synonym of *Pt. edulis* (i. e. *Pt. vampyrus*), while at the same time he described the true *Pt. edwardsi* under the name *Pt. phaeops*, and *Pt. giganteus* (Continental India) as *Pt. medius*; in 1837 (*Mon. Mamm. ii.*) he recognized the validity of the Geoffroyan *Pt. edwardsi*, put his own *Pt. medius* down as a synonym of this species, which therefore he

\* Misspelt *Pteropus phaeops*.

considered "répandue dans toute l'Inde, à Ceylon et à Madagascar." and deliberately changed the type locality of *Pt. phaiops* from "Madagascar" into "Macassar," erroneously believing the former word to be a slip of the pen for the latter. It is of some importance to bear this confusion of names and species in remembrance, because Temminck's view as to the specific identity of *Pt. edwardsi* and the rather similarly coloured *Pt. medius* was accepted by a long series of later writers (see synonymy of *Pt. giganteus*), so that, when no locality is given (*e. g.* in anatomical papers), it is often difficult or impossible to see if the name "*Pt. edwardsi*" refers to the Malagasy (*Pt. rufus*) or the Indian species (*Pt. giganteus*).

*Pteropus madagascariensis*, Oken; 1816.—Type locality, Madagascar. A renaming of E. Geoffroy's *Pt. edwardsi*. References: *Pt. edwardsi* and *Vespertilio vampyrus*. Description an almost verbal German translation of Geoffroy's description (size, colour) of *Pt. edwardsi*.

*Pteropus phaiops*, Temm.; 1825.—Temminck's *Pt. phaiops*, 1825, is E. Geoffroy's *Pt. rufus*; Temminck's *Pt. phaiops*, 1837, is a mixture of *Pt. rufus* and *Pt. melanopogon*. The explanation of the mistake is this: In 1825 Temminck described two specimens of a *Pteropus* from Madagascar as *Pt. phaiops*; both of these specimens are still in the collection of the Leyden Museum ( $\sigma$  ad.,  $\text{♀}$  ad., mounted; Jentink, Cat. Syst. p. 146, sub *Pt. edwardsi*, specimens *c*, *d*; skull of *c* in situ, skull of *d* separate: Cat. Ost. p. 259, *c*); they are in every respect indistinguishable from British Museum specimens of *Pt. rufus rufus*; but when later on receiving six specimens of a *Pteropus* from Amboina, obtained by Müller and Macklot, Temminck believed in these to recognize his *Pt. phaiops*, and considering that the same species could hardly be common to Madagascar and Amboina, he now (Mon. Mamm. ii. p. 66, 1837) regarded "Madagascar" as an "erreur ou faute d'impression" for "Macassar" (Celebes). The truth is that the cotypes of *Pt. phaiops* were correctly ticketed Madagascar, while Müller and Macklot's Amboina specimens were the very different *Pt. melanopogon*; that Temminck failed to distinguish the latter from the former is easily explained by the fact that *Pt. melanopogon* in the colour of the fur bears no small resemblance to *Pt. rufus*.—All later records in literature of *Pt. phaiops*, resp. *phaops*, from Macassar or Celebes in general (see references above) are based solely on Temminck's deliberate changing of the true type locality of *Pt. phaiops*, viz. Madagascar, into Macassar.

<i>a</i> , <i>b</i> . 2 ad. sks.; skulls.	Madagascar.	Purchased (Blyth, Greene & Jourdain).	76.1.31.28, 29.
<i>c</i> . $\sigma$ ad. al.	N. Madagascar.	Rev. R. Baron [C. & P.].	91.11.20.1.
<i>d</i> . Ad. skeleton.	N. Madagascar.	A. Crossley [C.].	70.5.5.11.
<i>e</i> . Ad. sk.; skull.	Vohemar, N.E. Madagascar.	A. Crossley [C.].	70.5.5.45.
<i>f</i> . $\text{♀}$ imm. head; skull.	Fianarantsona, Central Mada- gascar (Dr. C. L. Forsyth Major).	Royal Society [P.].	97.9.1.29.

28 b. *Pteropus rufus princeps*, K. And.

? *Pteropus edwardsi* (nec E. Geoff. subsp.), Bartlett, P. Z. S. 1875, p. 63 (S.E. coast of Madagascar).

*Pteropus rufus princeps*, K. Andersen, Ann. & Mag. N. H. (8) ii. p. 367 (1 Oct. 1908: Ft. Dauphin).

*Diagnosis*.—Skull and external dimensions larger (see measurements, pp. 210, 211). Forearm about 170.5 mm. *Hab.* S. Madagascar.

*Specimen examined*. One, the type.

*Range*. South Madagascar: Ft. Dauphin.

*Type* in collection.

a. ♂ ad. al.; skull. Ft. Dauphin, S.E. M. Cloisel [C.]. 91.11.30.10.  
Madagascar. (Type of subspecies.)

29. *Pteropus comorensis*, Nicoll.

*Pteropus edwardsi* (pt.), Dobson, Cat. Chir. B.M. p. 53.

*Pteropus edwardsi* (nec E. Geoff.), Peters, Reise Mossambique, Zool. i. Säug. p. 23 (1852: Johanna I.; notes on anatomy; habits); Wagner, Schreiber's Säug., Suppl. v. p. 595 (pt.) (1853-55: Comoros); P. L. Schater, P. Z. S. 1861, p. 268 (Johanna); Schlegel, P. Z. S. 1866, p. 419 (Mayotte); Peters, MB. Akad. Berlin, 1867, p. 325 (pt.) (Comoros); Pollen, in Pollen & v. Dam, Rech. Faune Madagascar, ii. pp. 25, 164 (1868: Mayotte; habits); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 416 (pt.) (1870: Comoros); Gray, Cat. Monk. &c. p. 103 (1870: Shoa, errore; Mohilla; Johanna); Dobson, Cat. Chir. B. M. pp. 53, 55 (1878: Mohilla; Johanna); Trouessart, Rev. & Mag. Zool. (3) vi. p. 202 (pt.) (1879: Mohilla; Johanna); Dobson, Rep. Brit. Assoc. 1878, p. 162 (pt.) (1879: remarks on distr.); Jentink, Cat. Ost. Mamm. p. 260 (1887: Mayotte); id., Cat. Syst. Mamm. pp. 246, 247 (1888: Mayotte); Milne-Edwards & Oustalet, N. Arch. Mus. d'Hist. Nat. Paris, (2) x. p. 223 (1888: Mayotte; Mohilla; Johanna); Brehm, Tierleben, 3 ed. i. p. 344 (1890: Mayotte; habits); Trouessart, Cat. Mamm. i. p. 81 (pt.) (1897: Mohilla; Johanna); Matschie, Megachir. p. 15 (pt.) (1899: Angazija; Johanna); Trouessart, Cat. Mamm., Suppl. p. 50 (pt.) (1904: Comoros).

*Pteropus rubricollis* (nec E. Geoff.), Layard, Cat. S. Afr. Mus. p. 19 (1861: Johanna).

*Pteropus comorensis*, Wallace, Island Life, p. 400 (1880: Comoros) (nomen nudum); id., op. cit. 2 ed. p. 428 (1892: Comoros) (nom. nud.); Keller, Ostaf. Inseln, p. 125 (1898: Comoros) (nom. nud.); Nicoll, Three Voy. of a Naturalist, pp. 87, 88, 90 (1908: Mayotte; habits).

*Diagnosis*.—Similar to *Pt. rufus*, but smaller, and with relatively much smaller ears and shorter hind legs. Forearm 151-157 mm. *Hab.* Comoro Is.

*Skull and teeth*.—Differing only in smaller size from those of *Pt. rufus rufus*. Ten skulls: total length 65.5-68 mm. (69-73.8 in five skulls of *rufus*); mandible 50.8-53.8 (54.5-58.2); diameter of

orbit 12·8–13·2 (13·8–14·6). Maxillary tooth-row, c-m<sup>2</sup>, in ten specimens 24–25·5 mm. (26–27·8 in five *rufus*); m<sup>1</sup> in 18 specimens, length 5–5·5 (5·7–5·8 in six *rufus*), breadth 3–3·1 (3·1–3·6); m<sub>1</sub>, length 4·5–4·9 (5·1–5·4), breadth 2·8–3·1 (3·1–3·2). For further details see measurements on p. 211.

*Ears*.—Much smaller than in *Pt. rufus*, but not differing in shape; length from lower margin of orifice about 31·5 mm. (37–38 in *rufus*).

*Fur*.—Distribution, quality, and length of fur as in *Pt. rufus*.

*Colour*.—Three ♂ ad. skins, teeth almost unworn, Mayotte, cotypes of species, 6.6.3.14–16:—Back and rump blackish or blackish seal-brown, very thinly sprinkled with silvery greyish-white hairs. Head, mantle, and underparts as in *Pt. rufus* (p. 203).

Specimens from Johanna, Mohilla, and Angazija do not differ appreciably in colour. The blackish or blackish seal-brown colour of the back fades almost invariably in the course of a few years to vandyck-brown, even in specimens not exposed to light.

*External dimensions*.—Smaller, at least on average, than *Pt. rufus rufus*, with proportionally much shorter tibiae. Forearm of twelve adults 151–157 mm. (158·5–165·5 in six adult *rufus*); third metacarpal 99–105·5 (109–113); lower leg 68–72 (80–82); foot with claws 47–50 (53–57). For details see measurements on p. 210.

*Specimens examined*. Nineteen, in the collection of the British Museum, including the cotypes of the species, and representing all the islands from which the species has been recorded.

*Range*. Comoro Islands: Mayotte, Johanna (Anjuan), Mohilla, Angazija (Great Comoro).

*Cotypes* in collection.

*Pteropus comorensis*, Nicoll; 1908.—The name *Pt. comorensis* seems to have been introduced into literature by Wallace in his 'Island Life' (1880, *l. s. c.*); at least I have been unable to trace the name further back; neither in the first nor in the second edition of that book (1892) does Wallace give any description; he appears to be unaware that he was using a new name for the Comoro bat. Keller (1898, *l. s. c.*) probably copied the name from Wallace. Nicoll admittedly (in litt. to the present writer) found the name in Wallace's book and, inadvertently, made it technically valid by the following descriptive note: "its fur was of a reddish colour, thick and soft" (1908, *l. s. c.* p. 88).

a. ♂ ad. sk ; skull.	Mayotte, Comoros, sea-level; 25 Feb. 1906 ( <i>M. J. Nicoll</i> ).	Earl of Crawford [P.].	6.6.3.16.
b, c. 2 ♂ ad. sks.; skulls.	Mayotte, 600'; 2 Mar. 1906 ( <i>M. J. Nicoll</i> ).	Earl of Crawford [P.].	6.6.3.14, 15.
(a–c, cotypes of species.)			
d. ♂ ad. al.	Mayotte ( <i>M. J. Nicoll</i> ).	Earl of Crawford [P.].	6.6.3.17.
e. Imm. sk ; skull.	Johanna I., Comoros.	John Barrow, Esq. [P.].	53.5.27.1.

<i>f.</i> Yg. ad. sk.; skull,	Johanna I. ( <i>Dr. Livingstone</i> ).	Earl Russell [P.].	63.12.11.1.
<i>g-m.</i> 4 ♂ ad., 1 ♂ imm., 1 ad., 1 imm. sks.; skulls.	Johanna I.	Bewsher [C.].	77.4.2.1-7.
<i>n.</i> Imm. sk.; skull.	Mohilla, Comoros; Aug. 1862.	Sir J. Kirk [C.].	65.10.25.1.
<i>o.</i> Imm. skull.	Mohilla.	Sir J. Kirk [C.].	65.10.25.1 bis.
<i>p.</i> Imm. sk.; skull, skeleton.	Angazija, Comoros.	Sir J. Kirk [C.].	79.11.12.3.
<i>q-s.</i> Imm., ♂ yg. ad, ♀ ad. sks.; skulls.	Angazija.	Sir J. Kirk [C.].	79.11.12.4-6.

*External measurements of Pteropus rufus and comorensis.*

	<i>Pt. rufus</i>			<i>Pt. comorensis.</i>	
	<i>rufus.</i> 6 ad. (Incl. cotypes of <i>Pt. phaiops</i> .)		<i>princeps.</i> ♂ ad. Type.	12 ad. (Incl. cotypes.)	
	Min.	Max.		Min.	Max.
Forearm .....	mm.	mm.	mm.	mm.	mm.
Pollex, total length, c. u. ....	158.5	165.5	170.5	151	157
" metacarpal .....	68	72.5	76	61.5	66.5
" 1st phalanx .....	15.5	17	18	14	16
2nd digit, metacarpal .....	35.5	37	39	31	36
" 1st phalanx .....	80	85	85.5	72	78
" 2nd-3rd phalanx, c. u. ....	19.5	21.5	23.5	18	21
3rd digit, metacarpal .....	18	21	20	16.5	18.5
" 1st phalanx .....	109	113	119.5	99	105.5
" 2nd phalanx .....	82	86	89.5	76	81
4th digit, metacarpal .....	111	118.5	125	104	116
" 1st phalanx .....	108	110	116	98	103.5
" 2nd phalanx .....	64	70	74	61	65.5
5th digit, metacarpal .....	63.5	71	73	60	64
" 1st phalanx .....	110	116	120	101	107
" 2nd phalanx .....	48	53	54.5	45	48
" 2nd phalanx .....	51.5	56.5	59	47	54
Ear, length from orifice .....		37 *	38		31.5 *
" greatest width, flattened ...		20 *	20		17 *
Front of eye to tip of muzzle ...		29 *	30.5		25 *
Interfemoral in centre, depth ...		15.5 *	...		10 *
Lower leg .....	80	82	82	68	72
Foot, c. u. ....	53	57	57	47	50
Calc. ....	(19 †)	22.5	22.5	19	(20 †)

\* From one alcoholic specimen.

† From dried skin.

Measurements of skulls and teeth of *Pteropus rufus* and *comorensis*.

	<i>Pt. rufus</i>			<i>Pt. comorensis</i> .	
	<i>rufus</i> . Skulls: 5 ad. Teeth: 5 ad., 1 imm. (Incl. cotype of <i>Pt. phaeops</i> .)		<i>princeps</i> . ♂ ad. Type.	Skull: 10 ad. Teeth: 11 ad., 7 imm. (Incl. cotypes.)	
	Min.	Max.		Min.	Max.
	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	69	73.8	77	65.5	68
„ palation to incisive foramina ...	34	36.2	37	31.2	33.2
„ front of orbit to tip of nasals ...	23	24.8	25	20.7	23.5
„ width of brain-case at zygomata.	24.2	26	26.8	23	24.8
„ zygomatic width .....	37.7	40	42	35	39
„ width across $m^1$ , externally ...	18.8	20.2	20.5	17.8	18.7
„ lachrymal width .....	14.8	15.2	16.5	13.5	14.6
„ width across canines, externally.	13	14.5	15.2	12	13.2
„ postorbital constriction .....	7.2	8.7	8.3	6.8	8.8
„ interorbital constriction .....	9.2	9.9	9.7	8.8	9.8
„ width of mesopterygoid fossa ...	8.4	9	8.7	7.2	8
„ between $p^1$ - $p^1$ , internally .....	11	12.5	13	10	11
„ between cingula of canines .....	6.7	8.2	...	5.8	6.7
„ orbital diameter .....	13.8	14.6	14.2	12.8	13.2
Mandible, length .....	54.5	58.2	62	50.8	53.8
„ coronoid height .....	23.7	29	29.8	24.2	26.5
Upper teeth, $c-m^2$ .....	26	27.8	28.7	24	25.5
Lower teeth, $c-m_3$ .....	29.2	30.8	32.5	26.2	28.2
Upper incisors, combined width .....	6.6	7	6.8	5.7	6.6
$p^3$ , length .....	4.7	5	4.8	4.1	4.7
„ width .....	3.4	3.7	3.7	3	3.2
$p^4$ , length .....	4.8	4.9	4.8	4.2	4.8
„ width .....	3.6	3.9	3.9	3.2	3.7
$m^1$ , length .....	5.7	5.8	5.8	5	5.5
„ width .....	3.1	3.6	3.6	3	3.1
$m^2$ , length .....	2.6	3.2	3	2.2	3.6
„ width .....	2.5	2.8	2.7	2.1	2.6
$p_1$ , length .....	2	2.2	2.5	1.8	2.3
„ width .....	1.9	2.1	2.2	1.8	2.1
$p_3$ , length .....	4.7	5.2	5.2	4.1	4.8
„ width .....	3.1	3.2	3.2	2.8	3
$p_4$ , length .....	5	5.2	5	4.3	4.9
„ width .....	3.2	3.6	3.5	2.8	3.1
$m_1$ , length .....	5.1	5.4	5	4.5	4.9
„ width .....	3.1	3.2	3.3	2.8	3.1
$m_2$ , length .....	4.1	4.7	4.2	3.5	4
„ width .....	2.9	3.1	3.1	2.7	2.8
$m_3$ , length .....	2.3	2.5	2.7	2.1	2.8
„ width .....	2	2.2	2.2	2	2.1

30. *Pteropus seychellensis*, Milne-Edw.

*Pteropus edwardsi* (pt.), Dobson, Cat. Chir. B.M. p. 53.

*Pteropus edwardsi* (nec E. Geoff.), Wright, Ann. & Mag. N.H. (4) ii. p. 436 (1868: Seychelles; habits); Wallace, Geogr. Distr. Anim. i. p. 281 (1876: Seychelles); Dobson, op. s. c. p. 53 (pt.) (1878: Seychelles); Trouessart, Rev. & Mag. Zool. (3) vi. p. 202 (pt.) (1879: Seychelles).

*Pteropus seychellensis*, A. Milne-Edwards, Bull. Soc. Philom. (7) ii. p. 221 (1887: Seychelles); Trouessart, Cat. Mamm. i. p. 81 (1897: Seychelles); Miller, Fam. & Gen. Bats, p. 58 (1907).

*Pteropus edwardsi a. seychellensis*, Matschie, Megachir. p. 16 (1899: Seychelles); Trouessart, Cat. Mamm., Suppl. p. 50 (1904: Seychelles).

*Diagnosis*.—Similar to *Pt. comorensis*, but dark colour of back and rump conspicuously sprinkled with silvery greyish-white. *Hab.* Seychelles.

Skull and external characters, except colour of fur, as in *Pt. comorensis*; teeth on the whole slightly smaller.

*Colour* (four specimens, slightly immature; cotypes).—Back and rump blackish seal-brown conspicuously sprinkled with glossy silvery greyish-white hairs, particularly on sides of back along membranes and on rump; owing to the mixture of seal-brown and greyish-white the general impression of the colour of the rump and hinder back approaches hair-brown or even very light mouse-grey; the degree of sprinkling with light-coloured hairs, though always conspicuous, is not equally strong in all specimens.—Breast and belly with long seal-brown bases to the hairs and short ochraceous or ochraceous-buff tips; these latter being too short to completely cover the dark bases, the general aspect of the colour is a dark brownish, lightened or thickly blotched with ochraceous or ochraceous-buff; some long shiny silvery greyish-white hairs on breast and belly. Flanks and anal region more uniform blackish seal-brown, some of the hairs with short ochraceous tips; a slight sprinkling with greyish-white hairs.—Mantle, occiput, crown, and sides of head and neck golden ochraceous-buff, in many places deepening to rich golden ochraceous, all the hairs with concealed blackish seal-brown bases; foreneck similar, or clouded with pale russet. Muzzle, chin, and throat blackish, as in *Pt. rufus* and *comorensis*.

As will be noticed from the above description, the only essential difference in colour from *Pt. rufus* and *comorensis* is the pronounced admixture of greyish-white on back and rump, and the darker colour of breast and belly, this latter owing to the bright tips of the hairs being shorter, and the dark ground-colour of the fur therefore more exposed.

*Measurements*. On pp. 221, 222.

*Specimens examined*. Eight, in the collections of the Paris (five), Berlin (one), and British Museums (two), including the cotypes of the species.



*Range.* Seychelles.

*Cotypes* in the Paris Museum.

*Habits.*—*Pt. seychellensis* is very common on all the islands of the Seychelle group. Though often on the wing in strong sunlight, between 8 and 10 in the morning, it is chiefly nocturnal in its habits. About an hour before sunset these fruit-bats may be seen flying at great heights from their resting-place in the woods, making as if they were going to cross the island and then, when just over the group of trees to be visited, falling down as it were among them. The first comers take up good places, with plenty of fruit near them, alighting without noise; by-and-by the arrivals are more numerous, and then the noise begins, every late comer trying to dislodge an earlier comer, and this not without much growling and grumbling and chattering. A little after sunset the noise is generally at its highest, and more than a hundred bats may now be found feeding in one small group of trees. Their favourite food seems to be the "fruit de Cythère" (*Spondias cytherea*) or the Mango (*Mangifera indica*), but almost any fruit is welcome to them. The flesh of these Bats is much appreciated by the Creole inhabitants of the Seychelles. (Ed. Perceval Wright, *l. s. c.*)

*Pteropus seychellensis*, A. Milne-Edw.: 1878.—Type locality, Mahé, Seychelle Islands (*Lantz coll.*). The Paris Museum possesses a series of specimens obtained by Lantz in Mahé, at least four of which must be regarded as cotypes of the species, viz. three mounted specimens (group on one block), all slightly immature, and one ♀ imm., unmounted skin; skulls of all *in situ*; Reg. nos. 1106, 1108, 1109, 1112. Separated by Milne-Edwards from "*Pt. edwardsi*" from Madagascar on account of its darker-coloured underparts, and because "le collier roux ferrugineux si marqué de ces chiroptères [i. e. *edwardsi*] manque chez ceux des Seychelles." I am unable to explain how Milne-Edwards came to give this latter character; as a matter of fact, all the specimens from the Seychelle Islands, including those examined by Milne-Edwards, are similar in the colour of the mantle to *Pt. rufus* and *comorensis*.

- a. ♂ pull. al. Seychelles. Dr. Ed. Perceval Wright [C.]. 69.5.2.11.  
b. ♀ imm. al.; skull. Seychelles. J. S. Gardiner, Esq. [P.]. 6.3.18.1.

### 31. *Pteropus aldabrensis*, True.

*Pteropus aldabrensis*, True, *Proc. U.S. Nat. Mus.* xvi. p. 533 (14 July, 1893: Aldabra I.); *Abbott, tom. cit.* p. 762 (1893: Aldabra); *Trouessart, Cat. Mamm.* i. p. 81 (1897: Aldabra); *Lorenz-Liburnau, Abh. Senck. nat. Ges.* xxi. pt. 3, p. 455, pl. xxxii. figs. 3 a, 3 b, 3 c, 3 d (skull) (1898: Aldabra); *Voeltzkow, op. cit.* xxvi. pt. 5, pp. 543, 552 (1902: Aldabra); *Miller, Fam. & Gen. Bats*, p. 58 (1907).

*Pteropus edwardsi b. aldabrensis*, Matschie, *Megachir.* p. 16 (1899); *Trouessart, Cat. Mamm., Suppl.* p. 50 (1904: Aldabra).

*Pteropus* [sp.?], *Voeltzkow, Abh. Senck. nat. Ges.* xxi. pt. 1, p. 66 (1897: Aldabra).

*Diagnosis.*—Allied to *Pt. comorensis*, but much smaller, and with

the colour of the back and rump strongly tinged with broccoli-brown and wood-brown. Forearm 134.5 mm. *Hab.* Aldabra I.

*Skull.*—Not differing from that of *Pt. comorensis* except in the much smaller size and relatively much broader mesopterygoid fossa; width of this latter 7.6 mm. (*i. e.* nearly seven-eighths of palate width between fronts of  $p^4$ - $p^4$ ), against 7.2-7.8 in the much larger Comoro species (*i. e.* seven-tenths of palate width between fronts of  $p^4$ - $p^4$ ).

*Teeth.*—Structure and relative size of teeth quite as in *Pt. comorensis* and allied species, except perhaps for a very slight reduction of  $m^2$  and  $m_3$ .

*Ears.*—Shape and relative size as in *Pt. comorensis*.

*Fur.*—Rather softer, more silky than in *Pt. comorensis*. Approximate length of longest hairs of back, mantle, and belly 21 mm. Width of furred space at middle of back (measured on dried skin) 64 mm. Distribution of fur as in the Comoro species.

*Colour.*—♂ ad., teeth slightly worn, skin:—General colour of back and rump a shade of broccoli-brown, darkest on front and middle of back, palest (almost wood-brown) on rump. Majority of individual hairs of back pale greyish at base with wood-brown extremities. A rather conspicuous sprinkling with silvery greyish-white hairs, particularly on sides of back, along membranes. Hairs on forearm and sides of tibia mars-brown.—Breast and belly ochraceous-buff with a tinge of buff-yellow; long concealed bases of hairs seal-brown. Flanks more uniform dark brown owing to shortness or, in many places, complete absence of bright-coloured tips.—Mantle orange-buff strongly tinged with ochraceous-rufous, shading posteriorly, in a transverse line across shoulders, into bright ochraceous-buff, and on sides of neck and foreneck into deep ochraceous-rufous. Concealed base of hairs of mantle and foreneck everywhere seal-brown; on the sides of the neck the seal-brown colour is restricted to the extreme base of the hairs or, above the neck-glands, quite obliterated.—Occiput, crown, interocular space, and temporal region bright ochraceous-buff with a tinge of buff-yellow; base of hairs (concealed on upperside of head, slightly showing through in temporal region) seal-brown. Muzzle, superciliaries, chin, and throat blackish.

The coloration, it will be noticed from the above, is in every essential respect like that of *Pt. comorensis* and allied species, save for the very strong admixture of broccoli-brown and wood-brown in the colour of the back and rump.

*Size.*—Much smaller than *Pt. comorensis*.

*Measurements.* On pp. 221, 222.

*Specimen examined.* One skin with skull, from the collection of the U.S. National Museum (Reg. no. 62061).

*Range.* Aldabra Island, N. of Comoro group.

*Cotypes* in the U.S. National Museum (nos. 20984, '85).

*Literature.*—A few examples collected by Dr. W. L. Abbott, and one skull (*fig. s. c.*) found by Dr. A. Veeltzkow in the house in Aldabra formerly occupied by Abbott, seem to be the only specimens recorded in literature.

32. *Pteropus niger*, Kerr.

*Pteropus vulgaris*, Dobson, Cat. Chir. B. M. p. 23.

*Vespertilio ingens*, *Clusius*, *Exot. libri decem*, p. 94, c. fig. (animal) (1605: Mauritius).

*Pteropus rufus* aut *niger*, auriculis brevibus acutiusculis: La Roussette, *Brisson*, *Regn. Anim.* p. 216 (1756: Reunion); *id.*, *op. cit.* 2 ed. p. 153 (1762: Reunion).

Le Chien-volant, *Daubenton*, *Mém. Acad. R. Sci. Paris*, p. 384 (1759: Reunion).

La Roussette, *Buffon*, *Hist. Nat.* x. pp. 55, 66, 81, pls. xiv., xv., xvi. (animal; tongue; skeleton) (1763: Reunion); *id.*, *op. cit. Suppl.* iii. pp. 253-262 (1776: habits); *Fouquet d'Obsonville*, *Essais philosophiques*, p. 77 (1783: Reunion); *E. Geoffroy*, *Ann. Mus. d'Hist. Nat.* vii. p. 227 (1806: Mauritius; habits in captivity); *Milbert*, *Voy. pictor. Ile-de-France*, ii. p. 244 (1812: Mauritius).

Great Bat of Madagascar (*nec Edwards*), *Grant*, *Hist. Mauritius*, p. 65 (1801: Mauritius).

*Vespertilio vampyrus*, *Linn. Syst. Nat.* 10 ed. i. p. 31 (pt.) (1758); *id.*, *op. cit.* 12 ed. i. p. 46 (pt.) (1766); *P. L. S. Müller*, *Vollst. Natursyst.* i. p. 152 (pt.) (1773). Var. A, *Schreber*, *Säuget.* pp. 153, 155, pl. xlv. (animal, copy from Buffon) (1774). *Boddaert*, *Elench. Anim.* i. p. 68 (pt.) (1785). Var. a, *Gmelin*, *Linn. Syst. Nat.* i. p. 45 (1787); *G. Cuvier*, *Tabl. Elém.* p. 104 (1798). Var. 2, *Turton*, *Linn. Syst. Nat.* i. p. 24 (1802).

*Pteropus vampyrus*, var. a, *Eracleben*, *Syst. Regn. Anim.* p. 133 (1777); *Desmarest*, *N. Dict. d'Hist. Nat.* xix. p. 543 (1803: Reunion).

*Spectrum vampirus*, *Lacépède*, *Tabl. Mamm.* p. 15 (1799); *id.*, *Mém. Inst. Paris*, iii. p. 499 (1801); *Daudin*, in *Buffon*, *Hist. Nat.*, *Didot ed.*, *Quadr.* xiv. p. 188 (1802\*).

*Pteropus* (*Spectrum*) *vampyrus*, *Matschie*, *Megachir.* p. 29 (1890: Mauritius); *Trouessart*, *Cat. Mamm.*, *Suppl.* p. 54 (1904: Tamatave; Reunion; Mauritius).

*Vespertilio vampirus niger*, *Kerr*, *Anim. Kingd.* i. pt. i. pp. xvii, 60, no. 106 (1792).

*Pteropus niger*, *G. Fischer*, *Zoognosia*, iii. p. 553 (1814).

*Vespertilio caninus*, *Blumenbach*, *Handb. Naturg.* 5 ed. p. 73 (pt.) (1797); *Goldfuss*, *Vergl. Naturbeschr. Säug.* p. 98, pl. xi. (1800).

*Pteropus fuscus*, *E. Geoffroy*, *Cat. Mamm. Mus. Nation. d'Hist. Nat.* p. 46 (1803: Reunion; Madagascar).

*Vespertilio mauritianus*, *Hermann (e Commerson MS.)*, *Obs. Zool.* p. 19 (1804: Mauritius); *Oken*, *Lehrb. Naturg.* iii. Abth. ii. p. 934 (1816).

*Pteropus mauritianus*, *Schinz*, *Thierr.* i. p. 155 (1821: Mauritius).

*Spectrum vulgare*, var. *mauritianum*, *Gray*, *Cat. Monk. &c.* p. 101 (1870: Mauritius).

*Pteropus rufus* (*nec E. Geoff.*), *Tiedemann*, *Zoologie*, i. p. 535 (1808).

*Pteropus vulgaris*, *E. Geoffroy*, *Ann. Mus. d'Hist. Nat.* xv. p. 92 (1810: Reunion; Mauritius); *Oken*, *Lehrb. Naturg.* iii. Abth. ii. p. 936 (1816); *G. Cuvier*, *Règne Anim.* i. p. 124 (1817: Mauritius; Reunion); *Desmarest*, *Mamm.* i. p. 109, no. 139 (1820:

\* Titlepage dated 1799. On the true year of publication see C. W. Richmond, *The Auk*, xvi. no. 4, p. 329 (Oct. 1899).

- Mascarenes); *Schinz, Thierr.* i. p. 154 (1821: Mauritius; Reunion); *Temminck, Mon. Mamm.* i. p. 182 (1825: Mauritius; Reunion; ? Madagascar; ? Africa); *Lesson, Man. Mamm.* p. 109, no. 279 (1827: Mauritius; Reunion); *Gray, Griffith's Anim. Kingd.* v. p. 55, no. 155 (1827: Mauritius; Reunion); *Desmarest, Dict. Sci. Nat.* xvi. p. 361 (1827: Mauritius; Reunion); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 699 (1828: Mauritius; Reunion); *J. B. Fischer, Syn. Mamm.* p. 83, no. 7 (1829: Reunion; Mauritius; ? Madagascar); *Wagler, Syst. Amph.* p. 9 (1830); *Temminck, Mon. Mamm.* ii. p. 74, pl. xxxviii. (whole fig. of juv., skull of juv. and ad.) (1837); *Gray, Mag. Zool. & Bot.* ii. p. 503 (1838: Mauritius; Reunion); *Oken, Allg. Naturg.* vii. Abth. ii. p. 985 (1838: Mauritius; Reunion); *Wagner, Schreber's Säug., Suppl.* i. p. 350 (1839: Mauritius; Réunion; ? Madagascar; ? Africa); *Lesson, N. Tabl. R. An., Mamm.* p. 13, no. 177 (1842: Reunion; Mauritius); *Schinz, Syst. Verz. Säug.* i. p. 124 (1844: Mauritius; Reunion); *Wagner, Schreber's Säug., Suppl.* v. p. 602 (1853-55: Mauritius; Reunion); *Gervais, Hist. Nat. Mamm.* i. p. 188, fig. p. 189 (animal) (1854: Mauritius; Reunion; Madagascar); *Giebel, Säug.* p. 997 (1855: Mauritius; Reunion); *Schlegel, Dierkunde,* i. p. 53 (1857: Reunion; Mauritius); *Peters, MB. Akad. Berlin,* 1867, p. 323 (Mascarenes); *Fitzinger, SB. Akad. Wien,* lx. Abth. i. p. 449 (1870: Reunion; Mauritius); *Bartlett, P. Z. S.* 1875, p. 63 (Tamatave); *Dobson, Cat. Chir. B. M.* p. 23 (1878: Mauritius); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 204 (1879: Tamatave; Reunion; Mauritius); *Möbius, Meeresfauna Mauritius,* p. 36 (1880: Mauritius; habits); *Jentink, Cat. Ost. Mamm.* p. 252 (1887: Mauritius; Madagascar); *id., Cat. Syst. Mamm.* p. 138 (1888: Mauritius; Madagascar); *H. Allen, Proc. Ac. Nat. Sci. Philad.* 1889, p. 336 (wing-membranes); *Trouessart, Cat. Mamm.* i. p. 77 (1897: Tamatave; Reunion; Mauritius); *Matschie, Megaehir.* pl. ix. figs. 2, 2 a, 2 b (skull) (1899).
- Spectrum vulgare, Gray, Cat. Monk. &c.* p. 100 (1870: Mauritius; Reunion; ? Madagascar).
- Pteropus edwardsi* (pt., nec *E. Geoff.*), *Pollen, in Pollen & v. Dam, Rech. Faune Madagascar,* ii. p. 26 (1868: Reunion).
- Pteropus pteropus*, "*Brisson*," *Merrim, Science*, (n. s.) i. no. 14, p. 376 (5 Apr. 1895).

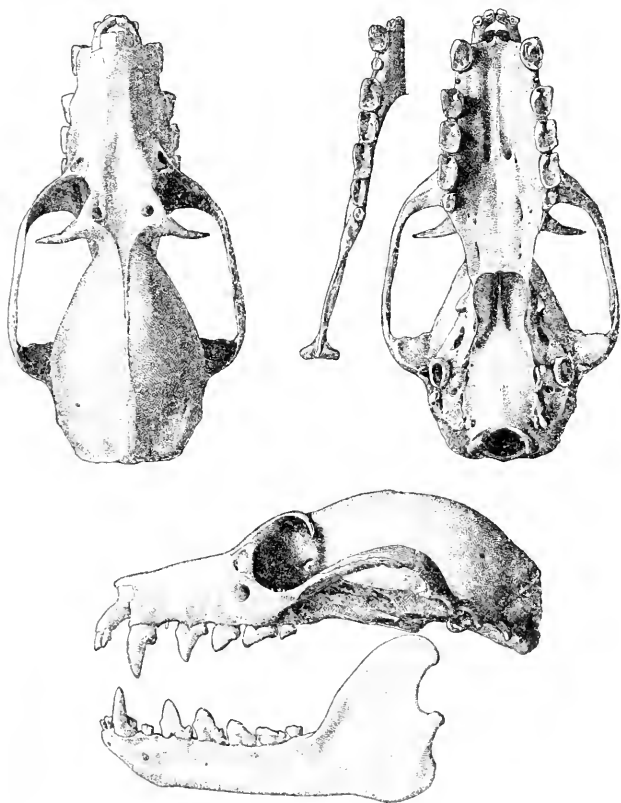
*Diagnosis.*—Skull and dentition (fig. 12) quite as in *Pt. rufus* and *comorensis*. Ears small, almost concealed in the fur. Tibia thickly haired above. Sides of back and rump buffy, contrasting with dark spinal tract. Forearm 159–171 mm. *Hab.* Mascarenes.

*Ears.*—Small, almost hidden in the long fur. Tip sharply pointed, outer margin distinctly concave below tip. Hinder face of conch clothed with short, thinly-set hairs on basal half, tip naked.

*Interfemoral.*—Central portion concealed by the fur, scarcely more than 2 mm. in depth.

*Fur.*—Longer than in *Pt. rufus*; directed backward but not closely adpressed on back, semierect on nape of neck. Approximate length of hairs at middle of back 26 mm., middle of mantle 27 mm., middle of belly 26 mm. Width of furred area at middle of back about 65 mm.

Above, humerus and proximal third of forearm clothed with short, densely-set fur; femur and tibia to a short distance from ankle long-haired; small bunches of rather long hairs on upperside of foot at base of first phalanges and distal extremity of second phalanges. Below, humerus and proximal part of forearm and tibia densely furred; closely-set woolly fur on membrane along outer side of forearm, and on plagiopatagium to a line between elbow and knee.



VERZ.

Fig. 12.—*Pteropus niger*, ♂. Mauritius. No. 66.1.24.1. †.

*Colour*.—Chief characters: face, sides of back and rump, anal region, and fur on tibia above and below buffy, strongly contrasting with dark mantle, spinal tract, and underparts.

Mauritius specimens:—Median tract of back and rump, from shoulders to interfemoral, approximately vandyck-brown, darkest (tinged with seal-brown) anteriorly, becoming gradually lighter (more pure vandyck-brown) posteriorly; the width of this dark longitudinal area varies individually between 28 and 38 mm. Sides of back, rump, and fur on upperside of tibia buff, strongly contrasting with dark spinal region.—Breast, belly as far back as anal region, and flanks dark seal-brown with a peculiar oily gloss, and slightly washed with mars-brown on middle of breast and belly; anal region and fur on underside of tibia buffy or ochraceous-buffy.—Mantle glossy blackish seal-brown, darkest in the middle, passing posteriorly gradually into the dark colour of the spinal stripe, anteriorly tinged with chestnut, and lightening on occiput to dark cinnamon-rufous; sides of neck similar to mantle, shading into golden tawny posteriorly near insertion of antebrachial membrane; foreneck blackish seal-brown, similar to (or rather darker than) breast.—Interocular space and sides of face buffy or ochraceous-buffy; crown, temporal region, chin, and throat buffy more or less strongly tinged with tawny or pale hazel.

*Measurements.* On pp. 221, 222.

*Specimens examined.* Ten, in the collections of the Paris, Leyden, Berlin, and British Museums.

*Range.* The Mascarenes: Reunion, Mauritius.

Some early writers have recorded this species from Madagascar, as a rule, however, with a sign of query. The only recent records from that island known to me are Bartlett's in P. Z. S. 1875, p. 63, of a specimen stated to have been obtained at Tamatave (by Mr. Waters), and Jentink's (Cat. Ost. p. 252; Cat. Syst. p. 138) of a specimen from Madagascar (Mulić, 1876). The former I have not seen; the Leyden specimen does not differ from Mauritius examples. The correctness of the locality is in both cases open to doubt; the specimens may have been brought alive from the Mascarenes to Madagascar.

*Type* not in existence.

*Habits.*—This species, de la Nux wrote from Reunion in a letter to Buffon (Suppl. iii. pp. 253–267), is only found in the forests; it rests in the crowns of the trees, suspended from the branches, wrapped in its wings, not (as *Pt. subniger*) in hollow trees or caves. It is less strictly nocturnal in its habits than *Pt. subniger*; by day-time it is sometimes seen flying at a considerable height, and it is probable that it not infrequently passes from Reunion to Mauritius and *vice versa*. Its favourite food in Reunion is bananas, peaches, guava, mistletoe-berries, &c., but the food varies of course greatly according to the season; also it is fond of sucking the juice of the blossoms of various species of Umbellifers; at the time of the year (mid-summer, *i. e.* January–February) these plants are in bloom, the Roussettes come in great numbers down to the lower parts of the island, and the ground may here and there be found literally covered with blossoms torn off by these bats. Pairing takes place about the middle of autumn (May); the period of gestation

is four and a half or five months, so that the single young is generally born about one month after spring equinox (October). After eight months (winter solstice, about June) the young is full-grown. In 1722, on his arrival at Reunion, de la Nux found the Roussettes extremely common; abundance of food would attract flocks of a hundred, a hundred and fifty, or even two hundred to one spot; during his more than fifty years of residence in the island the number of individuals rapidly decreased, chiefly owing to deforestation of the island and the shooting of these Fruit-bats for food.

*Earliest records of the species.*—Few, if any, species of Fruit-bat can be traced so far back in literature as *Pt. niger*. The example named by L  cluse (1605) *Vespertilio ingens* was seen by him in Amsterdam in 1603, and stated to have been brought from Ilha do Cerne (Mauritius); his woodcut alone would almost be sufficient for a safe identification of the species; the description and locality exclude all doubt.

The habitat of the species accounts for the fact that it was particularly well known to the French zoologists in the latter half of the eighteenth century. It is Daubenton's "Chien-volant" from Reunion (1759), of which he gives an excellent detailed description. Whether his "Roussette" from the same island (*l. s. c. p.* 385), stated to differ from the Chien-volant in colour only, but of which he had only seen one specimen in bad condition, is *Pt. niger* or *Pt. subniger* is open to question.

Brisson (1756 and 1762) discriminated three species of *Pteropus*: *Pt. rufus aut niger*, "La Roussette," from Reunion, which is unquestionably *Pt. niger*; but with this species Brisson erroneously united Seba's *Canis volans Ternatanus Orientalis*; further, *Pt. collo rubro*, from Reunion, which is *Pt. subniger*; and *Pt. auriculis patulis*, from Nova Hispania, which is *Vampyrus spectrum*.

Buffon (1763) distinguished sharply between La Roussette and La Rougette, both from Reunion; the former is *Pt. niger*, the latter *Pt. subniger*. In Buffon's time the Roussette was represented in the Royal Cabinet by one specimen, mounted with expanded wings, sent from Reunion by de la Nux, one skeleton, and some anatomical preparations; Buffon's plate shows the light-coloured sides of the back so characteristic of *Pt. niger*. No later writer has given a better, more detailed and vivid account of the habits of this species than de la Nux (quoted by Buffon, 1776). Buffon's specimens are probably no longer in existence; none of the specimens I have seen in the Paris Museum can be identified with those described by Buffon.

*Vespertilio* (and *Pteropus*) *vampyrus*, of Linn   and the early post-Linnean writers.—Linn  's *V. vampyrus* (1758 and 1766) is a mixture of three species, viz. *Pt. vampyrus* (i. e. "*Pt. edulis*, Geoff.," as understood by Dobson), based on Seba; *Pt. niger*, based on L  cluse; and *Pt. rufus*, based on Edwards (Great Bat from Madagascar). Technically the name *vampyrus* must stand for the first of these species.

Most of the earlier post-Linnean writers (Schreber, Erxleben, Boddaert, Gmelin, Kerr, &c.) divide "*vampyrus*" into three varieties: a larger, which is *Pt. niger*, or a mixture of *Pt. niger* and *Pt. vampyrus*, sometimes also *Pt. rufus*; a smaller (*Pt. subniger*); and a straw-yellow (*Eidolon helvum*). Schreber, Erxleben, and Gmelin designated these varieties by letters only (A, B, C, or  $\alpha$ ,  $\beta$ ,  $\gamma$ ); Kerr was apparently the first to distinguish them by technical names (*niger*, *subniger*, *helvus*).

*Vespertilio vampyrus niger*, Kerr; 1792.—Based by Kerr on Schreber's figure (vol. i. pl. xlv.) of *V. vampyrus* var. A, which is a copy of Buffon's plate (vol. x. pl. xiv.) of La Roussette. The type locality of this latter, viz. Reunion, must, therefore, be fixed as the type locality of *V. v. niger*. Most of the synonyms given by Kerr under the heading *V. v. niger* (Clusius, Brisson, Daubenton) also have reference to the present species; the rest partly (Seba, Pennant) to *Pt. vampyrus*, partly (Bontius) to a Flying Lemur.

*Vespertilio caninus*, Blumenbach; 1797.—Name proposed in lieu of the Linnean *V. vampyrus*, because this bat "blosz von Baumfrüchten lebt und also schlechterdings nicht Vampyr genannt werden kann." Diagnosis a verbal copy from Linné; references three, viz. Linné's *vampyrus* [i. e. *Pt. vampyrus*, *niger*, and *rufus*], Buffon's Roussette [*Pt. niger*], and Schreber's pl. xlv. [*Pt. niger*].—Goldfuss's plate of "*V. caninus* Blumenb." (1809, l. s. c.) is a copy of Schreber's plate xlv., of *V. vampyrus* var. A, i. e. *Pt. niger*.

*Pteropus fuscus*, E. Geoffroy; 1803.—Type locality, Reunion. The following statements in the diagnosis are sufficient for an identification of the species: "des poils roux [in the description 'roux-jaunâtres'] sur la face, autour de l'anus, et sur les parties latérales du dos." Based by Geoffroy on three specimens in the collection of the "Muséum national d'histoire naturelle," viz., two mounted specimens (wings expanded), sent from Reunion by de la Nux (nos. 86 and 87), and a third "envoyé de Madagascar, par le citoyen Macé, naturaliste" (no. 88); in addition, the Museum possessed some embryos in alcohol (no. 89). As mentioned above, Buffon's specimen of the Roussette (mounted, wings expanded; ancient Royal Cabinet) was obtained in Reunion by de la Nux; since also two of Geoffroy's cotypes of *Pt. fuscus* (both mounted, wings expanded) had been sent from Reunion by de la Nux, it is possible that the former specimen was identical with one (no. 86 or 87) of the latter. Geoffroy's specimen no. 88, stated to have been sent from Madagascar, was probably a dealer's specimen; the fact that Geoffroy in 1810, on redescribing *Pt. fuscus* under the name *Pt. vulgaris*, gave as habitat only "l'île de France et celle de Bourbon," without any reference to the Madagascar specimen, may indicate that he was himself in doubt as to the correctness of this locality. None of the specimens I have seen in the Paris Museum can be identified with Geoffroy's cotypes of *Pt. fuscus*.

*Vespertilio mauritanus*, Hermann; 1804.—Type locality, Mauritius. Based on MS. notes by Commerson. The words "capite dorsique lateribus rufis," together with the locality, exclude all doubt as to the identification.



*Pteropus rufus*, Tiedemann; 1808.—Based on Brisson's *Pt. rufus aut niger* (the name *Pt. rufus* is evidently an abbreviation of "*Pt. rufus aut niger*"); other synonyms quoted by Tiedemann: *Vesp. vampyrus*, L., which is partly *Pt. niger*; *Vesp. caninus*, Blumenb., Buffon's Roussette, and Schreber's pl. xliv., all of which are *Pt. niger*. Name preoccupied by *Pt. rufus*, E. Geoff., 1803, which is *Pt. edwardsi*, auctorum.

*Pteropus vulgaris*, E. Geoffroy; 1810.—A redescription and renaming of Geoffroy's *Pt. fuscus*, 1803 (but without any reference to this latter, because Geoffroy wished to suppress his Catalogue from 1803). The type locality of *fuscus*, viz. Reunion, must therefore be fixed as the type locality of *vulgaris*, too; it is even highly probable that the latter was based on the same individuals

*External measurements of Pteropus seychellensis,  
aldabrensis, and niger.*

	<i>Pt. seychellensis. 5 yg. ad. (Incl. cotypes.)</i>		<i>Pt. aldabrensis. ♂ ad. (U.S.N.M. 62061.)</i>	<i>Pt. niger. 2 ad.</i>	
	MIN.	MAX.		MIN.	MAX.
	mm.	mm.	mm.	mm.	mm.
Forearm .....	143 *	154	134.5	159	171
Pollex, total length, c. u. ....	65	70.5	58	69	72.5
„ metacarpal .....	13.5	16.5	13	...	...
„ 1st phalanx .....	35	37	29	...	...
2nd digit, metacarpal .....	74	76	64	81	84
„ 1st phalanx .....	20.5	22.5	14.5	20.7	24
„ 2nd-3rd phalanx, c. u. ....	18.5	19.5	15	17.5	17.8
3rd digit, metacarpal .....	96 *	103	90	101.5	114
„ 1st phalanx .....	75	76.5	65.5	80.2	83.5
„ 2nd phalanx .....	100.5 *	106.5	89	105.5	112
4th digit, metacarpal .....	95 *	100	86	99.5	112
„ 1st phalanx .....	60	63	54	67.2	68.5
„ 2nd phalanx .....	62.5	64	51	62.5	65.2
5th digit, metacarpal .....	100	103	91	106.5	119
„ 1st phalanx .....	44.5	49	40	49	50.5
„ 2nd phalanx .....	48.5	51	40	50.5	54
Ear, length from orifice .....	31	32	(24 †)	...	...
„ greatest width, flattened .....	18	18	...	...	...
Interfemoral in centre, depth .....	8	...	...	...	...
Lower leg .....	69	72.5	76.3	75.5	...
Foot, c. u. ....	48	51	74.3	51	..
Calcaneal .....	18	18	...	17	...

\* The four minimum measurements of *Pt. seychellensis* marked with an asterisk are taken from specimens which I suspect to be not quite full-grown; the other examples measured, though also slightly immature, are probably full-sized.

† Estimate from dried skin (in the two cotypes, which also are skins, the ears measure, according to True, 24 and 25 mm.).

*Measurements of skulls and teeth of Pteropus seychellensis, aldabrensis, and niger.*

	<i>Pt.</i> <i>seychellensis</i> , ♀ imm. (B.M. 6.3.18.1.)	<i>Pt.</i> <i>aldabrensis</i> , ♂ ad. (U.S.N.M. 62061.)	<i>Pt. niger</i> , Skull and teeth: 1 ad.
	mm.	mm.	mm.
Skull, total length to gnathion .....	...	58.3	67
„ palation to incisive foramina ...	...	28	33.2
„ front of orbit to tip of nasals ...	...	18.8	22
„ width of brain-case at zygomata ...	...	21.8	23.8
„ zygomatic width .....	...	32.8	35.5
„ width across m <sup>1</sup> , externally .....	...	15.2	18.8
„ lachrymal width .....	...	12.5	14.5
„ width across canines, externally ...	...	11.5	13.8
„ postorbital constriction .....	...	7.8	8.2
„ interorbital constriction .....	...	8	9.8
„ width of mesopterygoid fossa ...	...	7.6	7.2
„ between p <sup>1</sup> -p <sup>1</sup> , internally .....	...	8.8	11
„ between cingula of canines .....	...	6	...
„ orbital diameter .....	...	11.7	12.8
Mandible, length .....	...	45.7	53
„ coronoid height .....	...	22.8	26
Upper teeth, e-m <sup>2</sup> .....	...	21.7	25.8
Lower teeth, e-m <sub>3</sub> .....	...	24.2	29
Upper incisors, combined width .....	...	5.6	...
p <sup>3</sup> , length .....	4.1	4	4.8
„ width .....	3.1	3	3.7
p <sup>4</sup> , length .....	4.1	4.1	4.8
„ width .....	3	3	3.7
m <sup>1</sup> , length .....	4.8	4.7	5.3
„ width .....	2.8	2.8	3.1
m <sup>2</sup> , length .....	2.7	2.2	3.1
„ width .....	2	2	2.5
p <sub>1</sub> , length .....	2.1	2	2.2
„ width .....	1.5	1.8	1.8
p <sub>3</sub> , length .....	4.5	4.2	4.9
„ width .....	2.9	2.8	3.2
p <sub>4</sub> , length .....	4.2	4.7	4.9
„ width .....	3	2.9	3
m <sub>1</sub> , length .....	4.1	4.5	4.7
„ width .....	2.8	2.8	3.1
m <sub>2</sub> , length .....	3.4	3.5	4.1
„ width .....	2.6	2.5	2.8
m <sub>3</sub> , length .....	1.9	2	2.7
„ width .....	1.8	1.8	2.2

as the former.—After a brief description of *Pt. vulgaris*, Geoffroy refers to “un autre individu, dernièrement apporté de l’île de France,” and which he regards as “une variété dans cette espèce” on account of its slightly different colour. The Paris Museum possesses a specimen (mounted, wings expanded, skull *in situ*; recent Register no. A. 1) marked in handwriting on the underside of the block “*Pteropus vulgaris* (Geoff.); type” (no locality written), and on the printed label “Ancien Cabinet; Maurice.” This specimen, which certainly bears the appearance of having been preserved for many years in the Museum (much bleached, back naked), is, most probably, not one of the true cotypes of *Pt. vulgaris* (and *Pt. fuscus*), which were obtained in Reunion, but Geoffroy’s “variety” of *Pt. vulgaris* referred to by him in the words quoted above; if so, it is the individual mentioned by Geoffroy in 1806 (Ann. Mus. d’Hist. Nat. vii. pp. 227–230) as having been kept in captivity by Surgeon-Major Roch, Mauritius, and brought by him to France in 1803.

“*Pteropus pteropus*, Brisson,” Merriam; 1895.—Combination introduced into literature by Merriam on the mistaken supposition that Brisson’s nomenclature was binomial.

*Remarks*.—*Pt. niger* is readily discriminated from any other species of the genus by the colour of the upperside: pale sides of back contrasting with dark mantle and spinal tract.

a. Yg. ad. st.	Pur-chased (Gardiner).	44.11.16.4.
b. ♂ yg. ad. sk.; skull. Mauritius.	H. Whitely, Esq. [P.].	66.1.24.1.

#### E. THE *PTEROPUS MELANOTUS* GROUP.

*Species*.—*Pt. melanotus*, *tytleri*, *niadicus*, *modiglianii*, *natalis*.

*Range*.—Nicobar Islands, north to the Andamans, south through Nias and Engano, to Christmas Island (S. of Java).—This is the absolutely dominant (and probably truly indigenous) type of the genus in the Andaman-Nicobar chain, the only other groups represented being the widely spread *hypomelanus* and the Indo-Malayan *vampyrus* groups.

*General characters*.—Skull typical Pteropine. Dentition without special modifications; cingulum of canines generally rather narrow; posterior basal ledges of  $p^3$ ,  $p_3$ , and  $p_4$  short, but distinctly marked off from teeth. Ears rather large, broad, scarcely attenuated above, tip rounded off; interfemoral generally distinctly developed in centre (obsolete in *Pt. natalis*); tibia practically naked above. Prevailing colour of fur blackish above and beneath, either entirely uniform, or with bright colour restricted to mantle or to mantle and centre of breast and belly; blackish colour in one species (*Pt. niadicus*) varied with greyish. Sexual differentiation inconspicuous (as in *hypomelanus* group). Size moderate or rather large (forearm 125–165 mm.). The extreme south-eastern species (*Pt. natalis*) is slightly aberrant in dentition.

*Specific differentiation*.—The Nicobar species (*Pt. melanotus*) is apparently the least modified form of the group: fur short, bright

mantle and centre of breast and belly contrasting with general dark colour of pelage. The Andaman species (*Pt. tytlerei*) is either entirely blackish or with some indication of a brighter tinge in the mantle; general size smaller. The Nias species (*Pt. niadicus*) is in all essential characters similar to *Pt. melanotus*, but with a conspicuous admixture of greyish in the dark-coloured parts of the fur. In the Engano species (*Pt. modiglianii*) the fur is longer and uniform blackish, the size smaller than *Pt. melanotus*. In the extreme south-eastern species, *Pt. natalis* (Christmas Island), the dentition is somewhat modified (see p. 233); as in *Pt. modiglianii* the colour is uniform blackish, with or without a faint trace of a paler tippet, the fur still longer, the size still smaller.

*Affinities of group.*—The *Pt. melanotus* is undoubtedly closely related to the Malagasy *Pt. rufus* group, with the typical members of which it accords in all essential characters of the skull and dentition, distribution of fur, and development of interfemoral; it differs chiefly in the shape of the ears and a pronounced tendency to suppression of all light colours. The five species of the *melanotus* group are so nearly interrelated that they may be presumed to be insular modifications of one type of bat which inhabited a land area of which the Andamans, Nicobars, Simalu, Nias, Mentawai, Engano, and Christmas Island are probably the remnants.

### 33. *Pteropus melanotus*, Blyth.

*Pteropus nicobaricus* (pt.), Dobson, Cat. Chir. B. M. p. 54.

*Pteropus edulis* (nec *E. Geoff.*), Blyth, J. A. S. B. xv. p. 367 (1846: Nicobars); Peters, MB. Akad. Berlin, 1867, p. 324 (pt.) (Nicobars).

*Pteropus melanotus*, Blyth, Cat. Mamm. Mus. As. Soc. p. 20 (1863: Nicobars); *id.*, Mouat's Andaman Islanders, App. p. 354 (1863: Nicobars); Mason, Rec. Ind. Mus. ii. pt. ii. p. 159 (1903: Nicobars).

*Pteropus nicobaricus*, Fitzinger, SB. Akad. Wien, xlii. p. 389 (1861: Nicobars) (nom. nud.); Blyth, Mouat's Andaman Islanders, App. p. 354 (1863: Nicobars) (nom. nud.); Zelebor, Reise 'Novara,' Zool. i. Säug. p. 11 (1869: Car Nicobar) (descr. princeps); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 410 (1870: Car Nicobar); Dobson, J. A. S. B. xlii. pt. 2, p. 198 (pt.), pl. xiv. fig. 2 (ear) (1873: Nicobars); *id.*, P. Z. S. 1873, p. 250 (pt.) (Nicobars; sexual colour difference); *id.*, Cat. Chir. Ind. Mus. pp. 2-3 (pt.) (1874: Nicobars); *id.*, Journ. Anthropol. Inst. iv. pt. 2, p. 458, footnote (pt.) (1875: Nicobars); *id.*, Mon. As. Chir. p. 17 (pt.) c. fig. (head), pp. 22, 188 (1876: Nicobars); *id.*, Cat. Chir. B. M. p. 54 (pt.) (1878: Nicobars); Trouessart, Rev. & Mag. Zool. (3) vi. p. 202 (pt.) (1879: Nicobars); J. Anderson, Cat. Mamm. Ind. Mus. pt. i. p. 102 (pt.) (1881: Nicobars); Jentink, Cat. Syst. Mamm. p. 147 (pt.) (1888: Katchall); Blanford, Fauna Brit. Ind., Mamm. pt. ii. p. 260 (pt.) (1891: Nicobars); Lydekker, R. Nat. Hist. i. p. 256 (pt.) (1893-94); Trouessart, Cat. Mamm. i. p. 81 (pt.) (1897: Nicobars); Matschie, Megachir. p. 16 (pt.) (1899: Nicobars); Miller, Proc. U.S. Nat. Mus. xxiv. p. 782 (1902: Great Nicobar; Tillan-

chong): *Kloss, Andamans & Nicobars*, pp. 70, 133, 325 (1903: Car Nicobar; Tillanchong; Great Nicobar; habits); *Trouessart, Cat. Mamm., Suppl.* p. 50 (pt.) (1904: Nicobars); *Miller, Fam. & Gen. Bats*, p. 58 (pt.) (1907).

*Diagnosis*.—Skull typical Pteropine. Posterior basal ledges of  $p^3$ ,  $p_3$ , and  $p_4$  distinctly marked off from teeth. Ears large, broad, exposed, tip rounded off. Tibia naked above. Fur of back short, adpressed. Mantle and centre of breast and belly bright-coloured, contrasting with blackish back, head, throat, and flanks. Size above medium: forearm 153–165 mm. *Hab.* Nicobar Is.

*Skull*.—As in *Pt. rufus*.

*Teeth*.—Essential characters as in *Pt. rufus*. Cingulum of upper canines rather narrower.  $p^1$ ,  $m^1$ , and  $p_4$  somewhat heavier,  $m_2$  smaller. Posterior basal ledge of  $p^3$  short, but distinctly marked off from tooth postero-externally; in  $p^1$  the ledge is usually more developed postero-internally than postero-externally, making posterior margin of crown more or less oblique on longitudinal axis of tooth. Posterior ledge moderate in  $p_3$ , short in  $p_4$ , in both teeth distinctly separated postero-externally from base of outer main cusp.

*Palate-ridges*.—5+5+3. First ridge terminating laterally at front of canine; second at back of canine; third at front of  $p^3$ ; fourth at back of  $p^3$ ; fifth at back of  $p^1$ ; sixth at front of  $m^1$ ; seventh at front of  $m^2$ ; eighth to tenth behind  $m^2$ ; eleventh to thirteenth situated near palation border.

*Ears*.—Rather large, broad, exposed. Inner margin strongly and evenly convex from base to tip; outer margin strongly convex in lower two-thirds, concave in upper third; tip rather broadly rounded off. Naked, except posteriorly at base and along basal half of outer and inner margins.

*Wings*.—Membranes arising close together near sides of spine (interspace about 16–17 mm.).

*Interfemoral*.—Much reduced in centre, depth about 2–4 mm.

*Fur*.—Short: straight and adpressed on back; wavy, somewhat crinkled and spreading on rump and mantle. Longest hairs of back and mantle about 15–16, of belly 13–14 mm. Width of furred area of back about 50–55 mm.

Above, a narrow line of adpressed hairs along upperside of humerus. Forearm naked, except for some very thinly spread and closely adpressed hairs. Knee and tibia practically naked. Interfemoral naked, except in central portion.—Below, forearm, tibia, and lateral interfemoral naked. Woolly hairs on antebrachial membrane, along outer side of forearm, and on lateral membrane next to body.

*Colour*.—Whole series examined, adult males and females, skins: Back and rump generally blackish seal-brown, occasionally with a slight tinge of dark vandyck-brown. A few greyish-white hairs as a rule detectable on close examination.—Middle of breast and belly bright-coloured, contrasting with blackish sides, flanks, and anal region. Bright-coloured area varying individually from golden ochraceous-buff (lightest extreme) to rich tawny, along the median

line of breast and belly sometimes tinged with pale drab; laterally, before merging into the blackish of the sides, this bright colour generally shades into cinnamon-rufous or russet. Concealed base of bright-coloured hairs blackish seal-brown.—Mantle much like bright centre of breast and belly, varying individually from pale ochraceous-buff, through tawny, to almost cinnamon-rufous; even the palest extreme (pale ochraceous-buff) is generally slightly clouded with orange-buff, and shades posteriorly and anteriorly (before merging into blackish back and blackish head) and laterally (sides of neck) into tawny or cinnamon-rufous; the darkest extreme is almost cinnamon-rufous in the centre, shading in front, behind, and on sides of neck into hazel or chestnut. No (or only extremely short) blackish bases to bright-coloured hairs. Foreneck russet, often slightly mixed with, occasionally almost obscured by, blackish hairs.—Crown, as far as back of ears, generally blackish, in strong contrast to bright mantle, but occasionally more or less strongly tinged with russet. Sides of head, chin, and throat blackish or seal-brown.

No appreciable sexual difference in colour (six males, three females, one skin of doubtful sex examined).

*Measurements.* On pp. 230, 231.

*Specimens examined.* Ten, from the collections of the Vienna (one, cotype of *Pt. nicobaricus*), U.S. National (five\*), and British Museums.

*Range.* Nicobar Islands, the whole group. Specimens examined from Car Nicobar, Tillanchong, Trinkut, and Great Nicobar.

*Cotypes* in the Calcutta Museum.

*Habits.*—In Great Nicobar, early in March, 1901, Dr. W. L. Abbott and Mr. C. B. Kloss found a colony of these bats, numbering several thousands, in mangroves on either side of a small river. The surrounding atmosphere was impregnated with the musky odour of their bodies. When disturbed they gave vent to a continuous "skirling" noise, somewhat like the song of cicadas, but less shrill in tone. By nature they were very fearless, and the majority merely stared inquisitively; a few spread their wings and flapped heavily away for a short distance, while others crawled actively along the branches back downwards. All the females carried, clinging to the breast, a young one of about one-third full growth; these the mothers hugged to themselves with a folded wing, but when unsupported, the young found no difficulty in maintaining its position, by means of its claws and its suction grip on the parent's teat. When the latter crawled about the body was supported in the membrane of the wing, which bagged slightly with the weight. The action of these bats when climbing a vertical branch is similar to a man's in climbing up a pole. The wings are first raised and a tight grip taken with the claw of the thumb, then the feet are drawn up, and, after they obtain a hold, the

\* U.S. N. M. nos. 111729 and 111732 (Tillanchong), 111738-40 (Great Nicobar).

wings are once more lifted. When taking to flight, they swing to and fro once or twice, and then let go in a backward direction.

*Pteropus melanotus*, Blyth; 1863.—Three examples of this species, collected in the "Nicobar Islands" by Capt. Lewis and presented by him to the Calcutta Museum, were briefly described (colour of fur) by Blyth, in 1846 (*l. s. c.*), who referred them to "*Pt. edulis* : *Pt. javanicus*, Horsf., &c., &c.," though with some emphasis on the peculiarities of the specimens. Seventeen years later, Blyth (1863, *l. s. c.*) proposed for the same specimens (now reduced to the number of two) the name *Pt. melanotus*. Name evidently given in allusion to the blackish back (*melanonotus*), not to the black ears (*melanotus*).

*Pteropus nicobaricus*, Zelebor; 1869.—Type locality, Car Nicobar. Two cotypes, ♂ ad. skin, ♂ jun. al., Vienna Museum; I have examined the latter and the skull of the former.

a. ♀ imm. al.; skull.	Nicobars.	Indian Museum [E.].	Not reg.
b. Ad. sk.; skull.	[Nicobars.]	A. O. Hume, Esq. [P.].	85.8.1.99.
c, d. ♂ ad., ♀ ad. sks.; skulls.	Trinkut, Nicobars, 17 Feb. 1873 ( <i>H. Davison</i> ).	A. O. Hume, Esq. [P.].	85.8.1.107, 108.

### 34. *Pteropus tytleri*, *Mason*.

*Pteropus nicobaricus* (pt.), Dobson, *Cat. Chir. B. M.* p. 54.

*Pteropus nicobaricus* (*nec Zelebor*), Dobson, *J. A. S. B.* xlii. pt. 2, p. 198 (pt.) (1873: Andamans); *id.*, *P. Z. S.* 1873, p. 250 (pt.) (Andamans; sexual colour difference); *id.*, *Cat. Chir. Ind. Mus.* pp. 2-3 (pt.) (1874: Andamans; colour of mantle); *Hume, Stray Feathers*, ii. p. 61 (1874: Little Jolly Boy); *Dobson, Journ. Anthropol. Inst.* iv. pt. 2, p. 458, footnote (pt.) (1875: Andamans); *id.*, *Mon. As. Chir.* pp. 17, 22, 188 (pt.) (1876: Andamans; colour of mantle); *id.*, *Cat. Chir. B. M.* p. 54 (pt.) (1878: Ross I.); *Trouessart, Rev. S. Mag. Zool.* (3) vi. p. 202 (pt.) (1879: Andamans); *J. Anderson, Cat. Mamm. Ind. Mus.* pt. i. p. 102 (pt.) (1881: Andamans); *Jentink, Cat. Ost. Mamm.* p. 259 (1887: Andamans); *id.*, *Cat. Syst. Mamm.* p. 147 (pt.) (1888: Andamans); *Blanford, Faun. Brit. Ind., Mamm.* pt. ii. p. 260 (pt.) (1891: Andamans); *Trouessart, Cat. Mamm.* i. p. 81 (pt.) (1897: Andamans); *Matschie, Megachir.* p. 16 (pt.) (1899: Andamans); *Müller, Proc. U.S. Nat. Mus.* xxiv. p. 782 (pt.) (1902: S. Andaman; Little Jolly Boy); *Kloss, Andamans and Nicobars*, p. 325 (pt.) (1903: S. Andaman; Little Jolly Boy); *Trouessart, Cat. Mamm., Suppl.* p. 50 (pt.) (1904: Andamans).

*Pteropus tytleri*, Dobson, *Cat. Chir. Ind. Mus.* p. 3 (1874: S. Andaman) (nom. nud.); *id.*, *Mon. As. Chir.* p. 189 (1876: S. Andaman) (nom. nud.); *Mason, Rec. Ind. Mus.* ii. pt. ii. p. 162 (pt.) (July, 1908: Rutland; S. Andaman; Little Jolly Boy).

*Diagnosis*.—Similar to *Pt. melanotus*, but smaller, and with the whole of the underparts uniform blackish; mantle often blackish

like back, occasionally tinged with a brighter colour. Forearm about 149.5 mm. *Hab.* Andaman Is.

*Skull and teeth.*—Skull as in *Pt. melanotus*, but conspicuously smaller; mandible about 53 mm. against 56.5-60 in the allied species. Dentition differing in no respect from that of the Nicobar species, except perhaps in a slightly smaller average size of the teeth.

*Colour.*—♀ ad., type, teeth much worn; imm. (probably full-grown), sex indeterminable (73.10.10.1):—Uniform blackish or blackish seal-brown above and beneath, faintly tinged with dark vandyck-brown on rump; a few greyish-white hairs among the dark ones on back and muzzle. Middle of breast and belly not differing from sides and flanks; underparts not differing from back, except perhaps in the still more intensely blackish tinge of the colour; mantle in certain lights tinged with seal-brown.

A young male (rather more than half-grown; 85.8.1.109) is precisely similar to the adult female, except for a rather more pronounced seal-brown colour of the mantle (with a faint suggestion of chocolate).

According to Dobson (P. Z. S. 1873, l. s. c.) females, from the Andamans and Nicobars, are "generally of an intensely black colour throughout; in a few specimens only, of apparently very aged individuals, the fur on the back of the head and neck has a slightly reddish tinge; while the males have the whole of the head and nape of the neck to the shoulders bright orange or pale yellow (very rarely, in old males, reddish brown) as in *Pt. medius*, contrasting as remarkably with the sombre hues of the females as the brilliantly coloured skin of the male Mandrill contrasts with the same parts in the other sex." So far as Nicobar individuals (*Pt. melanotus*) are concerned, the alleged sexual difference in colour is imaginary; all the specimens I have seen (ten), females as well as males, have the mantle, occiput, and middle of breast and belly bright-coloured, contrasting with the blackish colour of the rest of the pelage, and such variation in the bright tinge as does occur is individual, not sexual (compare also Miller, Proc. U.S. Nat. Mus. xxiv. p. 784; 1902). As to the Andaman species (*Pt. tytleri*), the few specimens available, one of which is a male, another a female, and a third of doubtful sex, are uniform blackish with the mantle practically similar to the back; but from Dobson's notes (1874 and 1876, l. s. c.) on the colour of the mantle of some Andaman individuals in the Calcutta Museum it appears certain that in this as in several other melanistic species of *Pteropus* the mantle is occasionally tinged with a brighter colour. It is probable that Dobson, by comparing Andaman with Nicobar individuals, mistook what is really a *specific* difference between *Pt. tytleri* (practically uniform blackish) and *Pt. melanotus* (bright mantle and centre of breast and belly) for a *sexual* colour difference between individuals of one species (" *Pt. nicobaricus* ").

*Measurements.* On pp. 230, 231.

*Specimens examined.* The British Museum material.



*Range.* Andaman Islands: Rutland Island, South Andaman, Little Jolly Boy.

*Type* presumably in private possession.

*History of technical name.*—Originally a manuscript name written by Blyth on the labels of three skins, obtained in South Andaman Island by Lieut.-Col. Tytler and presented by him, in 1864, to the Calcutta Museum (specimens 22, 23, and 24 in Dobson's Mon. Asiat. Chir. p. 188; specimens *d*, *e*, and *f* in J. Anderson's Cat. Mamm. Ind. Mus. i. p. 102, specimen *f* wrongly stated to be from S. Nicobars instead of S. Andamans). The name remained unpublished until printed, without description, by Dobson in 1874 and 1876 (*l. s. c.*). The type of Mason's *Pt. tytleri* (1908, *l. s. c.*) is stated to be an adult male, skin and skull, Rutland I., collected by B. B. Osmaston, March 5, 1907. Mason failed to point out the real differential characters of the species as compared with *Pt. melanotus*. His statement that the two sexes differ in colour to such extent that they "might readily be mistaken at first sight for distinct species" is erroneous.

- a, b.* ♀ ad., ♂ Andamans (*W. Davison*). A. O. Hume, Esq. [P.]. 85.8.1.98.  
           juv. sks.; 85.8.1.109.  
           skulls.  
*c.* Imm. sk.; Ross I., Port Blair, S. R. G. Wardlaw Ramsay [C.]. 73.10.10.1.  
           skull. Andaman.

### 35. *Pteropus niadicus*, Miller.

? *Pteropus edulis* (*nec E. Geoff.*), *Nieuwenhuisen & Rosenberg, Verh. Batav. Genootsch. Kunst & Wet.* xxx. p. 19 (1863: Nias).

? *Pteropus* [sp.], *Rosenberg, Malay. Arch.* p. 219 (1878: Nias).

*Pteropus nicobaricus* (*nec Zelebor*), *Jentink, Cat. Syst. Mamm.* p. 147 (pt.) (1888: Nias); *Modigliani, Ann. Mus. Civ. Genova*, (2) vii. p. 239 (1889: Nias); *Trouessart, Cat. Mamm.* i. p. 81 (pt.) (1897: Nias); *Matschie, Megachir.* p. 16 (pt.) (1899: Nias); *Trouessart, Cat. Mamm., Suppl.* p. 50 (pt.) (1904: Nias); *Willink, Nat. Tijds. Nederl. Ind.* lxxv. p. 275 (1905: Nias).

*Pteropus niadicus*, *Miller, Proc. Biol. Soc. Wash.* xix. p. 64 (1 May, 1906: Nias).

*Diagnosis.*—Similar to *Pt. melanotus*, but dentition rather heavier. back more or less approaching hair-brown, flanks and sides of breast and belly pale greyish-drab sprinkled with blackish. Fore-arm 153–160 mm. *Hab.* Nias.

*Skull and teeth.*—Skull not differing appreciably from that of *Pt. melanotus*. Teeth decidedly heavier (see measurements p. 231), but not differing in structure.

*Colour.*—Three adult males, teeth much worn, skins (B. M. 88.12.1.4; U.S. Nat. Mus. 141231, '32, paratypes):—Back and rump seal-brown, thickly mixed with greyish-white, mouse-greyish, or buffy-greyish hairs, producing the general effect of a shade more or less approaching hair-brown. The amount of greyish admixture, though, so far as the material goes, always conspicuous, is subject to no small variation; one specimen (141232) has the spinal tract

seal-brown, distinctly but not heavily sprinkled with greyish-white hairs, and (on the rump) with tawny tips to the brown hairs, the admixture of paler hairs being thicker on the humerus and along the membranes; in the British Museum specimen the pale greyish are much in excess of the dark brown (in this specimen almost blackish) hairs, so as to make the whole of the back and rump appear light hair-brown or almost drab, sprinkled with blackish; the third specimen (141231) is intermediate.—Middle of breast rich ochraceous, brightest (brilliant ochraceous-buff or orange-buff) in the centre, gradually shading to tawny and from this to cinnamon-rufous or russet laterally. Anteriorly, towards the foreneck, the bright colour passes into chestnut more or less clouded with blackish, posteriorly, in anal region, into dull chestnut or chocolate more or less mixed with pale greyish. Extreme base of hairs in bright area seal-brown. Flanks and sides of breast and belly pale drab or drab-grey sprinkled with blackish hairs, or blackish heavily sprinkled with pale drab or drab-grey.—Mantle chestnut more or less distinctly sprinkled with golden tawny hairs, shading posteriorly, in a transverse line across shoulders, into tawny lightened

*External measurements of Pteropus melanotus, tytleri, and niadicus.*

	<i>Pt. melanotus.</i> 8 ad.		<i>Pt. tytleri.</i> ♀ ad.	<i>Pt. niadicus.</i> 3 ad. (Incl. two paratypes.)	
	Min. Max.			Min. Max.	
	mm.	mm.	mm.	mm.	mm.
Forearm .....	153	165	149.5	153	160
Pollex, total length, c. u. ....	65.5	71	63.5	70.5	73.5
„ metacarpal .....	14	17	14.5	17	17.5
„ 1st phalanx .....	35	39.5	35.5	37	38.5
2nd digit, metacarpal .....	80.5	86.5	75.5	77	81
„ 1st phalanx .....	16.5	20	18	18.2	19.5
„ 2nd-3rd phalanx, c. u. ....	16	18	16	16	18
3rd digit, metacarpal .....	105.5	112	101	101	108
„ 1st phalanx .....	77.5	80.5	70	74	78
„ 2nd phalanx .....	108	120	...	99	114.5
4th digit, metacarpal .....	101	108.5	99.5	98.5	102
„ 1st phalanx .....	61	66	58.5	60.5	65
„ 2nd phalanx .....	63	70	61	58.5	66
5th digit, metacarpal .....	109.5	117.5	105.5	105.5	113.5
„ 1st phalanx .....	45	50	44.5	47	48
„ 2nd phalanx .....	47.5	54	46	47	48
Ear, length from orifice .....	(27*)				
„ greatest width, flattened .....	(19*)				
Lower leg .....	72	76	66	68	72.5
Foot, c. u. ....	47.5	52	46.5	...	51.5
Calcar .....	.....		...	17	

\* From a slightly immature alcoholic specimen.

† Estimate from skins.

*Measurements of skulls and teeth of Pteropus melanotus, tytleri, and niadicus.*

	<i>Pt. melanotus.</i> Skulls and teeth: 9 ad.		<i>Pt. tytleri.</i> Skull: 1 ad. Teeth: 1 ad., 1 imm.		<i>Pt. niadicus.</i> Skulls: 3 ad. Teeth: 2 ad. (Incl. two paratypes.)	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	72	75.5	66*	...	72	75
„ palation to incisive foramina ...	36	38.5	...	...	35.8	37.7
„ front of orbit to tip of nasals ...	24.7	26.5	23.2	...	23.8	26.5
„ width of brain-case at zygomata ..	23.8	25.5	...	...	23.8	24.8
„ zygomatic width .....	37.2	40.2	...	...	39.2	40.8
„ width across m <sup>1</sup> , externally .....	18.8	20.7	19	...	19	19.8
„ lachrymal width .....	15	15.3	15	...	16	16.7
„ width across canines, externally ..	14	15.5	12.8	...	14	15
„ postorbital constriction .....	6.5	8	7.7	...	7.7	8
„ interorbital constriction .....	9	10	9.5	...	10.8	16.8
„ width of mesopterygoid fossa ...	8	9.2	...	...	8	9.2
„ between p <sup>4</sup> -p <sup>4</sup> , internally .....	11.5	12.7	11	...	11	12.2
„ between cingula of canines .....	7.8	8.5	7	...	8	9
„ orbital diameter .....	13.2	14	13.2	...	13	13.8
Mandible, length .....	56.7	60	53.2	...	56	59
„ coronoid height .....	27.2	29.8	25.8	...	27	28.7
Upper teeth, c-m <sup>2</sup> .....	27.3	29.6	26.8	...	27.5	27.8
Lower teeth, c-m <sub>3</sub> .....	30	33	29	...	30.5	31.7
Upper incisors, combined width.....	6.8	7.1	6.2	...	6.5	...
p <sup>2</sup> , length .....	4.8	5.1	4.7	4.8	4.2	4.7
„ width .....	3.5	3.8	3.5	3.8	3.1	3.3
p <sup>4</sup> , length .....	5.1	5.7	4.9	5	4.8	5
„ width .....	3.8	4	3.7	3.9	3.6	3.7
m <sup>1</sup> , length .....	5.8	6.2	5.8	5.8	5.7	5.8
„ width .....	3.5	3.7	3.3	3.6	3	3.1
m <sup>2</sup> , length .....	2.2	3.7	2.4	2.8	2.1	2.5
„ width .....	2	2.8	2.1	2.6	1.8	1.9
p <sub>1</sub> , length .....	2	2.2	1.8	2.2	1.7	1.8
„ width .....	1.8	2.1	1.8	2.1	1.7	1.8
p <sub>2</sub> , length .....	5	5.5	4.8	5.1	4.8	4.8
„ width .....	2.9	3.5	3	3.1	2.8	2.8
p <sub>1</sub> , length .....	5	5.7	4.7	5.2	4.8	4.9
„ width .....	3.1	3.5	3.2	3.2	3	3
m <sub>1</sub> , length .....	5	5.6	5.1	5.2	4.8	5
„ width .....	3	3.5	3	3	3	3
m <sub>2</sub> , length .....	3.7	4.2	3.8	4.2	3.7	3.7
„ width .....	2.8	3	2.8	2.8	2.8	2.8
m <sub>3</sub> , length .....	2.1	2.8	2	2.7	2	...
„ width .....	2	2.1	1.8	2.1	1.7	...

\* Estimate.

with orange-buff. Sides of neck dark chestnut. Foreneck similar, but more or less strongly blotched with blackish.—Occiput similar to mantle (chestnut), shading into a rather brighter tinge (chestnut-russet) on crown. Muzzle and sides of head grizzled blackish and pale drab, in some specimens washed with russet in temporal region. Chin and throat blackish, with or without pale greyish sprinkling.

*Measurements.* On pp. 230, 231.

*Specimens examined.* Three, in the collections of the U.S. National (two paratypes) and British Museums.

*Range.* The island of Nias, off W. Sumatra.

*Type* in the U.S. National Museum (no. 141233).

*Remarks.*—Undoubtedly a Nias representative of *Pt. melanotus* (Nicobar Islands). In *Pt. melanotus* a slight sprinkling of the blackish colour of the back, sides of breast and belly, and flanks with pale greyish is detectable; in *Pt. niadicus* this admixture of pale colour has become so conspicuous as to change the general colour of the back into, or in the direction of, hair-brown, and that of the flanks and sides of breast and belly into pale drab. In *Pt. melanotus* the head, as far as back of ears, is usually blackish, but specimens occur in which the bright colour of the mantle extends forward on the crown, even to the front of the eyes; this latter has apparently become a fixed character in *Pt. niadicus*. The only other appreciable modification is the rather heavier dentition.

a. ♂ ad. sk.; Lelemboli, Nias; Aug. 1886 Marquis G. Doria 88.12.1.4.  
skull. (Dr. E. Modigliani). [P.].

### 36. *Pteropus modiglianii*, Thos.

*Pteropus modiglianii*, Thomas, *Ann. Mus. Civ. Genova*, (2) xiv. p. 106 (10 April, 1894: Kifa-juc, Bua-Bua, Engano); Trouessart, *Cat. Mamm.* i. p. 81 (1897: Engano); Miller, *Proc. U.S. Nat. Mus.* xxx. p. 823 (1906: Pulo Dua, Engano; habits); *id.*, *Fam. & Gen. Bats*, p. 56 footnote, p. 58 (1907).

*Pteropus nicobaricus a. modiglianii*, Matschie, *Megachir.* p. 17 (1899: Engano); Trouessart, *Cat. Mamm., Suppl.* p. 50 (1904: Engano); Willink, *Nat. Tijds. Nederl. Ind.* lxx. p. 275 (1905: Engano).

*Diagnosis.*—Similar to *Pt. melanotus*, but fur longer, colour practically uniform blackish above and beneath, size smaller. Fore-arm 134.5–141 mm. *Hab.* Engano.

*Skull and teeth.*—General characters of skull as in *Pt. melanotus*, but size considerably smaller; total length 61.5–67 mm., against 72–75.5 in *melanotus*; actual size of orbits very nearly as in *niadicus* and *melanotus*, relative size therefore (considering smaller dimensions of skull) somewhat larger; diameter of orbit contained 4.75–5.0, in *niadicus* and *melanotus* 5.4–5.55, times in total length of skull.—Teeth not reduced to the same degree as skull, therefore relatively larger than in the allied species (compare measurements, p. 236); structure of teeth quite as in *melanotus* and *niadicus*.

*Fur.*—Longer and more silky than in *Pt. melanotus*. Directed backward, but not closely adpressed, on back, spreading on mantle

and rump. Longest hairs of back approximately 18, mantle 20, belly 20 mm. Distribution of fur as in *Pt. melanotus*.

*Colour*.—Whole series examined (adult males and females, skins):—General colour uniform blackish above and beneath; mantle and middle of breast and belly not differing from rest of pelage. Sides of rump in most specimens more or less distinctly washed with dull vandyck-brown or mars-brown (in one specimen with ochraceous), this tinge occasionally extending forward on sides of back along membranes, and sometimes detectable also in the colour of the glandular hairs on the sides of the neck.

*Measurements*. On pp. 235, 236.

*Specimens examined*. Seven, from the collections of the U.S. National\* and British Museums, including one cotype of species.

*Range*. Engano (and Pulo Dua, off S.E. Engano).

*Cotypes* in the Genoa (one) and British Museums (one).

*Habits*.—In November 1904 Dr. W. L. Abbott found this species common in Engano, less common in the small islet of Pulo Dua, about one mile south-east of Engano. It was feeding on wild fruit, but did not frequent the cocoa-nut trees.

a. ♀ ad. al.; skull. Bua-Bua, Engano; Marquis G. Doria [P.]. 94.1.7.1. June, 1891 (*Dr. E. Modigliani*). (*Cotype of species.*)

### 37. *Pteropus natalis*, *Thos.*

*Pteropus natalis*, *Thomas*, *P. Z. S.* 1887, p. 511 †, pl. xli. (animal) (Christmas I.); *Lister*, *Nature*, xxxvii. p. 203 (1887: Christmas I.); *id.*, *P. Z. S.* 1888, p. 516 (Christmas I.); *Thomas*, *tom. cit.* p. 532 (Christmas I.); *Ridley*, *J. Straits Branch R. As. Soc.* no. 23, pp. 128, 130 (1891: Christmas I.; habits); *Trouessart*, *Cat. Mamm.* i. p. 81 (1897: Christmas I.); *Andrews*, *Mon. Christmas I.* p. 23, fig. 7 (skull), pl. i. (animal) (1900: habits); *Miller*, *Fam. & Gen. Bats*, p. 58 (1907).

*Pteropus* (Spectrum) hypomelanus *l. natalis*, *Matschie*, *Megachir.* p. 26 (1899). *i. natalis*, *Trouessart*, *Cat. Mamm., Suppl.* p. 52 (1904: Christmas I.).

Large Fruit Bat, *Andrews*, *Geogr. Journ.* xiii. p. 32 (1899: Christmas I.).

*Diagnosis*.—Allied to *Pt. modiglianii*, but smaller, with shorter cheek-teeth and much longer fur. Blackish or seal-brown above and beneath, with or without a slight paler wash on the mantle. Forearm 125–135 mm. *Hab.* Christmas I. (Indian Ocean).

*Skull*.—General characters of skull as in *Pt. modiglianii*, but size much smaller: total length 54.5–56 mm., against 61.5–67 in *Pt. modiglianii*; size of orbits (diameter contained 5.1–5.25 times in total length of skull) slightly larger than in *Pt. niadicus* and *melanotus* (5.4–5.55 times), but not quite as large as in *Pt. modiglianii* (4.75–5.0 times).

*Teeth*.—Differing from those of *Pt. modiglianii* in the following particulars:—Canines heavier at base, and more recurved; cingulum

\* U.S. N. M. nos. 140978, 80, 81, 83, 84, 85.

† Misprinted *Pt. melas* on p. 512.

broader; vertical groove on front face of upper canines in most specimens quite obliterated, occasionally traceable on close examination;  $p_1$  comparatively larger,  $m^2$  and  $m_3$  reduced,  $p^3$ - $m^2$  and  $p_3$ - $m_3$  comparatively shorter, owing to a reduction of the posterior portion of the teeth; posterior basal ledges of  $p^3$  and  $p_3$  distinct, though much shortened, in all other cheek-teeth scarcely developed. —All cheek-teeth, particularly the molars, in adult specimens covered with a dark brown or blackish coat of tartaric acid (sometimes so thick as to nearly obliterate the structure of the teeth).

*Fur*.—Much longer than in *Pt. modiglianii*, dense, soft; directed posteriorly on back, but not adpressed, spreading on mantle and rump. Longest hairs of back and mantle 25 mm., of belly 24 mm. Distribution of fur as in *Pt. modiglianii*, but hairs on upper surface of proximal third of forearm slightly more conspicuous, and fur on lateral interfemoral extending backward along inner side of tibia to end of proximal third or half of the limb.

*Colour*.—Twelve skins, adult males and females (Feb., Aug., Sept., Oct.), teeth in different stages of wear:—General impression, uniform blackish seal-brown above and beneath. Underparts (fore-neck, breast, belly, flanks) in some specimens precisely similar in tinge to back, in others distinctly paler, a dark shade of vandyck-brown approaching seal-brown. Mantle generally not differing from back and head, but in some specimens the tippet is indicated by a distinct russet or pale cinnamon wash of the hairs on the sides of the neck (above the neck-glands), and in some of these specimens this same tinge extends to the base of the fur of the whole of the mantle, while in others the paler tinge is confined to the sides of the mantle, the hairs in the central portion of the mantle being dark-coloured from tip to base. Rump generally not differing from back, sometimes faintly tinged with vandyck-brown. Fur everywhere very thinly sprinkled with greyish-white or greyish-buffy hairs, particularly on the underside of the body.

There is no appreciable sexual difference in colour. Three females (skins, teeth unworn or much worn; Oct., Nov., one undated) have no trace of a tippet; of nine adult males, five (skins, teeth unworn; Feb., Aug., Sept., Oct.) have an indication of a tippet as described above, while four (same age; Aug., Oct., Nov.) are similar to the females.

A half-grown young male (skin) is similar in colour to the adults, and with no trace of pale colour in the mantle.

*Measurements*. On pp. 235, 236.

*Specimens examined*. The British Museum series.

*Range*. Christmas Island, S. of Java.

*Type* in collection.

*Habits*.—This species (Dr. Andrews writes, 1900, *l. s. c.*) is very common all over Christmas Island, hundreds of individuals being sometimes seen together. Near the settlement it causes considerable destruction of fruit (papaia, bananas), but when the wild fruits, particularly those of the "Saoh" (*Sideroxylon*) and the "Gatet" (*Inocarpus*) are ripe, comparatively few of these bats visit the gardens, while great numbers may be seen in the forest. They

are largely diurnal in their habits; several may be observed sailing and circling high in the air in the hot sunlight, even at midday, and they are also frequently seen feeding in the daytime. The cry is a very loud harsh screech, apparently uttered both during the inspiration as well as the expiration of the breath. Fœtal specimens, some near the term, were obtained towards the end of December; a female carrying a well-grown young one was shot at the end of July.

- a.* ♀ ad. al.; skull. Christmas I., S. of Java (H.M.S. 'Flying Fish': Capt. Maclear). Lords of the Admiralty [P.]. 87.4.26.1. (Type of species.)
- b, c.* ♀ ad., ♂ pull. al. Christmas I. (H.M.S. 'Flying Fish': Capt. Maclear). Lords of the Admiralty [P.]. 87.4.26.2, 3.
- d.* ♂ ad. sk.; skull. Christmas I.; 30 Sept. 1887 (H.M.S. 'Egeria'). J. J. Lister, Esq. [C. & P.]. 88.7.9.1.
- e, f.* ♂ ad., ♀ ad. al. Christmas I.; 30 Sept., 3 Oct. 1887 (H.M.S. 'Egeria'). J. J. Lister, Esq. [C. & P.]. 88.7.9.2, 3.
- g-l.* 3 ♂ ad., 1 ♂ juv., 2 ♀ ad. sks.; skulls of *g-k.* Christmas I.; Oct. 1897, Feb. 1898 (Dr. C. W. Andrews). Sir John Murray [P.]. 99.8.6.1-4, 50-51.
- m.* ♀ ad. skeleton. Christmas I. (Dr. Andrews). Sir John Murray [P.]. 99.8.6.5.
- n-r.* 4 ♂ ad., 1 ♀ juv. sks.; skulls. Christmas I.; 22, 31 Aug., 4 Sept. 1908 (Dr. Andrews). Sir John Murray [P.]. 9.1.16.1-5.

*External measurements of Pteropus modiglianii and natalis.*

	<i>Pt. modiglianii.</i> 7 ad. (Incl. cotype.)		<i>Pt. natalis.</i> 12 ad. (Incl. type.)	
	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.
Forearm .....	134.5	141	125	135
Pollex, total length, c. u. ....	58	62.5	53	57.5
" metacarpal .....	13.5	15	11	13.5
" 1st phalanx .....	29	31.5	26.5	29
2nd digit, metacarpal .....	70.5	75.5	62	68
" 1st phalanx .....	16.5	18.5	13.5	15
" 2nd-3rd phalanx, c. u. ....	14.5	15.5	11.5	15.5
3rd digit, metacarpal .....	93.5	97.5	83	92.5
" 1st phalanx .....	69.5	74.5	60	69
" 2nd phalanx .....	92	100.5	80.5	94
4th digit, metacarpal .....	90.5	96.5	78	89
" 1st phalanx .....	55	60.5	51	54
" 2nd phalanx .....	54	56.5	49	56.5
5th digit, metacarpal .....	96.5	101	85.5	94
" 1st phalanx .....	40.5	45	38	41
" 2nd phalanx .....	39	42.5	35.5	43.5
Ear, length from orifice .....	27	...	25	27
" greatest width, flattened .....	17	...	15	17
Front of eye to tip of muzzle .....	...	...	21.5	23
Lower leg .....	61	64	60	66
Foot, c. u. ....	44	...	37.5	42.5
Calcar .....	16	...	15	17.5

*Measurements of skulls and teeth of Pteropus modiglianii  
and natalis.*

	<i>Pt. modiglianii.</i> Skulls: 7 ad. Teeth: 6 ad. (Incl. cotype.)		<i>Pt. natalis.</i> Skulls and teeth: 12 ad. (Incl. type.)	
	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.
Skull, total length to gnathion .....	61.7	66.8	54.5	56
„ palation to incisive foramina .....	31.5	34.2	26.8	28
„ front of orbit to tip of nasals .....	19.8	21.8	17.7	18.7
„ width of brain-case at zygomata .....	22	23.7	19.3	20.7
„ zygomatic width .....	33	37	27.2	30.2
„ width across m <sup>1</sup> , externally .....	18.2	19	15.3	16.8
„ lachrymal width .....	12.8	13.8	11	11.8
„ width across canines, externally .....	12.6	13.8	11.2	12.2
„ postorbital constriction .....	6.5	8	4.8 *	7
„ interorbital constriction .....	8.2	9.5	6	6.7
„ width of mesopterygoid fossa .....	7	8	6.7	7.2
„ between p <sup>4</sup> -p <sup>4</sup> , internally .....	10	10.8	8	8.5
„ between cingula of canines .....	6.6	7.7	5.2	6.2
„ orbital diameter .....	13	13.3	10.4	10.9
Mandible, length .....	49.5	52.8	43.8	45.5
„ coronoid height .....	23.7	26	22.2	24.7
Upper teeth, c-m <sup>2</sup> .....	24	26.5	21.5	22.8
Lower teeth, c-m <sub>3</sub> .....	27.2	29.2	23.2	24.8
Upper incisors, combined width .....	6.7	7.1	5	5.6
p <sup>3</sup> , length .....	4.8	4.8	4	4.2
„ width .....	3.2	3.7	3.2	3.4
p <sup>4</sup> , length .....	5	5.2	4.2	4.8
„ width .....	3.2	3.7	3.2	3.8
m <sup>1</sup> , length .....	5.7	6.1	4.8	5.5
„ width .....	3.1	3.2	3.2	3.7
m <sup>2</sup> , length .....	2.7	3	1.7	2
„ width .....	2.2	2.7	1.8	2.1
p <sub>1</sub> , length .....	2	2.2	2.1	2.7
„ width .....	2	2.2	2	2.2
p <sub>3</sub> , length .....	4.8	5	4.1	4.2
„ width .....	2.8	3.2	2.9	3
p <sub>4</sub> , length .....	5	5.2	4.5	4.5
„ width .....	3	3.1	3.2	3.4
m <sub>1</sub> , length .....	5	5.3	4.7	4.8
„ width .....	3	3.1	3.2	3.5
m <sub>2</sub> , length .....	4	4.3	3.5	3.7
„ width .....	2.8	3	3	3.2
m <sub>3</sub> , length .....	2.1	2.8	1.8	2.1
„ width .....	1.8	2.1	1.8	2

\* Senile specimen.



F. THE *PTEROPUS MELANOPOGON* GROUP.

*Species*.—*Pt. melanopogon*, *aruensis*, *keyensis*, *livingstonei*.

*Range*.—Amboina group (perhaps north-west to Sanghir Islands), Banda Islands, Timor Lant, Key and Aru Islands. One species in the Malagasy region (Comoros).

*General characters*.—Skull typical Pteropine (rostrum somewhat shortened in *Pt. keyensis*), dentition heavy but not otherwise modified. Palate-ridges normal (5+5+3). Ears moderate, broader than usual, not attenuated above; tip rather blunt, in one species extremely broadly rounded off. Fur generally very short and closely adpressed; tibia always naked above. Interfemoral scarcely developed in centre. Colour varying according to species. Sexual differentiation inconspicuous (canines heavier in males, no neck-tufts). Size large or very large (forearm 162–204 mm.).

*Specific differentiation*.—*Pt. melanopogon* is peculiar in having the fur of the back excessively shortened and restricted to a narrow spinal tract (aged specimens in abraded pelage being nearly naked on back); in the other species the furred area of the back is of normal breadth. In colour *Pt. melanopogon* is the most ordinary-looking of the four species: blackish back, chestnut head and collar, golden-buffy underside of body (compare *Pt. rufus*). *Pt. aruensis* is not essentially different from *Pt. melanopogon* in the colour of the head, collar and underparts, but the back is glossy silvery whitish (an excessive development of the silvery whitish element in the colour of the back is seen in certain other species of the genus: compare *Pt. hypomelanus canus* and *lepidus* with the dark-backed races of the same species, certain individuals of *Pt. hypomelanus tomesi* with the normal dark-backed individuals of the same race; even in *Pt. aruensis* the back is not uniform silvery whitish, but thinly sprinkled with blackish hairs, reminiscent of the descent of the species from a dark-backed form). *Pt. keyensis* is nearly uniform yellowish above and beneath. As already mentioned above, the ears in the typical species of this group are rather broader than usual with the tip somewhat blunt; in the only Malagasy representative (*Pt. livingstonei*) they are so excessively broadened above as to be almost semicircularly rounded off, the fur is longer and harsher than usual, the general colour blackish above and beneath, with or without a remnant of a bright tippet; it is a mountain form, confined to the Comoros, perhaps to one island (Johanna I.).

*Affinities of group*.—Judging from the typical Pteropine characters of the skull and dentition, the origin of this group is probably close to that of the foregoing types of the genus. It is not improbable that the *rufus*, *melanotus*, and *melanopogon* groups are rather intimately related (compare the style of colour of *Pt. melanopogon* with that of *Pt. rufus*), the first representing a truly Malagasy, the second an Andaman-Nicobar, the third an Austro-Malayan branch of the same prototype. *Pt. melanopogon*, *keyensis*, and *aruensis* have hitherto been placed in the closest vicinity of *Pt. papuanus* and

*neohibernicus* (originally these five species were described as varieties of one form); but *Pt. papuanus* and *neohibernicus* are so essentially different from the three former species in dentition and palatoidges (5+8+3) that a close relationship with the *melanopogon* group would seem to be excluded.

### 38. *Pteropus melanopogon*, Pet.

*Pteropus melanopogon* (pt.), Dobson, Cat. Chir. B. M. p. 44.

*Pteropus phaiops* (nec Temm., 1825), Temminck, Mon. Mamm. ii. p. 65 (pt.), pl. xxxv. fig. 3 (head), pl. xxxvi. figs. 1, 2, 3 (skull) (1837: Amboina); Wagner, Schreber's Säug., Suppl. i. p. 346 (pt.) (1839: Amboina); S. Müller, in Temminck's Nat. Gesch. Nederl. Oerz. Bez., Zoogd. pp. 20, 59 (pt.) (1839-44: Amboina; Banda); Lesson, N. Tabl. R. An., Mamm. p. 13, no. 171 (pt.) (1842: Amboina); Schinz, Syst. Verz. Säug. i. p. 122 (pt.) (1844: Amboina; Banda); Gray, Zool. 'Samarang,' Vert. p. 11 (pt.) (1849: Amboina; Banda); Wagner, Schreber's Säug., Suppl. v. p. 596 (pt.) (1853-55: Amboina; Banda); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 418 (pt.) (1870: Amboina; Banda); Rosenberg, Malay. Arch. pp. 322, 360 (1878: Ceram; Goram).

*Pteropus phaeops* (pt.), Giebel, Säug. p. 996 (1855: Amboina).

*Eunycteris phaiops* var., Gray, Cat. Monk. &c. p. 113 (1870: Buru; Ceram; Goram).

*Pteropus melanopogon*, Peters, MB. Akad. Berlin, 1867 (27 May), p. 330 (Buru; Amboina; Boano; Saparua; Ceram; Goram; Manavolka); Dobson, Cat. Chir. B. M. pp. 44, 47 (pt.) (1878: Buru; Ceram; Goram; the locality "Ceram" for specimen *d* is a mistake for Goram); Trouessart, Rev. & Mag. Zool. (3) vi. p. 205 (pt.) (1879: Amboina; Boano; Saparua; Ceram; Goram; Manavolka); Jentink, Cat. Ost. Mamm. p. 255 (pt.) (1887: Siao, Sanghir Is.; Buru; Amboina; Boano; Ceram; Goram; Manavolka); id. Cat. Syst. Mamm. p. 142 (1888: Siao; Buru; Amboina; Boano; Saparua; Ceram; Goram; Manavolka); Trouessart, Cat. Mamm. i. p. 80 (pt.) (1897: Buru; Amboina; Ceram); Willink, Nat. Tijds. Nederl. Ind. lxx. p. 272 (pt.) (1905: Buru; Amboina; Ceram; Goram; Banda); Miller, Fam. & Gen. Bats, p. 58 (1907).

*Pteropus* (*Eunycteris*) *melanopogon*, Matschie, Megachir. p. 11 (1899: Buru; Amboina); Trouessart, Cat. Mamm., Suppl. p. 49 (1904: Sanghir; Buru; Amboina; Ceram).

*Diagnosis*.—Skull typical Pteropine. Posterior ledges of premaxillaries above and below well marked but short; cingulum of canines well defined but rather narrow. Ears moderate, broadly rounded off above; wing-membranes arising very close together from sides of spine; interfemoral short in centre; fur of back extremely short, adpressed, and restricted to a very narrow spinal line; forearm and tibia practically naked. Back blackish; head and neck all round rich chestnut lightened with golden orange-buff above; breast and belly generally uniform light golden buffy, sometimes buffy in centre and darker on sides; chin and throat blackish. Size very large: forearm 196-204 mm. Hab. Amboina group; Banda Is.; Timor Laut.

*Skull*.—Heavily built, with large orbits, strong crests, and long postorbital processes. Rostrum deep and broad; distance from tip of postorbital processes to gnathion more than from former point to lambda. Orbital diameter greater than width of rostrum across alveolar borders of  $p^1$ - $p^1$ ; front of orbit above front of  $m^1$ . Postorbital processes nearly reaching, sometimes in contact with, corresponding processes of zygoma; frontal region between postorbital processes much concave. Sagittal crest deep. Palate much broader than in *Pt. vampyrus*: between inner sides of  $p^4$ - $p^4$  14-14.8 mm., against 12.2 to 12.8 in *Pt. vampyrus vampyrus*. Coronoid process broad antero-posteriorly, but not higher than usual; coronoid height of mandible less than  $c-m_3$ ; condyle considerably above alveolar line of mandible.

*Teeth*.—Cingulum of upper canines well defined but rather narrow; crown in profile slightly recurved; median ridge on lingual face and anterior and posterior margins sharply projecting; vertical groove on front face broad and deep, terminating well above tip of tooth.  $p^1$  spiculiform, deciduous. Posterior ledge of  $p^3$  and  $p_3$  short, distinctly marked off postero-externally by small notch from base of outer main cusp. Corresponding ledge of  $p^1$  and  $p_1$  short, more developed on inner than outer side of tooth; postero-external notch generally obsolete, sometimes (at least in young teeth) quite distinct; line of posterior margin of  $p^1$  projected inward passing very nearly through middle of  $m^1$  of opposite side.  $m^1$  nearly once and a half as long as broad.  $m^2$  equal to or slightly larger than  $p_1$ .  $i_2$  once and a half or nearly twice the bulk of  $i_1$ . Lower canines recurved, cingulum well defined, but rather narrow.  $p_1$  from twice to nearly twice and a half the size of  $i_2$ .  $m_3$  generally a trifle smaller than  $p_1$ .

*Palate-ridges*.—5+5+3. First ridge terminating laterally at front of canine; second at back of canine; third at front of  $p^3$ ; fourth at back of  $p^3$ ; fifth at middle or front of  $p^4$ ; sixth at front of  $m^1$ ; seventh at back of  $m^1$ ; eighth to tenth behind  $m^2$ ; eleventh to thirteenth situated at palation border.

*Ears*.—Moderate, exposed, reaching about half the distance to hinder corner of eyes. Upper third of inner margin strongly convex, corresponding portion of outer margin flatly convex, making tip of conch rather broadly rounded off.

*Wings*.—Membranes arising unusually close together (about 10 mm. apart) from sides of spinal region.

*Interfemoral*.—Much reduced in centre; depth a few millimetres.

*Fur*.—Extremely short on upperside of body, and restricted to a narrow spinal line of closely adpressed hairs; moderate on neck and underparts. Length: back 7-8, mantle 16-19, belly 13-17 mm. Least width of furred line of back 9-11 mm. Specimens in abraded pelage are nearly naked on middle of back.

Forearm, tibia, and tip of femur naked above and beneath, except for some thinly scattered, short, adpressed hairs on upperside of forearm in front of elbow region. Interfemoral naked, except in

centre and along inner side of femur. Hairing on underside of membranes as usual.

*Colour*.—Skins of two adults, Buru and Ceram (62.5.24.1 and 52.5.1.5): Back glossy blackish seal-brown; rump slightly mixed with chestnut, inner sides of thighs with chestnut and greyish buffy hairs.—Breast rich glossy golden yellowish-buff, strongly contrasting with chestnut foreneck, shading gradually into glossy golden straw-yellow on belly and crissum, and into orange-ochraceous on flanks. Base of fur everywhere nearly straw-yellow. Underside of humerus blackish sprinkled with buffy.—Mantle rich glossy chestnut mixed with golden orange-buff hairs, lightening posteriorly (shoulder-region) to deep golden orange-buff, and passing on sides of neck into dark chestnut, this in turn on foreneck into a slightly brighter golden chestnut. Concealed bases of hairs everywhere paler than tips.—Crown glossy yellowish orange-buff (somewhat paler than shoulders), darkening on sides of head to chestnut sprinkled with orange-buff hairs, this again to blackish on throat and chin.

A nearly new-born young from Buru (skin, 62.5.24.3; hairs not out on centre of breast and throat) is similar in colour to the adults, but with paler mantle and head.

An immature female from Goram (skin, 61.12.11.5) is similar to the adult specimens from Buru and Ceram, but with underside of body conspicuously darker. Centre of breast and belly rich glossy golden buff-yellow, gradually shading into tawny ochraceous and tawny on sides of breast and belly, and this tinge again into deep vandyck-brown on flanks and anal region. Underside of humerus blackish.

An immature male from Timor Laut (al., 83.3.24.1) is perfectly similar in colour to the above described adult specimens from Buru and Ceram.

The type of the species (Amboina) and five specimens in the Leyden Museum from Amboina, Ceram, and Saparna are on the whole very similar to the British Museum series from Buru, Ceram, Goram, and Timor Laut, the only noteworthy individual variations being nearly the same as in the British Museum series, viz., the lighter or darker tinge of the colour of the head, mantle, and flanks, and the more or less conspicuous sprinkling of the inner sides of the thighs with chestnut and buffy hairs. The colour of the flanks varies in the whole series from rich orange-ochraceous (brightest extreme) to nearly chestnut seal-brown.

*Sexual differentiation*.—Canines noticeably stronger in males than in females. Measurements taken on one male and three females: upper canines, vertical extent from alveolar border 12 mm. (male) and 10–11 (females), antero-posterior basal diameter 6 (male) and 5.2–5.6 (females); lower canines, vertical extent 10.5 (male) and 8–9 (females), antero-posterior basal diameter 4.5 (male) and 3.8–4 (females).

*Measurements*. On pp. 244, 245.

*Specimens examined*. Thirteen, in the collections of the Berlin

(one, the type, Amboina), Leyden (seven, Amboina, Ceram, Saparua, viz. mounted specimens *g, h, i, j, l*, skeletons *a, b*), and British Museums (five, Buru, Ceram, Goram, Timor Laut).

*Range.* Amboina group: Buru, Amboina, Ceram, Boano, Saparua, Goram, Manavolka; Banda Islands; Timor Laut. The species has been recorded in literature from the Sanghir Islands; see references, above.

*Type* in the Berlin Museum.

*Pteropus melanopogon*, Peters; 1867.—Type locality, Amboina. Type, a mounted young adult male, skull *in situ*, collected by S. Müller, and acquired from the Leyden Museum; Reg. no. 2627.

*Remarks.*—The broad rostrum, well-marked posterior ledges of the premolars, broad ears, excessively narrow furred area of the back, and very large size, are the most conspicuous diagnostic characters of *Pt. melanopogon*. In the reduction of the fur of the back it is approached by *Pt. papuanus* and *neohibernicus*, in which, however, the posterior ledges of the premolars are obsolete; in size it is surpassed only by the largest races of *Pt. vampyrus*. The species has rather closely allied representatives in the Aru (*Pt. aruensis*) and Key Islands (*Pt. keyensis*).

a. [♀] ad. skull.		Purchased (Baker).	56.10.1.7.
b, c. ♀ ad., pull. sks.; skull of b.	Buru.	Dr. A. R. Wallace [O.].	62.5.24.1, 3.
d. Ad. st.	Ceram.	Purchased (Verreaux).	52.5.1.5.
e. ♀ imm. sk.; skull.	Goram.	Dr. A. R. Wallace [C.].	61.12.11.5.
f. ♂ imm. sk. in al.; skull.	Timor Laut (Dr. H. O. Forbes).	British Association [P.].	83.3.24.1.

### 39. *Pteropus aruensis*, Pet.

*Pteropus melanopogon* (pt.), Dobson, Cat. Chir. B. M. p. 44.

*Pteropus argentatus* (nec Gray, 1844), Gray, *P. Z. S.* 1858, p. 107 (Aru Is.); *id.*, *Cat. Mamm. New Guinea*, p. 2 (1859: Aru Is.); *Finsch, New-Guinea*, p. 150 (pt.) (1865: Aru Is.); *Rosenberg, Reis. Zuidoostereil.* p. 31 (pt.) (1867: Aru Is.); *id.*, *Malay. Arch.* p. 360 (pt.) (1878: Aru Is.).

*Pteropus melanopogon* var. *aruensis*, Peters, *MB. Akad. Berlin*, 1867 (27 May), p. 330 (Aru Is.); *Peters & Doria, Ann. Mus. Civ. Genova*, xvi. p. 689 (1881: Aru Is.); *Trouessart, Cat. Mamm. i.* p. 80 (1897: Aru Is.); *Matschie, Megachir.* pl. vi. figs. 3, 3a, 3b (skull) (1899).

*Pteropus aruensis*, *Jentink, Cat. Ost. Mamm.* p. 256 (pt.) (1887: Wokam; Wonumbay); *id.*, *Cat. Syst. Mamm.* p. 143 (pt.) (1888: Wokam; Wonumbay); *Matschie, Megachir.* p. 14 (1899: Aru Is.); *Trouessart, Cat. Mamm., Suppl.* p. 49 (1904: Wokam); *Willink, Nat. Tijd. Nederl. Ind.* lxx. p. 274 (1905: Aru Is.).

*Pteropus melanopogon* *aruensis* (pt.), *Heller, Abh. Mus. Dresden*, vi. no. 8, p. 4 (1897: Aru Is.).

*Pteropus rubiginosus*, *Rosenberg, Reis. Zuidoostereil.* p. 31 (1867: Wokam); *id.*, *Malay. Arch.* p. 360 (1878: Wokam).

- ? *Pteropus fumigatus*, *Rosenberg, Reis. Zuidoostereil.* p. 31 (1867: Wonumbay); *id.*, *Malay. Arch.* p. 260 (1878: Wonumbay).  
*Pteropus hypomelas* (*nec* *Pt. hypomelanus*, *Temm.*), *Gray, Cat. Monk.* &c. p. 110 (1870: Aru Is.).  
*Pteropus melanopogon* *var. B* (pt.), *Dobson, Cat. Chir. B. M.* pp. 45, 47 (1878: Aru Is.).  
*Pteropus melanopogon* (pt.), *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 205 (1879: Aru Is.); *Willink, Nat. Tijl. Nederl. Ind.* lxx. p. 272 (1905: Aru Is.).

*Diagnosis*.—Similar to *Pt. melanopogon*, but furred area of back not unusually narrow, colour different. Back and rump glossy silvery whitish, contrasting with chestnut collar. Forearm about 190–191 mm. *Hab.* Aru Is.

*Skull and teeth*.—Apparently not differing in any noteworthy character from those of *Pt. melanopogon*. The three skulls examined (Leyden Museum, *a*, *b*, *c*) are slightly immature.

*Fur*.—Closely adpressed on back, but longer than in *Pt. melanopogon*. Approximate length, back 12–13, mantle and belly 16–17 mm. Least width of furred area of back 45–47 mm. Distribution of fur on limbs as in *Pt. melanopogon*.

*Colour* (type).—Back and rump glossy silvery greyish-white, everywhere thinly sprinkled with blackish hairs [“back of a silky or silvery shining white, very beautiful in the freshly killed animals,” Wallace MS. quoted by Gray, *l. s. c.*]—Flanks and belly golden buffy slightly washed with pale cinnamon, gradually darkening to cinnamon-rufous on lateral parts of front of breast, and clouded with blackish chestnut on centre of breast. Breast, belly, and flanks everywhere sprinkled with glossy pale golden buffy and a few blackish hairs.—Mantle blackish maroon-chestnut, lightening to chestnut posteriorly in shoulder region and anteriorly on occiput, and gradually darkening to blackish seal-brown on sides of neck and foreneck. Base of fur of collar everywhere much lighter than exposed tips of hairs.—Crown and sides of head dark brownish, heavily sprinkled with shiny pale buffy hairs. Chin blackish seal-brown like foreneck.

Individual variation chiefly confined to a darker or somewhat paler tinge of the chestnut-coloured portions of the pelage. Back and rump silvery whitish in all specimens examined.

*Measurements*. On pp. 244, 245.

*Specimens examined*. Six, in the collections of the Berlin (two), Leyden (three), and British Museums, including the type of the species.

*Range*. Aru Islands (Wokam).

*Type* in the Berlin Museum.

*Pteropus argentatus*, Gray; 1858.—*Pteropus argentatus*, Gray, 1844, is a species allied to *Pt. dobsoni* and *Pt. caniceps* (see *antea*, p. 197). *Pt. argentatus*, Gray, 1858 (*l. s. c.*), is the species here under consideration, as proved by his description and the specimen he had before him and which is in the collection. There can be no doubt that Gray, in 1858, correctly considered this bat an undescribed

species, and that it was only by a slip of the memory that he gave it a name which he had, fourteen years earlier, proposed for a different species of the genus. In 1870 (Cat. Monk. &c. p. 110, under the synonyms of *Pt. hypomelas*) he had discovered the lapsus, but now committed the error to identify the Aru bat with the widely different *Pt. hypomelanus*, Temm., the technical name of which he wrote *Pt. hypomelas*.

*Pteropus melanopogon* var. *aruensis*, Peters; 1867.—Type: ♂ ad. mounted, skull *in situ*, Aru Islands, collected by Bernstein, acquired by the Berlin from the Leyden Museum, Reg. no. 4962. The figure of the skull in the 'Megachiroptera des Berliner Museums' (*l. s. c.*) is not drawn from the type, nor from the only other specimen in the Berlin Museum (4703, Aru, Dr. Beccari); the original may be a Leyden skull (?).—Dobson (Cat. Chir. 1878) followed Peters, in so far as he considered *Pt. aruensis* only a variety of *Pt. melanopogon*, but with this variety he united *Pt. keyensis*. Jentink's view (Cat. Ost., 1887; Cat. Syst., 1888) is only a slight modification of Dobson's; he recognized *Pt. aruensis* as specifically distinct from *Pt. melanopogon*, but united with the former *Pt. keyensis*. Matschie (1899) recognized *Pt. melanopogon*, *aruensis*, and *keyensis* as distinct species, but the former he placed in the subgenus *Eonycteris*, the two latter in the subgenus *Pteropus*.

*Pteropus rubiginosus*, Rosenberg; 1867.—Described by Rosenberg as uniform "roestkleurig," darkest on head and neck, palest on underparts, iris brownish red; somewhat larger than "*Pt. argentatus*" [which in Rosenberg's writings is synonymous with *Pt. aruensis* and *Pt. keyensis*, as shown by a series of specimens from the Aru and Key Islands in the Leyden Museum, collected by Rosenberg, and labelled *Pt. argentatus*]. One example only, Wokam, Aru Islands; original number 23. In Rosenberg's manuscript Catalogue preserved in the Leyden Museum this specimen (Wokam, no. 23) is described as "roestgeel," larger than *Pt. argentatus*, iris brownish red, 9th April, perhaps a new species. The type is not in the Leyden Museum. By Matschie (*l. s. c.*) referred, with a query, to *Pt. aruensis*, but Rosenberg's brief notes (as quoted above) would rather seem to indicate a species allied to *Pt. papuanus*.—Rosenberg's 'Reis naar de Zuidoostereilanden' (dated 1867) appears to have been published late in 1867 or early in 1868, in either case after the May issue of the 'Monatsberichte' of the Berlin Academy for 1867 which contained Peters's description of *Pt. melanopogon* var. *aruensis*.

*Pteropus fumigatus*, Rosenberg; 1867.—Described by Rosenberg as "grauw-bruin" (in the German version, 1878, "einfarbig rauchbraun"), smaller than *Pt. argentatus*, iris brownish yellow; common in Wonumbay, Aru Islands. In Rosenberg's MS. Catalogue of his collections (Leyden Museum) only one specimen is registered: Wonumbay, no. 56, female, "grijsachtig bruin," below medium size, iris brownish yellow, 15th May. The type is not in the Leyden Museum. By Matschie (*l. s. c.*) put down, with a query, under *Pt. aruensis*, a suggestion certainly not supported by Rosenberg's note on the colour and size. Perhaps a distinct species.

*Remarks.*—The collar (mantle, sides of neck, and foreneck) is in this species rather similar in colour to that of *Pt. melanopogon*, though on the whole slightly darker. But the chestnut of the collar is made still more conspicuous by the contrast of the beautiful silky whitish tinge of the back, a colour rather rare in the genus (cf. *Pt. temmincki*, *capistratus*, *personatus*, *hypomelanus canus*, *h. lepidus*). There can be no doubt that *Pt. aruensis* is the Aru representative of *Pt. melanopogon*, with which species it completely agrees in the characters of the skull and teeth and the shape and size of the ears. *Pt. aruensis* is similar to many other species of the genus in the distribution of the fur of the back, but peculiar in colour, while *Pt. melanopogon* is rather ordinary in colour, but peculiar in the extreme reduction of the furred area of the back.

a. Ad. st.

Aru Is.

Dr. A. R. Wallace [C.] 58.2.20.2.  
(Type of *Pt. argentatus*, Gray, 1858 nec 1844.)

*External measurements of Pteropus melanopogon and aruensis.*

	<i>Pt. melanopogon</i> . 3 ad.*		<i>Pt. aruensis</i> . 2 ad.†	
	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.
Forearm .....	196	204	190	191
Pollex, total length, c. u. ....	74.5	81	72.5	81.5
„ metacarpal .....	17.5	20	17	19
„ 1st phalanx .....	40.5	41.5	37.5	40
2nd digit, metacarpal .....	103	108	99.5	103.5
„ 1st phalanx .....	21.5	24	23	24
„ 2nd-3rd phalanx, c. u. ....	19	20	18	21.5
3rd digit, metacarpal .....	134	144.5	128	133
„ 1st phalanx .....	97.5	104.5	91	93
„ 2nd phalanx .....	144.5	147	127	...
4th digit, metacarpal .....	128.5	136	122.5	128
„ 1st phalanx .....	80.5	86.5	76.5	78
„ 2nd phalanx .....	81.5	85	74	74.5
5th digit, metacarpal .....	137	147	132.5	136
„ 1st phalanx .....	61	63.5	57	58
„ 2nd phalanx .....	60	63.5	...	...
Ears, length from orifice.....	30 <sup>+</sup>		...	
„ greatest width, flattened ...	19.5 <sup>+</sup>		...	
Lower leg .....	83.5	85	...	78.7
Foot, c. u. ....	...	58	...	...
Calcar .....	...	24	...	...

\* B.M. 62.5.24.1 (Buru) and 52.5.1.5 (Ceram); Leyden Museum 1 (Amboina).

† Type of species, and B.M. 58.2.20.2.

‡ Estimate (skins).



*Measurements of skulls of Pteropus melanopogon, and teeth of  
Pt. melanopogon and aruensis.*

	<i>Pt. melanopogon.</i> Skulls: 2 ad. Teeth: 2 ad., 2 imm.*		<i>Pt. aruensis.</i> Skulls: none. Teeth: 3 imm.†	
	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.
Skull, total length to gnathion .....	...	90		
„ palation to incisive foramina .....	40	44.5		
„ front of orbit to tip of nasals .....	28.2	31.2		
„ width of brain-case at zygomata .....	27.2	29.2		
„ zygomatic width .....	44	49		
„ width across m <sup>1</sup> , externally .....	22.8	23.5		
„ lachrymal width .....	17.8	19.8		
„ width across canines, externally .....	16.2	16.8		
„ postorbital constriction .....	7.5	8.7		
„ interorbital constriction .....	11	12.7		
„ width of mesopterygoid fossa .....	8.5	9.7		
„ between p <sup>1</sup> -p <sup>4</sup> , internally .....	14	14.8		
„ between cingula of canines .....	8.5	9.2		
„ orbital diameter .....	15.2	16.8		
Mandible, length .....	64.5	73		
„ coronoid height .....	32.8	37		
Upper teeth, c-m <sup>2</sup> .....	32.5	34.5		
Lower teeth, c-m <sub>3</sub> .....	36	39		
p <sup>3</sup> , length .....	6	6.8	6	6.2
„ width .....	4	4.7	3.8	...
p <sup>4</sup> , length .....	6.2	7	5.8	6
„ width .....	4.2	4.9	4.3	...
m <sup>1</sup> , length .....	7	7.1	6.8	7.2
„ width .....	3.8	4.1	3.7	...
m <sup>2</sup> , length .....	3	3.3	2.8	3.2
„ width .....	2.5	3	2.2	...
p <sub>1</sub> , length .....	2.5	3	2.7	2.8
„ width .....	2.2	2.8	...	2.8
p <sub>3</sub> , length .....	5.8	6.8	6.1	6.2
„ width .....	3.7	4	3.7	...
p <sub>4</sub> , length .....	6	6.8	6.2	6.8
„ width .....	3.8	4	3.8	...
m <sub>1</sub> , length .....	6	6.7	6.3	6.7
„ width .....	3.5	3.8	3.7	...
m <sub>2</sub> , length .....	4.8	5.1	5	5.2
„ width .....	3.2	3.7	3.2	...
m <sub>3</sub> , length .....	2.2	2.6	2	2.8
„ width .....	2.2	2.5	...	2.2

\* 2 ad., viz. B.M. 62.5.24.1 (Buru), Leyden Museum skeleton *a* (Amboina);  
2 imm., viz. B.M. 61.12.11.5 (Goram) and 83.3.24.1 (Timor Laut).

† Leyden Museum, teeth of skulls *a*, *b*, *c*.

40. *Pteropus keyensis*, *Pet.*

*Pteropus melanopogon* (pt.), Dobson, *Cat. Chir. B. M.* p. 44.

*Pteropus melanopogon* var. *keyensis*, *Peters, MB. Akad. Berlin*, 1867 (27 May), p. 330 (Key Is.); *Peters & Doria, Ann. Mus. Civ. Genova*, xvi. p. 689 (1881: Key Is.); *Trouessart, Cat. Mamm. i.* p. 80 (1897: Key Is.).

*Pteropus keyensis*, *Matschie, Megachir.* p. 14 (1899: Key Is.); *Trouessart, Cat. Mamm., Suppl.* p. 49 (1904: Great Key; Little Key; Koor); *Willink, Nat. Tijds. Nederl. Ind.* lxx. p. 274 (1905: Key Is.; Koor).

*Pteropus argentatus* (pt., *nec* Gray), *Rosenberg, Reis. Zuidoostereil.* p. 31 (1867: Key Is.); *id., Malay. Arch.* p. 360 (1878: Key Is.).

*Pteropus melanopogon* var.  $\beta$  (pt.), Dobson, *Cat. Chir. B. M.* p. 45 (1878: Key Is.).

*Pteropus melanopogon* (pt.), *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 205 (1879: Key Is.); *Willink, Nat. Tijds. Nederl. Ind.* lxx. p. 272 (1905: Key Is.).

*Pteropus aruensis* (pt., *nec* *Pet.*), *Jentink, Cat. Ost. Mamm.* p. 256 (1887: Great Key; Little Key; Koor); *id., Cat. Syst. Mamm.* p. 143 (1888: Great Key; Little Key; Koor).

*Pteropus melanopogon aruensis* (pt.), *Heller, Abh. Mus. Dresden*, vi. no. 8, p. 4 (1897: Key Is.).

*Pteropus chrysargyrus*, *Heude, Mém. Hist. Nat. Emp. Chîn.* iii. p. 177, footnote, pl. v. fig. 6 (teeth) (1896: Little Key).

*Diagnosis*.—Similar to *Pt. aruensis*, but colour of fur nearly uniform light yellowish above and beneath. Forearm 179–187.5 mm. *Hab.* Key Is.

*Skull and teeth*.—Rostrum markedly shorter than in *Pt. melanopogon*: from front of orbit to tip of nasals 25–27.7 mm., against 28.2–31.2 in *Pt. melanopogon*; front of orbit vertically above back of  $p^4$ , in *Pt. melanopogon* above front of  $m^1$ . Teeth not differing appreciably from those of *Pt. melanopogon* and *aruensis*.

*Palate-ridges*.—As in *Pt. melanopogon*.

*Wings*.—Membranes less closely approximated than in *Pt. melanopogon*, about 21 mm. apart at origin from sides of back.

*Fur*.—Length and distribution of fur as in *Pt. aruensis*. Approximate length, back 11–13, mantle and belly 14–15 mm. Least width of furred space of back about 45–47 mm.

*Colour*.—♂ ad. al., teeth worn, 82.7.27.3: Back and rump yellowish cream, tinged with pale maize-yellow on back and with buff-yellow on rump.—Fur of breast, belly, flanks, and crissum cream-coloured at base, tipped with buff-yellow on breast, belly, and flanks, and with light straw-yellow on crissum. Underside of humerus and woolly hairs on underside of membranes pale buffy.—Mantle, sides of neck, and foreneck deep chrome, palest on foreneck, shading into light buff-yellow on crown and sides of head, and into cream on muzzle and throat.

Individual variation in colour apparently small. All the individuals examined differ only in the deeper or paler tinge of the colours.

*Measurements.* On pp. 248, 249.

*Specimens examined.* Sixteen, in the collections of the Berlin (three), Leyden (twelve), and British Museums, including the type of the species.

*Range.* Key Islands: Great Key, Key Doulan, Little Key, Koor. Type in the Berlin Museum.

*Pteropus melanopogon* var. *keyensis*, Peters; 1867.—Type locality, Grand Key. Type, ♂ ad., mounted, skull extracted, collected by Rosenberg, acquired from the Leyden Museum: Reg. no. 4752.

*Pteropus chrysargyrus*, Heude; 1896.—Type locality, Little Key. Cotypes (at least two) presumably in the Zi-ka-wei Museum, Shanghai. The description of colour and size, and figure of teeth agree perfectly with *Pt. keyensis*.

*Remarks.*—This species is the Key Island representative of the *Pt. melanopogon* type. It accords with *Pt. melanopogon* and *aruensis* in the characters of the skull (apart from some shortening of the rostrum) and teeth, the number and arrangement of the palatridges, and the size and shape of the ears. It accords with *Pt. aruensis* and differs from *Pt. melanopogon* in the less closely approximated wing-membranes and broader furred area of the back. And it differs from both of the related species in the highly peculiar pale yellowish colour of the fur.

a. ♂ ad. al.; Key Doulan, Key Is. Lords of the Treasury [P.]. 82.7.27.3. skull. (H.M. 'Challenger').

#### 41. *Pteropus livingstonei*, Gray.

*Pteropus livingstonii*, Dobson, Cat. Chir. B. M. p. 55.

*Pteropus livingstonii*, Gray, P. Z. S. 1866, p. 66 (Johanna I.); *id.*, Cat. Monk. &c. p. 109 (1870: Johanna); Dobson, l. s. c. pl. iii. fig. 6 (ear) (1878: Johanna); Trouessart, Rev. & Mag. Zool. (3) vi. p. 202 (1879: Johanna); Dobson, Rep. Brit. Assoc. 1878, p. 162 (1879: remarks on distribution); Jentink, Cat. Syst. Mamm. p. 147 (1888: Johanna); Milne-Edwards & Oustalet, N. Arch. Mus. d'Hist. Nat. Paris, (2) x. p. 224 (1888: Johanna); Trouessart, Cat. Mamm. i. p. 81 (1897: Johanna); Matschie, Megachir. pl. iv. figs. 9, 10 (skull) (1899: Johanna); Miller, Fam. & Gen. Bats, p. 58 (1907).

*Pteropus* (Spectrum) *livingstonii*, Matschie, Megachir. p. 30 (1899: Johanna); Trouessart, Cat. Mamm., Suppl. p. 54 (1904: Johanna).

*Pteropus edwardsi* (pt., nec E. Geoff.), Peters, MB. Akad. Berlin, 1867, p. 325.

*Diagnosis.*—Allied to *Pt. melanopogon*, but ears semicircularly rounded off above, fur much longer, furred area of back of normal breadth, size smaller. Blackish above and beneath, with rump and sides of belly sprinkled with bright-coloured hairs, and with or without a tuft of tawny hairs on each shoulder. Forearm 162–172 mm. Hab. Johanna I., Comoros.

*Skull and teeth.*—Skull very similar in general shape to that of

*Pt. melanopogon*, but somewhat smaller, with narrower premaxillæ and relatively smaller orbits. Upper and lower postorbital processes sometimes fused so as to completely encircle the orbits.—Structure of cheek-teeth as in the allied species, but  $m^1$ ,  $m_1$ , and  $m_2$  relatively smaller. Vertical groove on front face of upper canines shallower, sometimes almost obsolete.

*Ears* (dried skins).—Large, exposed; differing in shape from those of any other species of this genus. Inner margin convex, outer margin straight or flatly convex; upper margin almost semicircularly rounded off.

*Wings*.—Lateral membranes arising more closely together than usual.

*Fur*.—Much longer than in *Pt. melanopogon*, rather harsh; directed backward but not very closely adpressed on back, spreading on mantle. Approximate length on back 21, mantle 25–27, belly 25 mm. Furred area of back not narrower than usual; forearm and tibia naked above.

*Colour*.—Two adult skins, unsexed, teeth quite or almost unworn

*External measurements of Pteropus keyensis and livingstonei.*

	<i>Pt. keyensis</i> 4 ad.*		<i>Pt. livingstonei</i> 3 ad. (Incl. type.)	
	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.
Forearm .....	179	187.5	162	172
Pollex, total length, c. u. ....	...	74	71	75
„ metacarpal .....	...	...	16.5	17.5
„ 1st phalanx .....	...	...	36.5	39.5
2nd digit, metacarpal .....	96	98	86.5	91.5
„ 1st phalanx .....	27	30	22	26
„ 2nd–3rd phalanx, c. u. ....	18	21	20.5	21.5
3rd digit, metacarpal .....	127	132	116	122
„ 1st phalanx .....	93	96	84	92
„ 2nd phalanx .....	133	140.5	115.5	122
4th digit, metacarpal .....	123.5	127.5	112.5	121
„ 1st phalanx .....	76	80	66.5	75
„ 2nd phalanx .....	76.5	80.5	...	...
5th digit, metacarpal .....	127	131	117	127.5
„ 1st phalanx .....	59	60	50	57.5
„ 2nd phalanx .....	57	59	48	53.5
Ears, length from orifice .....	33			
„ greatest width, flattened ...	22			
Front of eye to tip of muzzle .....	31.5			
Lower leg .....	86.5		? 80	
Foot, c. u. ....	54.5		51.5	53.5
Calcar .....	23.5		18 †	19.5 †

\* Type of species, and B.M. 82.7.27.3, and Leyden Museum *d* and *g*.

† Estimate (skins).

*Measurements of skulls and teeth of Pteropus keyensis and livingstonei.*

	<i>Pt. keyensis.</i> Skulls: 6 ad. Teeth: 2 ad., 2 imm.*		<i>Pt. livingstonei.</i> Skulls and teeth: 3 ad. (Incl. type.)	
	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	...	...	72†	75†
„ palation to incisive foramina .....	..	41.5	34.8	36
„ front of orbit to tip of nasals .....	25	27.7	25.8	26.5
„ width of brain-case at zygomata .....	...	...	...	25
„ zygomatic width .....	...	48.7	...	39†
„ width across m <sup>1</sup> , externally .....	22	22	20.3	20.8
„ lachrymal width .....	18	18.8	17.2	18.2
„ width across canines, externally .....	16	17	14.8	15
„ postorbital constriction .....	...	8.8	9	10.7
„ interorbital constriction .....	...	11.8	12	12.8
„ width of mesopterygoid fossa .....	...	8.7	9	9.7
„ between p <sup>4</sup> -p <sup>4</sup> , internally .....	...	13	12	12.8
„ between cingula of canines .....	...	10	8.7	8.8
„ orbital diameter .....	15.2	16	13	13.5
Mandible, length .....	65.8	66.5	56.5	59.5
„ coronoid height .....	33.8	37.2	28.2	31.5
Upper teeth, c-m <sup>2</sup> .....	29.2	33.3	28	29
Lower teeth, c-m <sub>3</sub> .....	33	36.8	31.2	32.3
Upper incisors, combined width .....	6.7	7.2	7	7
p <sup>3</sup> , length .....	5.7	6.2	5.3	5.7
„ width .....	3.7	4	3.7	3.8
p <sup>4</sup> , length .....	5.7	6.2	5.7	5.8
„ width .....	3.8	4.2	3.8	3.9
m <sup>1</sup> , length .....	6	7.1	6	6.3
„ width .....	3.2	3.5	3.6	3.7
m <sup>2</sup> , length .....	2.2	3	3	3.2
„ width .....	2.2	2.3	2.2	2.5
p <sub>1</sub> , length .....	2.5	2.8	2.7	2.9
„ width .....	2.1	2.2	2	2.5
p <sub>3</sub> , length .....	5.5	6.5	5.6	5.8
„ width .....	3.1	3.6	3.1	3.2
p <sub>4</sub> , length .....	5.8	6.2	5.9	6.2
„ width .....	3.1	3.6	3.2	3.3
m <sub>1</sub> , length .....	5.7	6.1	5.3	5.9
„ width .....	3.1	3.2	3.2	3.6
m <sub>2</sub> , length .....	4.2	5	4.2	4.8
„ width .....	2.8	3.1	3	3.1
m <sub>3</sub> , length .....	1.8	2.5	2.7	2.8
„ width .....	1.7	2.5	1.9	2

\* 6 ad., viz. type of species, and B.M. 82.7.27.3, and Leyden Museum skulls *d, g, h, i* (Grand Key, Petit Key) 2 imm., viz. Leyden Museum, teeth of skulls *e, f*.

† Estimate.

(type, and 88.5.9.1). Blackish or dark seal-brown above and beneath; rump, sides of belly, and flanks more or less thickly sprinkled with golden ochraceous or tawny hairs, most of these hairs with concealed silvery greyish-white bases. "Tippet" (mantle) reduced to a tuft of rich tawny hairs on each shoulder (or one median tuft), the tawny colour confined to the tips of the hairs and shading through ochraceous-buff in subapical portion to buffy whitish in basal portion of hairs; many of the blackish hairs in shoulder region tipped with golden tawny.

A third skin (aged, unsexed, teeth well worn; 88.5.9.2) differs in having the mantle practically uniform blackish, with some of the hairs in the shoulder region tipped with chestnut.

*Measurements.* On pp. 248, 249.

*Specimens examined.* The British Museum material.

*Range.* Only known from Johanna Island, Comoros. According to Humblot common in the large forests covering the summit of Johanna Island, but never seen in the low-lying portions of the island (Milne-Edwards & Onstalet, *l. s. c.*).

*Type* in collection.

a. Ad. sk.; skull.	Johanna I., Comoros	Earl Russell [P.].	63.12.11.2.
	(Dr. Livingstone).	(Type of species.)	
b, c. 2 ad. sks.; skulls.	Johanna I.	Purchased (Frank).	88.5.9.1,2.

#### G. THE *PTEROPUS RAYNERI* GROUP.

*Species.*—Six: *Pt. cognatus*, *rayneri*, *rubianus*, *lavellanus*, *grandis*, and *chrysoproctus*.

*Range.*—Solomon Islands and Moluccas.

*General characters.*—Rostrum shortened; coronoid height of mandible generally less than  $e-m_3$ . Posterior ledges of premolars short;  $m_3$  reduced;  $i_1$ ,  $i_2$ , and  $p_1$  unmodified. Ears moderate, exposed; fur of back short, adpressed; tibia hairy above (in *Pt. chrysoproctus* very thinly so). Colour in one species nearly uniform brownish above and beneath, with paler mantle, in all the others the upperside is tricoloured (bright mantle, dark back, bright rump). Males of all species, except *Pt. chrysoproctus*, with well-developed neck-tufts. Size varying (forearm 120–177 mm.).

*Differentiation of species.*—The extreme eastern species (*Pt. cognatus*: San Christoval) is externally (colour, size) rather similar to *Pt. brunneus* and *Pt. lombocensis*. In the other four Solomon Island species the rump is considerably brighter than the back, as bright as, or brighter than, the mantle; this tricoloured style of the coloration of the upperside (bright mantle, dark back, bright rump) is found again in the Moluccan representative of this group, but in no other species of the genus. *Pt. rayneri* (Guadalcanar) is larger than *Pt. cognatus*; *Pt. rubianus* (Rubiana), *Pt. lavellanus* (Vella Lavella), and *Pt. grandis* (Shortland and Bougainville) still larger. The three latter species, which are closely interrelated, differ

from each other in minor details of dentition, colour, and size. *Pt. chrysoproctus* (Amboina group) is on the whole rather closely allied to the large western Solomon Island species. As yet no form of this group is known from New Guinea.

*Affinities of group*.—Closely allied to the *Pt. lombocensis* group (*infra*), with which it accords in the shortening of the rostrum (a character still further developed in the *lombocensis* group), reduced size of  $m_3$ , tendency in certain species to reduction also of  $m^2$ , distribution of fur (tibia clothed above), and development of neck-tufts in males; *Pt. cognatus*, in colour apparently the least specialized form of the group, shows, as mentioned above, externally no small resemblance to *Pt. lombocensis*. The *rayneri* group differs from *Pt. lombocensis* chiefly in the lesser shortening of the rostrum, the less constant and less conspicuous reduction of  $m^2$ , and the perfectly normal  $i_1$ .

#### 42. *Pteropus cognatus*, K. *And.*

*Pteropus rayneri* (pt.), Dobson, Cat. Chir. B. M. p. 33.

*Pteropus rayneri* (pt.), Gray, Cat. Monk. &c. p. 108 (1870: San Christoval; nec Guadalcantar); Dobson, l. s. e. (1878: San Christoval); Trouessart, Rev. & Mag. Zool. (3) vi. p. 204 (1879: San Christoval); *id.*, Cat. Mamm. i. p. 78 (1897: San Christoval).

*Pteropus* (Spectrum) *rayneri* (pt.), Trouessart, Cat. Mamm., Suppl. p. 51 (1904: San Christoval).

*Pteropus cognatus*, K. Andersen, Ann. & Mag. N. H. (8) ii. p. 365 (1 Oct. 1908: San Christoval).

*Diagnosis*.—Rostrum short and broad;  $m_3$  conspicuously reduced in size. Ears moderate, exposed, narrowly rounded off at tip. Tibia clothed above. Dark brownish above and beneath (rump not differing from back) with cinnamon or russet mantle. Forearm at least 121 mm. (no perfectly adult specimens seen). *Hab.* San Christoval, E. Solomon Is.

*Skull*.—Chief characters (compared with the typical Pteropine skull): Rostrum short and broad, front of orbit vertically above posterior half of  $p^4$ ; mandible heavier posteriorly: coronoid height (26 mm.) subequal to length of lower tooth-row,  $c-m_3$  (25.5 mm.).

*Teeth*.— $m_3$  considerably reduced, little more than half the size of  $p_1$ ; also  $m^2$  slightly smaller than in *Pt. hypomelanus*. Cingulum of upper and lower canines stronger than in *Pt. hypomelanus*, forming a well-defined rather broad ledge at inner base of teeth. Other teeth scarcely differing, neither in form nor in size, from those of *Pt. hypomelanus*.

*Fur*.—Rather short, adpressed on back; approximate length of hairs, back 11–12, mantle 14, belly 14 mm. Tibia thickly clothed above for proximal two-thirds or three-fourths, underside of tibia hairy for proximal half.

*Colour*.—♂ imm. skin, December, type of species: General

aspect of back and rump Prout's brown; individual hairs seal-brown at base, with short paler brownish or buffy brownish tips, incompletely concealing the darker base of the fur. Rump not differing in colour from back.—Entire underside approximately Prout's brown, of a rather paler tinge than back, palest (indistinctly washed with buffy russet) on foreneck, and darkening almost to seal-brown along centre of breast and belly.—Mantle and sides of neck cinnamon, slightly tinged with russet, becoming paler posteriorly at shoulders; concealed base of hairs seal-brown. A tuft of buff-yellow glandular hairs on each side of neck, nearly concealed by surrounding darker fur (probably sexual character).—Crown and sides of head similar to back.

A second specimen (male, a little younger than the above; December; skin) is slightly paler in colour, owing to the pale-coloured tips of the hairs being rather longer and more approaching buffy cinnamon.

*Measurements.* On p. 257.

*Specimens examined.* The British Museum material.

*Range.* San Christoval, E. Solomon Islands.

*Type* in collection.

*History in literature.*—Gray's *Pt. rayneri* (1870, l. s. c.) is a mixture of two species, the one from Guadalcanar (his "male" and "female"), the other from San Christoval (his "young"). Since *Pt. rayneri* was based by Gray primarily on the adult "male" and "female" (which in fact are two adult females), both of which are from Guadalcanar, the name *Pt. rayneri* must be restricted to the Guadalcanar species. The characters of the San Christoval species were pointed out by me, and the species named *Pt. cognatus*, in 1908 (l. s. c.). The British Museum specimens of *Pt. cognatus* are the only ones on record (February, 1909).

*Remarks.*—From *Pt. rayneri*, with which this species accords in the characters of the skull and teeth (except perhaps in a still more conspicuous shortening of the rostrum), it is readily distinguished by having the rump similar in colour to the back, whereas in *Pt. rayneri* the rump is much brighter than and contrasting with the back. It is probably smaller than *Pt. rayneri*. Externally (distribution of fur, colour, size) it bears much resemblance to the Australian species of the *Pt. hypomelanus* group, *Pt. brunneus*, which however is typical hypomelanine in skull and dentition.

- |                       |  |   |            |
|-----------------------|--|---|------------|
| a. ♂ ad. skull.       | San Christoval, Solomon Is.; Dec. 1854 ( <i>J. MacGillivray</i> ). | Museum of Economic Geology [P.].                            | 55.11.7.5. |
| b. ♂ imm. sk.; skull. | San Christoval; Dec. 1845 ( <i>J. MacGillivray</i> ).              | Museum of Economic Geology [P.].                            | 55.11.7.9. |
| c. ♂ juv. sk.; skull. | San Christoval; Dec. 1854 ( <i>Dr. F. M. Rayner</i> ).             | ( <i>Type of species.</i> )<br>Lords of the Admiralty [P.]. | 56.7.7.1.  |



43. *Pteropus rayneri*, Gray.

*Pteropus rayneri* (pt.), Dobson, Cat. Chir. B. M. p. 33.

*Pteropus rayneri* (pt.), Gray, Cat. Monk. &c. p. 108 (1870: Guadalcanar; nec San Christoval); Dobson, l. s. c. (1878: Guadalcanar); Trouessart, Rev. & Mag. Zool. (3) vi. p. 204 (1879: Guadalcanar); id., Ann. Sci. Nat. (6) Zool. viii. Art. 12, p. 16 (1879: remarks on distr.); Thomas, P. Z. S. 1887, p. 322 (Guadalcanar); id., P. Z. S. 1888, p. 472 (Aola, Guadalcanar); Trouessart, Cat. Mamm. i. p. 78 (1897: Guadalcanar).

*Pteropus* (Spectrum) *rayneri* (pt.), Matschie, Megachir. p. 22 (1899: Aola, Guadalcanar); Trouessart, Cat. Mamm., Suppl. p. 51 (1904: Guadalcanar).

*Diagnosis*.—Similar to *Pt. cognatus*, but rump much brighter than and contrasting with back. Forearm 137.5–140.5 mm. *Hab.* Guadalcanar, E. Solomon Is.

*Skull and teeth*.—Skull similar to that of *Pt. cognatus*, though perhaps slightly larger, and with the rostrum not quite so much shortened (compare measurements, p. 257). Teeth scarcely differing from those of the allied species.

*Palate-ridges* (two specimens; 88.15.2, 3).—No special modifications. Formula  $\bar{5} + \bar{5} + 3$ . First ridge terminating laterally at front of canine; second at back of canine; third at front of  $p^3$ ; fourth at back of  $p^3$ ; fifth at middle of  $p^4$ ; sixth at front of  $m^1$ ; seventh at back of  $m^1$ ; eighth at back of  $m^2$ ; ninth and tenth behind  $m^2$ ; eleventh to thirteenth situated at palation border.

*Colour*.—♀ ad. skin, teeth slightly worn, December; cotype of the species (56.7.7.4):—Back uniform seal-brown with a slight purplish gloss, rather more inclining to vandyck-brown laterally along membranes, and posteriorly near rump. Rump and upperside of femur much brighter than and contrasting with back, buffy clay, washed with ochraceous-buff anteriorly near back, and shading to mars-brown on outer side of femur along membrane and upperside of tibia.—Breast uniform seal-brown. Flanks vandyck-brown, shading to mars-brown on belly, anal region, and underside of femur and proximal part of tibia.—Mantle and occiput deep cinnamon-rufous, approaching rich russet, contrasting with seal-brown back, passing through a darker shade on sides of neck, to vandyck-brown on fore-neck, the colour of this latter being scarcely different in tinge from that of the flanks. Concealed base of fur of mantle seal-brown.—Crown between Prout's brown and mars-brown, passing through a darker shade on sides of head to almost seal-brown on chin and throat, the colour of this latter very similar to that of the breast; crown, sides of head, chin, and throat sparsely sprinkled with silvery white hairs.

In the second cotype (same locality, sex, age, and month; skin; 55.11.7.7) the contrast between mantle and back, and back and rump is less striking, owing to the darker tinge of the mantle and rump: mantle approaching burnt-umber, rump pale russet with a slight wash of clay. Underside as in the foregoing, but the seal-brown colour restricted to the centre of the breast; sides of breast, flanks, belly, and anal region uniform pale vandyck-brown.

The amount of pale (silvery white, cream-buffy, or pale buffy) sprinkling of the fur of the head is individually variable; in one specimen ( $\varnothing$  imm. al.; 88.1.5.4) the pale hairs are so much in excess of the dark ones as to make the whole of the face, including the chin, cream-buffy, strongly contrasting with the mantle, back, and underparts.

*Sexual differentiation.*—Males differ from females in having a tuft of rich orange-buff glandular hairs on each side of the neck, nearly concealed by the surrounding darker fur. The tuft is present also in immature males, but absent in three females examined.

*Measurements.* On pp. 256, 257.

*Specimens examined.* The British Museum material.

*Range.* Guadalcanar, E. Solomon Islands.

*Cotypes* in collection.

*History in literature.*—Gray's *Pt. rayneri* (1870, *l. s. c.*) was based primarily on two adult skins collected by J. MacGillivray and F. M. Rayner in Guadalcanar. These two specimens (described by Gray as "male" and "female," but in fact both of them females) must therefore be taken as cotypes of *Pt. rayneri*, and Guadalcanar as the type locality of the species. Two immature specimens, obtained by MacGillivray and Rayner in San Christoval, and described by Gray (*l. s. c.*) as the "young" of *Pt. rayneri*, are a distinct species, *Pt. cognatus* (antea, p. 251).—The cotypes of *Pt. rayneri* (and an odd skull in the British Museum, probably also dating from MacGillivray or Rayner) remained for many years the only specimens known, until in 1887 C. M. Woodford collected a few examples in Aola, Guadalcanar, three of which are now in the British Museum, one in the Dresden Museum. So far, these are the only specimens on record (February, 1909).

*Remarks.*—Externally this species is readily distinguished from *Pt. cognatus* by its bright-coloured rump. In specimens which have this character strongly pronounced, the upperside is strikingly tricoloured: mantle some shade of russet, back seal-brown, rump buffy clay, the rump being decidedly brighter than the mantle, and the contrast between rump and back therefore greater than between mantle and back; this tricoloured pattern of the upperside is found again in *Pt. rubianus* (New Georgia group), *Pt. lavellanus* (Vella Lavella), *Pt. grandis* (Bougainville group), and *Pt. chrysoproctus* (Moluccas), but in no other known species of the genus.

a. Imm. skull.			Not reg.
b. $\varnothing$ ad. sk.; skull.	Guadalcanar, Solomon Is.; Dec. 1845 ( <i>J. MacGillivray</i> ).	Museum of Economic Geology [P.].	55.11.7.7.
c. $\varnothing$ ad. sk.; skull.	Guadalcanar; Dec. 1854 ( <i>Dr. F. M. Rayner</i> ).	Lords of the Admiralty [P.].	56.7.7.4.
		( <i>b, c</i> : cotypes of species.)	
d-f. $\sigma$ imm., $\sigma$ ad., $\varnothing$ imm., al.; skull of c.	Aola, Guadalcanar.	C. M. Woodford, Esq. [C.].	88.1.5.2-4.

44. *Pteropus rubianus*, K. And.

*Pteropus grandis* (pt.), Thomas, *P. Z. S.* 1888, p. 470 (1889: Rubiana, Solomons); Trouessart, *Cat. Mamm.* i. p. 80 (1897: Solomons); Matschie, *Megachir.* p. 15 (1899: Rubiana); Trouessart, *Cat. Mamm., Suppl.* p. 49 (1904: Rubiana).

*Pteropus rubianus*, K. Andersen, *Ann. & Mag. N. H.* (8) ii. p. 366 (1 Oct. 1903: Rubiana).

*Diagnosis*.—Allied to *Pt. rayneri*, but much larger. Back vandyck-brown, rump strongly contrasting yellowish buff, mantle and foreneck dark russet, shading to deep tawny on sides of breast and belly, and to yellowish buff on crissum; centre of breast seal-brown; forehead and sides of face mottled yellowish buff and chestnut. Forearm 163 mm. *Hab.* New Georgia group, Central Solomon Is.

*Skull*.—Scarcely differing in general shape from that of *Pt. rayneri*, but much larger and more heavily built, with strong sagittal crest, and unusually deep zygomatic arches. Rostrum rather short, deep, distinctly compressed laterally; front of orbit vertically above front of  $m^1$ .

*Teeth*.—Structure of teeth essentially as in *Pt. rayneri*. Upper canines heavy at base, antero-posterior basal diameter 5 mm.; ciugulum strong, forming a well defined, rather broad ledge; crown in profile faintly recurved, vertical groove on front face deep and broad; vertical keel on lingual face sharply projecting.  $p^1$  a minute spicule. Posterior ledge of  $p^3$  and  $p_3$  short, but distinctly marked off from tooth postero-externally. Ledge of  $p^4$  and  $p_4$  very short, postero-external notch distinct though very small in  $p^4$ , obsolescent in  $p_4$ .  $m^2$  much smaller than  $p_1$ , slightly larger than  $m_3$ .— $i_2$  twice and a half the bulk of  $i_1$ . Lower canines heavy at base: ciugulum forming a broad ledge; crown recurved.  $p_1$  large, twice the size of  $i_1$ .  $m_3$  very small, subequal to  $i_2$ .

*Palate-ridges* (one, the type).— $5+5+3$ . Arrangement as in *Pt. rayneri*.

*Ears*.—Short, covering about half the distance from base of ear to back of eye, when laid forward. Outer margin flatly concave in upper third, tip of ear rather narrowly rounded off. Basal half of hinder face of conch hairy.

*Wings*.—Membranes about 20 mm. apart at origin from back.

*Interfemoral*.—Short in centre; depth about 7 mm.

*Fur*.—Hair of back rather short, adpressed. Approximate length, back 13, mantle 19, belly 15 mm. Least width of furred area of back about 47 mm.

Above, fur extending in a narrow line of short closely adpressed hairs along humerus; region round elbow naked; forearm naked, except for some short thinly set hairs on proximal third. Femur, knee, proximal three-fourths of tibia, membrane along outer side of femur and proximal half of tibia, and interfemoral along inner side of femur and proximal three-fourths of tibia, thickly furred.—Below, forearm and tibia practically naked. Antebrachial

membrane, lateral membrane along outer side of forearm and between humerus and femur covered with rather long woolly hairs.

*Colour* (type, ♂ ad. al.).—Back glossy brownish, between vandyek-brown and burnt-umber, with a tinge of golden buffy, this colour extending backward in a narrow line along sides of rump next to membranes. Rump, upperside of interfemoral, and thighs yellowish buffy, much lighter than mantle and strongly contrasting with back; upperside of tibiae similar, but washed with ochraceous; base of fur of rump seal-brown.—Centre of breast dark seal-brown, forming a large well-defined patch. Sides of breast, flanks, and belly rich tawny, this colour confined to tips of hairs; sub-apical portion of hairs paler, ochraceous or ochraceous-buff, extreme base seal-brown. Anal region and thighs yellowish buff, nearly similar in tinge to rump.—Occiput, mantle, sides of neck, foreneck, and throat rich glossy russet, approaching pale chestnut, darker than sides of breast, and lightening to yellowish ochraceous-buff on shoulders; extreme base of hairs of mantle dark brown. A tuft of rigid, orange-ochraceous glandular hairs on each side of neck, contrasting in colour with surrounding darker fur (sexual character). Forehead and sides of face mixed yellowish buff and chestnut, shading on crown gradually into bright chestnut of occiput.

*External measurements of Pteropus rayneri and rubianus.*

	<i>Pt. rayneri.</i> ♂ ad. (Incl. cotypes.)		<i>Pt. rubianus.</i> ♂ ad. Type.
	Min.	Max.	
	mm.	mm.	mm.
Forearm .....	137.5	140.5	163
Pollex, total length, c. u. ....	57	63	69
"  metacarpal .....	11.8	12.8	16
"  1st phalanx .....	29	34.2	35.5
2nd digit, metacarpal .....	67	70	82
"  1st phalanx .....	16.7	18.7	21
"  2nd-3rd phalanx, c. u. ....	13.2	15.2	19.5
3rd digit, metacarpal .....	89	92	110.5
"  1st phalanx .....	68	69	81.5
"  2nd phalanx .....	96.5	101	118
4th digit, metacarpal .....	85.2	90.5	105.5
"  1st phalanx .....	54.2	58.5	66
"  2nd phalanx .....	55	55.5	70
5th digit, metacarpal .....	92.5	96.8	113
"  1st phalanx .....	40.2	43.7	48
"  2nd phalanx .....	41	41.5	50
Ear, length from orifice .....	26	...	27
"  greatest width, flattened .....	16	...	16
Front of eye to tip of muzzle .....	24	...	25.5
Interfemoral .....	...	...	7
Lower leg .....	59.2	63.5	76.5
Foot, c. u. ....	40.5	...	50
Calcar .....	19	...	21.5

*Measurements of skulls and teeth of Pteropus cognatus, rayneri, and rubianus.*

	<i>Pt. cognatus.</i> Skull: 1 ad. Teeth: 1 ad., 2 imm. (Incl. type.)		<i>Pt. rayneri.</i> Skulls: 2 ad. Teeth: 2 ad., 1 imm. (Incl. cotypes)		<i>Pt. rubianus.</i> ♂ ad. Type.
	Min.	Max.	Min.	Max.	
	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	.....	.....	.....	.....	.....
" palation to incisive foramina .....	28.7		30	30	34.3
" front of orbit to tip of nasals .....	17		18.8	19.5	22.6
" width of brain-case at zygomata .....	22		23	23	...
" zygomatic width .....	33.2		33	33	...
" width across $m^1$ , externally .....	18		17.2	18.7	20
" lachrymal width .....	13.2		13.2	13.2	15.5
" width across canines, externally .....	14		13	13.7	14.5
" postorbital constriction .....	7.2		7.2	7.7	7
" interorbital constriction .....	8.7		8.2	8.3	9
" width of mesopterygoid fossa .....	7.2		7.5	7.7	8.2
" between $p^4$ - $p^4$ , internally .....	10.2		9.7	9.7	11
" between cingula of canines .....	7		7	7	7.3
" orbital diameter .....	13		12.7	...	13.8
Mandible, length .....	47		48.2	49	...
" coronoid height .....	26		24.8	25.5	...
Upper teeth, c- $m^2$ .....	23		23.8	24	27.7
Lower teeth, c- $m_3$ .....	25.5		25.5	26.2	30.7
Upper incisors, combined width .....	.....		7.1	7.2	7.8
Upper canines, ant.-post. basal diameter .....	.....		.....	.....	5
Lower canines, ant.-post. basal diameter .....	.....		.....	.....	4
$p^3$ , length .....	4.5	4.8	4.6	4.7	5.5
" width .....	3.1	3.6	3.1	3.6	3.8
$p^4$ , length .....	4.7	4.8	4.7	4.8	5.2
" width .....	3.3	3.4	3.6	3.8	4.2
$m^1$ , length .....	5.6	5.7	5.5	5.7	6.8
" width .....	3	3.1	3.2	3.5	3.9
$m^2$ , length .....	2.2	2.5	2.2	2.6	2.7
" width .....	1.8	2	1.8	2	2.2
$p_1$ , length .....	2.1	2.5	2.1	2.7	2.8
" width .....	1.9	2	2	2.2	2.7
$p_3$ , length .....	4.8	5	4.7	4.8	5.2
" width .....	2.7	2.8	2.8	3	3.5
$p_4$ , length .....	4.8	4.9	4.7	4.8	5.6
" width .....	2.8	2.8	2.9	3	3.8
$m_1$ , length .....	4.7	5	4.8	4.9	5.7
" width .....	2.8	2.8	2.8	2.9	3.5
$m_2$ , length .....	3.7	3.8	3.7	3.9	4.7
" width .....	2.5	2.7	2.7	2.8	3
$m_3$ , length .....	1.8	1.8	1.7	1.8	2.1
" width .....	1.6	1.6	1.4	1.6	1.8

*Measurements.* On pp. 256, 257.

*Specimen examined.* One, the type.

*Range.* As yet known only from Rubiana, off New Georgia, Central Solomon Islands.

*Type* in collection.

*a.* ♂ ad. al.; skull. Rubiana, Central C. M. Woodford, Esq. 88.1.5.1.  
Solomon Is. [C.]  
(*Type* of species.)

#### 45. *Pteropus lavellanus*, K. And.

*Pteropus lavellanus*, K. Andersen, *Ann. & Mag. N. H.* (8) ii. p. 366  
(1 Oct. 1908: Vella Lavella, Solomon Is.).

*Diagnosis.*—Allied to *Pt. rubianus*, but smaller, with much shorter tibia, and much darker colour of the fur. Crown and face grizzled buffy, greyish, and dark brown. Forearm 151–155.5 mm. *Hab.* Vella Lavella, Solomon Is.

*Skull and teeth.*—Skull distinctly smaller than in *Pt. rubianus*, but scarcely differing in shape. Dentition as in *Pt. rubianus*, but cingulum of upper and lower canines broader than in any other form of the *Pt. rayneri* group.

*Fur.*—Length and distribution of fur as in *Pt. rubianus*. Approximate length, back 13–15, mantle 18–21, belly 17–18 mm. Least width of furred area of back about 45 mm. Tibia thickly haired above for proximal three-fourths.

*Colour.*—Type, ♂ ad. skin, teeth well worn:—Back glossy seal-brown, this colour continued backward in a narrow line along sides of rump next to membranes and on upperside of tibiae. Rump and inner side of thighs and tibiae pale cinnamon-rufous, paler than mantle and strongly contrasting with dark back; base of fur of rump seal-brown.—Centre of breast and upper belly glossy blackish, forming a large oval patch; sides of breast and belly, including flanks, dark mars-brown, contrasting with blackish pectoral patch, and shading gradually into dark cinnamon-rufous on crissum.—Occiput, mantle, sides of neck, and foreneck chestnut-chocolate; extreme base of fur blackish. A tuft of rigid, orange-tawny glandular hairs on each side of neck, on spreading contrasting in colour with surrounding darker fur (sexual character).—Crown and interocular space similar to occiput, but conspicuously sprinkled with tawny and buffy hairs. Circumocular space and sides of face mixed blackish, buffy, and pale greyish. Chin and throat chestnut seal-brown. “Iris brown” (A. S. Meek).

In three specimens examined the individual variation is chiefly confined to a brighter or darker tinge of the rump and a greater or smaller admixture of pale hairs in the colour of the crown and face. Rump varying from cinnamon-rufous, through cinnamon, to nearly orange ochraceous-buffy. In the palest-headed specimen (♀ imm.) the crown and forehead are golden buffy sprinkled with greyish-white and blackish hairs.

*Sexual differentiation.*—A tuft of rigid, brighter-coloured glandular hairs on each side of neck in males, wanting in females. Canines heavier in males than in females.

*Measurements.* On pp. 263, 264.

*Specimens examined.* Three, as registered below.

*Range.* So far only known from Vella Lavella, New Georgia group, Central Solomon Islands.

*Type* in collection.

*Remarks.*—This species differs from *Pt. rubianus* chiefly in the characters given in the diagnosis above. From *Pt. grandis*, which it closely resembles in the colour of the neck, back, rump, and underparts, it is readily distinguished by its smaller size, relatively shorter tibia and smaller ears, and by having the crown and face grizzled buffy, greyish, and dark brown, not uniform blackish or seal-brown as in *Pt. grandis*.

a. ♂ ad. sk.; skull.	Vella Lavella, Solomons;	A. S. Meek 8.11.16.2.
	12 March, 1908.	[C].
		(Type of species.)
b, c. ♀ imm., ♀ ad. sks.; skulls.	Vella Lavella; 17 Feb., 2 March, 1908.	A. S. Meek 8.11.16.1.3. [C].

#### 46. *Pteropus grandis*, Thos.

*Pteropus grandis*, Thomas, *Ann. & Mag. N. II.* (5) xix. p. 147 (1 Feb. 1887: Shortland I.); *id.*, *P. Z. S.* 1887, p. 320, pl. xxv. (animal), text-fig. 1 (teeth) (Alu, Shortland I.): Woodford, *Nat. among the Head-hunters*, p. 197 (1890: Shortland group): Trouessart, *Cat. Mamm.* i. p. 80 (pt.) (1897: Solomons): Matschie, *Megachir.* p. 15 (pt.) (1899: Alu): Trouessart, *Cat. Mamm., Suppl.* p. 49 (pt.) (1904: Shortland); Miller, *Fam. & Gen. Bats*, p. 58 (1907).

*Diagnosis.*—Similar to *Pt. lavellanus*, but larger with relatively longer tibia and larger ears. Crown and face uniform blackish seal-brown. Forearm 167–172 mm. *Hab.* Bougainville group, Solomon Is.

*Colour.*—Type, ♂ ad. skin, Alu:—Back glossy blackish seal-brown, this colour continued backward in a narrow line along sides of rump next to membranes and on upperside of tibiae. Rump pale ochraceous-buff, much paler than mantle and strongly contrasting with back, shading into cinnamon-rufous along inner sides of thighs, and this in turn into chestnut along inner sides of tibiae. Base of fur of rump seal-brown.—Centre of breast and upper belly glossy blackish, forming a large patch or broad stripe; sides of breast and belly, including flanks, dark chocolate, shading gradually into dark cinnamon-rufous on crissum.—Occiput, mantle, sides of neck, and foreneck dark chocolate, similar to sides of breast and not very strongly contrasting with back. A tuft of rigid, mars-brown glandular hairs on each side of neck, on spreading somewhat contrasting in colour with surrounding darker fur (sexual character). Crown, forehead, sides of face, chin, and throat blackish. “Iris yellow-brown” (C. M. Woodford).

An adult male from Bougainville (skin, 8.11.16.4) is similar to

the foregoing, but rump still brighter, nearly buff-yellow, with extreme base of hairs seal-brown. "Iris brown" (A. S. Meek).

*Sexual differentiation*.—Probably as in *Pt. lavellanus* (p. 259), but no females seen.

*Measurements*. On pp. 263, 264.

*Specimens examined*. Three, as registered below.

*Range*. Shortland Island (Alu) and Bougainville, W. Solomon Islands.

*Type* in collection.

*Remarks*.—The differential characters given in the diagnosis of this species rest on a comparison with *Pt. lavellanus*. From *Pt. rubianus* it is easily discriminated by its larger ears and much darker colour. The vandyek-brown tinge of the back in *Pt. rubianus* is in *Pt. grandis* replaced by blackish or dark seal-brown; the dark russet and deep tawny of the mantle, foreneck, and sides of breast and belly, by dark chocolate; the mixed buffy and chestnut of the face, by blackish. The colour of the fur of *Pt. grandis* is, on the whole, much like that of *Pt. lavellanus*, except for the complete suppression of the light sprinkling of the colour of the face, so conspicuous in *Pt. lavellanus*. In the characters of the skull and teeth *Pt. grandis* is similar to *Pt. rubianus*; cingulum of canines as in that species, narrower than in *Pt. lavellanus*. The length and distribution of the fur is practically the same in all three species.

- |                      |   |                               |                                  |
|----------------------|---|-------------------------------|----------------------------------|
| a. Ad. skull.        | Alu, Shortland I.,<br>Solomons; April,<br>1886.   | C. M. Woodford, Esq.<br>[C.]. | 87.1.18.1.                       |
| b. ♂ ad. sk.; skull. | Alu; April, 1886.                                 | C. M. Woodford, Esq.<br>[C.]. | 87.1.18.2.<br>(Type of species.) |
| c. ♂ ad. sk.; skull. | Buin, Bougainville,<br>Solomons; 11 Jan.<br>1908. | A. S. Meek [C.].              | 8.11.16.4.                       |

#### 47. *Pteropus chrysoproctus*, Temm.

*Pteropus chrysoproctus* (pt.), Dobson, Cat. Chir. B. M. p. 47.

*Pteropus chrysoproctus*, Temminck, *Mon. Mamm.* ii. p. 67, pl. xxxv. fig. 2 (head), pl. xxxvi. figs. 7, 8 (skull) (1837: Amboina); Wagner, *Schreber's Säug., Suppl.* i. p. 348 (1839: Amboina); S. Müller, in Temminck's *Nat. Gesch. Nederl. Oerz. Bez., Zoogd.* pp. 20, 59 (1839-44: Amboina); Lesson, *N. Tabl. R. An., Mamm.* p. 13, no. 173 (1842: Amboina); Schinz, *Syst. Verz. Säug.* i. p. 123 (1844: Amboina); E. Desmarest, *Dict. Univ. d'Hist. Nat.* xi. p. 247 (1848: Amboina); Gray, *Zool. 'Sumarang'*, *Fert.* p. 11 (1849: Amboina); Wagner, *Schreber's Säug., Suppl.* v. p. 597 (1853-55: Amboina); Cuvier, *Hist. Nat. Mamm.* i. p. 187 (1854: Amboina); Giebel, *Säug.* p. 994, footnote (1855: Amboina); Fensch, *Neu-Guinea*, p. 150 (1865: Amboina); Peters, *MB. Akad. Berlin*, 1867, p. 331 (Amboina; Ceram; Pulo Pandjang; Goram); Fitzinger, *SB. Akad. Wien*, lx. Abth. 1. p. 425 (1870: Amboina); Marchi, *Atti Soc. Ital. Sci. Nat.* xv. p. 515, pl. viii. fig. 2 (1872-73: structure of hairs); Dobson, *Cat. Chir. B. M.* p. 47 (pt.) (1878: Watubella I.); Rosenberg, *Malay. Arch.*



p. 322 (1878: Ceram); *Trouessart, Rec. & Mag. Zool.* (3) vi. p. 205 (1879: Amboina; Ceram; P. Panjang; Goram; Watubella); *Jentink, Cat. Ost. Mamm.* p. 257 (1887: Amboina; Ceram; Kelling I.; P. Panjang; Goram; Sanghir); *na., Cat. Syst. Mamm.* p. 144 (1888: Amboina; Ceram; Arsilulu; Kelling; P. Panjang; Goram; Sanghir); *Trouessart, Cat. Mamm.* i. p. 80 (pt.) (1897: Amboina; Ceram; P. Panjang; Goram; Watubella); *Matschie, Megachir.* p. 14 (pt.), pl. ix. figs. 5, 5 a, 5 b (skull) (1899: Amboina; Ceram; Goram); *Trouessart, Cat. Mamm., Suppl.* p. 49 (1904: Sanghir; Amboina; Ceram; Goram; Watubella); *Willink, Nat. Tijds. Nederl. Ind.* lxx. p. 272 (pt.) (1905: Amboina; Ceram; Goram); *Miller, Fam. & Gen. Bats*, p. 58 (1907).

Eunveteris phaiops (pt., nec *Pteropus phaiops*, Temm.), *Gray, Cat. Monk. Sc.* p. 113 (1870: Watubella I.).

*Diagnosis.*—Allied to *Pt. grandis*, but canines much slenderer at base,  $i_2$  and  $p_1$  smaller, cheek-teeth narrower, upperside of tibia more sparsely haired, colour of fur paler. Back dark brownish, rump similar or much paler; breast and belly some shade of cinnamon-rufous or chestnut or seal-brown, rarely uniform, generally distinctly darker in centre than on sides of breast and belly; head and neck all round tawny or tawny ochraceous, contrasting with darker back. Males without bright-coloured neck-tufts. Forearm 163–176.5 mm. *Hab.* Amboina group.

*Skull.*—Size and general characters as in *Pt. rubianus* and *grandis*, but orbits slightly larger, rostrum longer; orbital diameter 15–15.5 mm. (13.8–14.8 in *Pt. rubianus* and *grandis*), rostrum from front of orbit to tip of nasals 25–29 (22.6–24), palate from palation to incisive foramina 37–39 (34.3–36.2).

*Teeth.*—Upper incisors smaller than in *Pt. rubianus* and *grandis*. Canines above and below practically of the same height as in the allied species, but considerably slenderer at base and with much narrower cingula; antero-posterior basal diameter of upper canines 4–4.8 mm., against 5–5.5 in *Pt. rubianus* and *grandis*; of lower canines 3–3.8, against 4–4.5.  $i_2$  and  $p_1$  conspicuously smaller;  $i_2$  once and a half or nearly twice (in *Pt. rubianus* and *grandis* twice and a half or nearly three times) the bulk of  $i_1$ ; crown of  $p_1$  2.5–2.8 × 2.2–2.4 mm. (in *Pt. rubianus* and *grandis* 2.8–3.3 × 2.7–3).  $p^3$ – $m^1$  and  $p_3$ – $m_2$  scarcely shorter than in the allied species, but considerably narrower; see detailed measurements p. 264.

*Fur.*—Length and distribution of fur essentially as in *Pt. rubianus* and *grandis*, but upperside of tibia thinly haired or naked.

*Colour.*—♂ ad. skin, Buru, teeth somewhat worn, 97.12.6.1:—General colour of back glossy dark burnt-umber. Individual hairs tawny or tawny cinnamon-rufous at base, seal-brown at tip. Owing to a gradual increase, in direction from front of back to rump, in the length of the pale-coloured bases of the hairs and corresponding decrease in the length of the dark tips, the colour becomes more and more distinctly tinged with golden tawny on posterior portion of back near rump, this latter tinge again shading

into tawny ochraceous on rump and into nearly ochraceous-buff on thighs. The colour of the rump and thighs thus becomes similar to or rather lighter than that of the mantle, and strongly contrasting with dark front of back.—Breast, belly, and flanks dark russet, darkest (washed with chocolate) on centre of breast, palest (tinged with buffy) in anal region; base of fur everywhere paler, ochraceous, ochraceous-buff, or buffy.—Head, mantle, sides of neck, and foreneck nearly uniform tawny ochraceous.

♂ yg. ad. skin, Ceram, 7.1.1.244: Differs from foregoing chiefly in the following particulars:—Back darker, glossy seal-brown; rump and thighs similar, but slightly washed with chocolate. A narrow longitudinal stripe of deep maroon seal-brown along middle of breast and belly, extending over anal region and underside of thighs; sides of breast and belly, and flanks buffy cinnamon-rufous. Circumocular space, sides of muzzle, chin, and throat seal-brown.

♀ ad. skin, Ceram, teeth slightly worn, 7.1.1.245: Differs from the Buru specimen only in the colour of the breast, belly, and flanks. Centre of breast glossy blackish tinged with maroon, gradually shading into chestnut on sides of breast and flanks, and into chestnut cinnamon-rufous on belly and anal region.

♂ ad. skin, Watubella I., teeth slightly worn, 61.12.11.6: Similar to the young adult male from Ceram (7.1.1.244) in the colour of the head, back, rump, mantle, sides of neck, and foreneck, but the whole of the breast, belly, flanks, and anal region glossy seal-brown, tinged with chocolate on sides of breast and belly; base of fur of sides of breast and belly ochraceous.

The differences in colour described above appear to be independent of locality, sex, and age. The four cotypes of the species (Amboina) in the Leyden Museum and a topotype in the Berlin Museum show somewhat similar individual variations, though none has the whole of the underside of the body so uniformly dark-coloured as the Watubella specimen. The variations, in the whole series examined, may be briefly epitomized as follows:—Back glossy seal-brown or washed with a paler shade of brown approaching dark burnt-umber; rump and thighs sometimes similar to back, but in most specimens much paler (similar to mantle) and contrasting with back. Breast, belly, and flanks sometimes nearly uniform dark russet with paler bases to the hairs (palest-bellied extreme), but generally with some seal-brown colour on centre of underparts, this dark tinge sometimes confined to centre of breast, sometimes extending also to centre of belly and anal region, rarely uniformly covering the whole of the breast, belly, anal region, and flanks (darkest-bellied extreme). Head, mantle, sides of neck, and foreneck some shade of ochraceous-buff or tawny ochraceous; circumocular region, sides of muzzle, chin, and throat similar to crown or darkened with seal-brown.

*Sexual differentiation.*—Canines conspicuously longer and slightly heavier in males than in females. Measurements taken on three males and one female: upper canines, length from alveolar border 10.2–10.8 (males) and 9 (female), antero-posterior basal diameter

4.3-4.8 (males) and 4 (female); lower canines, length 8-9 (males) and 7.5 (female), antero-posterior basal diameter 3.2-3.8 (males) and 3 mm. (female). (No distinct rigid and brighter-coloured glandular neck-tufts detectable in males, nor in females.)

*Measurements.* Below and on p. 264.

*Specimens examined.* Ten, in the collections of the Leyden (specimens *f, g, h, i*; Amboina), Berlin (nos. 2626 and 3318; Amboina and Ceram), and British Museums, including the cotypes of the species.

*Range.* Amboina group: Buru, Amboina, Ceram, Arsilulu, Keffing, Pulo Panjang, Goram, Watubella. The species has been recorded in literature from the Sanghir Islands (Siao); see synonyms, pp. 260, 261.

*Cotypes* in the Leyden Museum.

*Pteropus chrysoproctus*, Temminck; 1837.—Type locality, Amboina; cotypes, four mounted specimens (originally in alcohol), collected by Müller and Macklot, specimens *f, g, h*, and *i* of Jentink's 'Catalogue systématique.'—The skull figured in 'Megachiroptera des Berliner Museums' (*l. s. c.*) is that of an adult male, skin mounted, collected in Ceram by Wallace, Reg. no. 3318.

*Remarks.*—This species is readily distinguished from the closely related *Pt. rubianus* and *grandis* by the characters of the skull,

*External measurements of Pteropus lavellanus, grandis, and chrysoproctus.*

	<i>Pt. lavellanus.</i> 2 ad. (Incl. type.)		<i>Pt. grandis.</i> 2 ad. (Incl. type.)		<i>Pt. chrysoproctus.</i> 4 ad.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.	mm.	mm.
Forearm .....	151	155.5	167	172	163	176.5
Pollex, total length, c. u. ....	66	69	74	74	70	79
" metacarpal .....	14	15	18	18	17	18
" 1st phalanx .....	33.5	34	38	38	35	42.5
2nd digit, metacarpal .....	74.5	78	84	86	86	91
" 1st phalanx .....	20.5	21	19	21.5	19.5	25
" 2nd 3rd phalanx, c. u. ....	16.5	19	15.5	18	19.5	23.5
3rd digit, metacarpal .....	100.5	107	115.5	117.5	116.5	122
" 1st phalanx .....	77.5	78.5	88	88.5	80	91
" 2nd phalanx .....	110	115	131	132	115.5	119.5
4th digit, metacarpal .....	97	102	110.5	113.5	112.5	119
" 1st phalanx .....	63	63	71	71.5	66.5	74
" 2nd phalanx .....	63	67	73.5	77	...	...
5th digit, metacarpal .....	102.5	108	117.5	...	117.5	124
" 1st phalanx .....	44	46	49	51	47.5	53.5
" 2nd phalanx .....	45	48.5	53.5	55	46.5	54
Ears, length from orifice .....	22.6 *	22.7 *	23.0 *	...	...	...
Lower leg .....	65.5	67.5	...	76.5	75.5	78.4
Foot, c. u. ....	48	48.5	...	57	52	55

\* Estimate (skins).

*Measurements of skulls and teeth of Pt. lavellanus, grandis, and chrysoproctus.*

	<i>Pt. lavellanus.</i> Skulls: 2 ad., 1 imm. (Incl. type.)		<i>Pt. grandis.</i> 3 ad. (Incl. type.)		<i>Pt. chrysoproctus.</i> 4 ad.	
	Min.	Max.	Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	65.8	69	72.8	76	...	...
„ palation to incisive foramina .....	29.8	32.8	34.7	36.2	37	39
„ front of orbit to tip of nasals .....	20.5	21.3	23.2	24	25	29
„ width of brain-case at zygomata .....	24.5	24.8	26	27.5	...	...
„ zygomatic width .....	...	40	40	42.5	...	...
„ width across $m^1$ , externally .....	20.5	21	20.5	21.8	19.8	23
„ lachrymal width .....	14.2	14.2	15.2	16	16.8	18.7
„ width across canines, externally .....	15.8	16	14.8	16.8	13.8	15.3
„ postorbital constriction .....	8.8	8.8	7.7	8	7.8	8.5
„ interorbital constriction .....	9.8	10	9.8	11	10	11
„ width of mesopterygoid fossa .....	7.7	8.5	8.7	9	...	8.8
„ between $p^1$ - $p^4$ , internally .....	11.7	11.8	11	11.8	10.8	12.2
„ between cingula of canines .....	8	8.2	7.7	8.8	7.8	8.8
„ orbital diameter .....	13.7	14	14.2	14.8	15	15.5
Mandible, length .....	53.2	54.2	58.2	61	58	63.2
„ coronoid height .....	27.5	28	29	31.2	30.2	33
Upper teeth, $c$ - $m^2$ .....	27	27	28	30	29	31.7
Lower teeth, $c$ - $m_3$ .....	29.7	30	31.3	33.5	32	34.2
Upper incisors, combined width .....	...	8	7.2	8.7	7.2	7.8
Upper canines, ant.-post. basal diameter .....	5	5.2	5	5.5	4	4.8
Lower canines, ant.-post. basal diameter .....	4.2	4.7	4	4.5	3	3.8
$p^3$ , length .....	5	5.5	5.3	5.8	5	5.2
„ width .....	3.8	4	4	4	3.7	3.9
$p^4$ , length .....	4.9	5.3	5.6	5.8	5.2	5.8
„ width .....	4.2	4.6	4.2	4.9	3.9	4.1
$m^1$ , length .....	6	6.7	6.6	7.2	6.3	7
„ width .....	3.9	4.2	3.9	4.2	3.5	3.9
$m^2$ , length .....	2.2	2.8	2.2	2.5	2.9	3.7
„ width .....	2.1	2.2	2.2	2.5	2.2	2.8
$p_1$ , length .....	2.7	3.1	2.8	3.3	2.5	2.8
„ width .....	2.5	2.7	2.7	3	2.2	2.4
$p_2$ , length .....	5	5.2	5.2	6	5	5.2
„ width .....	3.2	3.5	3.3	3.7	3	3.2
$p_3$ , length .....	5	5.2	5.7	5.8	5.2	5.7
„ width .....	3.2	3.7	3.7	3.9	3.2	3.5
$m_1$ , length .....	5.5	5.7	5.7	6	5.7	6
„ width .....	3.3	3.6	3.7	3.8	3.5	3.7
$m_2$ , length .....	4.2	4.7	4.3	4.8	4.2	4.8
„ width .....	3	3.1	3.2	3.2	3.2	3.2
$m_3$ , length .....	1.6	2	1.8	2	2.2	2.8
„ width .....	1.5	1.7	1.7	1.8	1.8	2.5

teeth, hairing of the upper surface of the tibia, and colour of the fur, as described above. The peculiar tricoloured pattern of the upper-side (bright head and mantle, dark back, bright rump) characteristic of nearly all species of this group of the genus appears to be less constant in *Pt. chrysoproctus* than in *Pt. rayneri*, *rubianus*, *lavellanus*, and *grandis*: in some individuals of *Pt. chrysoproctus* the rump is as pale as, or rather paler than, the mantle, thus strongly contrasting with the dark brown back, while in others it is practically similar in colour to the back, though, at least in certain lights, showing distinct chestnut reflections. Dark-rumped individuals of *Pt. chrysoproctus* are in the colour of the upperside very similar to *Pt. melanopoigon*, which inhabits the same group of islands; externally they may be distinguished by the more narrowly pointed ears, much broader furred area of the back, much paler sides of neck and foreneck, much darker breast and belly, and smaller size.

a. ♂ ad. sk.; skull.	Kayeli. Burn;	Hon. W. Rothschild	97.12.6.1.
	March, 1897	[P.].	
	(Doherty).		
b, c. ♂ yg. ad., ♀ ad.	Ceram (Dr. A.	Tomes Coll.	7.1.1.244, 245.
sk.; skulls.	R. Wallace).		
d. ♂ ad. sk.; skull.	Watubella I.	Dr. A. R. Wallace	61.12.11.6.
		[C.].	

## H. THE *PTEROPUS LOMBOCENSIS* GROUP.

*Species*.—Four, *Pt. lombocensis*, *solitarius*, *rodricensis*, and *molossinus*.

*Range*.—Lesser Sunda Islands; Mascarenes (Rodriguez); Caroline Islands.

*General characters* (compare fig. 13, p. 270, skull and dentition of *Pt. solitarius*).—Rostrum short and broad.  $m_3$ ,  $m^2$ , and  $i_1$  conspicuously reduced,  $i_1$  one-fourth to one-sixth the bulk of  $i_2$ . Ears moderate or quite short; tibiæ clothed above, except in the Caroline species. Colour paler or darker brown above and beneath with ochraceous or buffy mantle, except the Caroline species, in which also the mantle is darkened to brownish. Males with glandular neck-tufts, except the Mascarene species. Size small (forearm 94–127 mm.).

*Differentiation of species*.—*Pt. lombocensis* (Lombok, Flores) and *solitarius* (Alor) present the cranial and dental characters of the group in their fullest development: rostrum very short and broad (still more so than in the *Pt. rayneri*, and quite as in the *Pt. samoensis* and *pselaphon* groups), coronoid portion of mandible heavy, coronoid height subequal to  $c-m_3$ ;  $m_3$ ,  $m^2$ , and  $i_1$  very small; dentition heavy for the size of the animals, with distinct but short posterior basal ledges to the premolars: ears typical Pteropine (*hypomelanus*-like, though somewhat more narrowly pointed); fur rather short and adpressed; secondary sexual characters (neck-tufts) well pronounced. The single Mascarene species (*Pt. rodricensis*) is

characterized by the conspicuously smaller size of the teeth, which however show the principal characters of the *lombocensis* dentition fully developed (reduced  $m_3$ ,  $m^2$ , and  $i_1$ ), the considerably heavier posterior basal ledges of  $p_3$ ,  $p_4$ , and  $m_1$ , and the more distinctly differentiated antero-internal base of  $p^3$ ,  $p^4$ , and  $m^1$ ; probably owing to the smaller teeth, the coronoid process is lower and more sloping, the coronoid height of the mandible less than  $c-m_3$ ; ears reduced (as in all species inhabiting the Mascarenes), fur longer and more spreading (also a character common to all Mascarene species); colour similar to that of *Pt. lombocensis*, but brownish of back and underparts rather darker, ochraceous of mantle richer. The principal modifications exhibited by the single Caroline species of the group (*Pt. molossinus*) are the unusually small, subsquarish cheek-teeth (weak coronoid process), peculiarly trenchant edges of the upper canines, relatively large  $p_1$  (compare the *Pt. samoënsis* and *pselaphon* groups), small ears, rather long fur, naked tibia, nearly uniform dark brown colour (compare *Pt. anetianus* and *pselaphon*), and very small size.

*Affinities of group*.—Rather closely related, on the one hand (and probably most intimately) to the *Pt. raymeri* group, with which it accords in the short and broad rostrum (but the character is still more pronounced in the *lombocensis* group) and reduced  $m_3$  and  $m^2$ , on the other hand to the *Pt. samoënsis* and *pselaphon* groups, which it closely resembles in cranial characters. That the four known species inhabit so widely separated areas as the Carolines, Lesser Sunda Islands, and Mascarenes, is evidence that they are the few survivors of a formerly much more generally distributed type of the genus.

#### 48. *Pteropus lombocensis*, Dobson.

*Pteropus lombocensis*, Dobson, *Cat. Chir. B. M.* p. 34.

*Pteropus mackloti* var., Gray, *Cat. Monk. Sc.* p. 110 (1870: Lombok).

*Pteropus lombocensis*, Dobson, *Cat. Chir. B. M.* p. 34, pl. iii. fig. 2 (ear), pl. iv. fig. 4 (teeth) (June, 1878: Lombok); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 204 (1879: Lombok); *id.*, *Cat. Mamm.* i. p. 79 (1897: Lombok); Miller, *Fam. & Gen. Bats*, p. 58 (1907).

*Pteropus* (Spectrum) *hypomelanus* (nec Temm.), k. *lombocensis*, Matschie, *Megachir.* p. 26 (1889). *i. lombocensis*, Trouessart, *Cat. Mamm.*, *Suppl.* p. 52 (1904: Lombok).

? *Pteropus tricolor* (nec Gray), Heude, *Mém. Hist. Nat. Emp. Chin.* iii. p. 177, footnote, pl. v. fig. 7 (teeth) (1896: Flores).

? *Pteropus* (*Sericonycteris*) *heudei*, Matschie, *Megachir.* p. 32 (1899: Flores).

? *Pteropus petersi heudei*, Willink, *Nat. Tijds. Nederl. Ind.* lxx. p. 275 (1905: Flores).

*Diagnosis*.—Rostrum very short and stout.  $m_3$ ,  $m^2$ , and  $i_1$  much reduced. Ears moderate, exposed. Fur rather short, adpressed;

tibia clothed above (though not very densely so). Back brownish, underparts paler, mantle ochraceous. Forearm 113-122 mm. *Hab.* Lombok; Flores.

*Skull* (compare fig. 13, p. 270, skull of *Pt. solitarius*).—Deflection of brain-case moderate, alveolar line if projected backward passing through upper part of occipital condyle. Sagittal crest, if developed, very low; even in perfectly adult individuals (teeth worn) the temporal crests, though closely approximated, are sometimes not quite united together to form a sagittal crest. Rostrum unusually short and heavy; front of orbit vertically above posterior half of  $p^1$ . Postorbital processes long and slender, sometimes almost reaching, or even completely fused with, corresponding processes of zygomatic arch. Coronoid height of mandible subequal to (a little smaller or larger than) length of lower tooth-row,  $c-m_3$ .

*Teeth* (compare fig. 13, p. 270, dentition of *Pt. solitarius*).—Cingulum of upper canines forming a well-defined, narrow ledge.  $p^1$  rudimentary, though slightly less so than in the allied species; generally a terete spicule, in some specimens with crown very slightly differentiated from shaft; present in all skulls (seven) examined, some of which have the teeth well worn, but probably deciduous in a higher age. Posterior ledge of  $p^3$  and  $p^4$  distinct, but short and not very sharply marked off from tooth; in  $p^3$  a minute notch, postero-externally at base of main cusp, is generally present, indistinctly separating the ledge from the outer main cusp; in  $p^4$  the ledge is practically confined to the postero-internal portion of the tooth, which therefore extends much further backward than the postero-external corner; owing to this, the line of the posterior margin of  $p^4$  if projected inward would pass through the middle, or the posterior half, in some specimens even through the posterior point of  $m^1$  on the opposite side.  $m^1$  almost twice as long as broad.  $m^2$  much reduced in size, subequal to  $i_2$ .— $i_1$  smaller than usual, one-fourth to one-sixth the bulk of  $i_2$ . Cingulum of lower canines forming a well-defined, narrow ledge, rather more sharply defined than in upper canines.  $p_1$  large, once and a half, sometimes almost twice the size of  $i_2$ . Posterior ledge of  $p_3$  and  $p_4$  short, in  $p_3$  rather distinctly though not sharply marked off from tooth, in  $p_4$  ill-defined.  $m_3$  reduced, much smaller than  $p_1$ , subequal to  $m^2$  and  $i_2$ .

*Palate-ridges* (one specimen, Flores).— $5 + 6 + 3$ . First ridge terminating laterally at front of canines; second at back of canines; third at front of  $p^3$ ; fourth at front of  $p^4$ ; fifth at middle of  $p^4$ ; sixth at front of  $m^1$ ; seventh at  $m^2$ ; eighth to eleventh behind  $m^2$ ; twelfth to fourteenth situated at palation border.

*Ears*.—Not reaching hinder corner of eye, when laid forward. Inner margin evenly convex from base to tip; outer margin flatly convex in lower, flatly concave in upper half; tip narrowly rounded off. Naked behind, except at base.

*Interfemoral*.—Extremely short or undeveloped in centre.

*Fur*.—Rather short and adpressed on back, spreading or a little

waved on rump. Approximate length of hairs at middle of back 12-14, middle of mantle 13-15, middle of belly 12-14 mm. Fur of upperside extending laterally on the membranes for a short distance beyond their line of origin from the back, the least width of the furred space of the back being 43-45 mm.

Above, humerus thinly covered with short adpressed hairs for proximal half; distal half practically naked. Forearm naked, except for a narrow line of short, very thinly spread, adpressed hairs on outer side along membrane, commencing about 15 mm. above elbow and extending forward for about 20-25 mm. The whole of the femur, and tibia along outer and inner side almost to ankle, densely haired; median line of upperside of tibia clothed with shorter and more thinly spread hairs, the naked skin often showing through.—A tuft of rather stiff glandular hairs on either side of neck (of seven specimens examined three are males, in the others the sex is indeterminable).

Beneath, antebrachial membrane, lateral membrane along outer side of forearm and between humerus and femur, covered with rather dense woolly hairs. Humerus clothed, the hairs becoming shorter and sparser distally. Forearm almost naked. Femur furred. Tibia naked.

*Colour*.—Series of adult and young adult (full-grown) skins, including type of species; Lombok:—Back vandyck-brown, in some specimens with a distinct wash of russet; concealed base of fur darker vandyck-brown, sometimes approaching seal-brown; tips of hairs paler, sometimes tinged with buffy. Rump similar to back, or slightly darker, chiefly owing to the semierect or slightly waved character of the fur, by which the darker basal colour is sometimes partly exposed.—Entire underside much paler than back, approaching raw umber or tawny olive; colour generally distinctly paler, washed with ochraceous-buff, on foreneck; along centre of breast generally slightly darker, owing to the darker base of the fur partly showing through.—Central part of mantle ochraceous, in some individuals tinged with tawny, in others more approaching ochraceous-buff; posteriorly, on shoulders, and laterally, on sides of neck, the colour lightens to more typical ochraceous-buff, sometimes with a distinct touch of clay. Concealed base of fur of mantle and sides of neck seal-brown. Glandular tufts on sides of neck orange-buff, only slightly contrasting with surrounding fur, owing to concealed position of tufts.—Occiput, crown, interocular space, and sides of head similar to central portion of mantle or somewhat darker, tawny, tawny ochraceous, or ochraceous, sometimes mixed ochraceous-buff and dark brown; concealed base of hairs vandyck-brown or seal-brown. Chin and throat similar to sides of head.

*Measurements*. On pp. 271, 272.

*Specimens examined*. The British Museum material.

*Range*. Lombok; Flores.

*Type* in collection.

*History in literature*.—The earliest reference in literature to this



species is found in Gray's Catalogue of Monkeys, Lemurs, and Fruit-eating Bats (1870, *l. s. c.*); probably misled by a certain similarity in the colour of the fur and the size and shape of the ears, Gray considered it, though with some doubt, a variety of the widely different *Acerodon mackloti*. Its specific distinctness was pointed out a few years later by Dobson (1878, *l. s. c.*), who also recognized its affinities to *Pt. rayneri*. The figure of the ear given by Dobson (pl. iii. fig. 2; drawn from a dried skin) is not quite satisfactory in details: the ear is rather too short, the inner margin too straight (not convex enough) in the upper half, the flat concavity in the outer margin below the tip not distinctly shown. By Matschie (1899, *l. s. c.*), who knew this species from literature only, it was wrongly put down as a geographical form of *Pt. hypomelanus*.

*Pteropus tricolor*, Heude (nec Gray); 1896.—Type locality, Flores; type presumably in the Zi-ka-wei Museum, near Shanghai. "Le seul sujet que j'ai de cette jolie espèce mesure 15 centimètres. La tête osseuse est moitié plus petite que celle de l'*edulis*. La tête et le menton sont roux clair; le cou est blanc un peu teinté de roux; le dos est gris. Les parties correspondantes inférieures ont les mêmes teintes. Pelage doux et soyeux" (Heude, *l. s. c.*). By Matschie (*l. s. c.*) considered "eine geographische Abart von *Pt. temmincki*," evidently owing to the pale colour of the fur; but the teeth (figured by Heude) are very different from those of *Pt. temmincki* and in all important characters closely similar to those of *Pt. lombocensis*.—The name *tricolor*, as being preoccupied, was changed by Matschie into *heudei*.

a. Ad. sk.;	? Lombok.	Dr. A. R. Wallace	57.4.17.1.
skull.		[C.].	
b. ♂ ad. sk.;	Lombok.	Dr. A. R. Wallace	64.4.12.2.
skull.		[C.].	
		(Type of species.)	
c-f. ♂ yg. ad.,	Lombok (Dr. A. R. Tomes Coll.		7.1.1.246-249.
3 yg. ad.	Wallace).		
sk. : skulls.			
g. ♂ ad. al.;	Flores, sea-level; Nov. A. Everett [C.].		97.4.18.9.
skull.	1896.		

#### 49. *Pteropus solitarius*, K. And.

*Pteropus temmincki* (nec *Pet.*), Hartert, Nov. Zool. v. p. 456 (1898 : Alor).

*Pteropus solitarius*, K. Andersen, Ann. & Mag. N. H. (8) ii. p. 367 (1 Oct. 1908 : Alor).

*Diagnosis*.—Similar to *Pt. lombocensis*, but smaller and paler in colour. Forearm 108.5 mm. *Hab.* Alor Island, N. of Timor.

*Colour*.—Type of the species (♂ ad. skin, teeth slightly worn; April): Back Prout's brown, much lightened with buffy or buffy-clay tips to the hairs, and becoming gradually purer (more unmixed) buffy-clay on rump. Base of fur (partly concealed on back, completely on rump) seal-brown.—Breast, belly, anal region,

and flanks much lighter than back, buffy with a distinct tinge of golden clay; base of fur between vandyck-brown and seal-brown. —Mantle between ochraceous-buff and buff, more inclining to the former tinge in central portion, more to the latter posteriorly at shoulders and laterally on sides of neck. Glandular tuft on sides

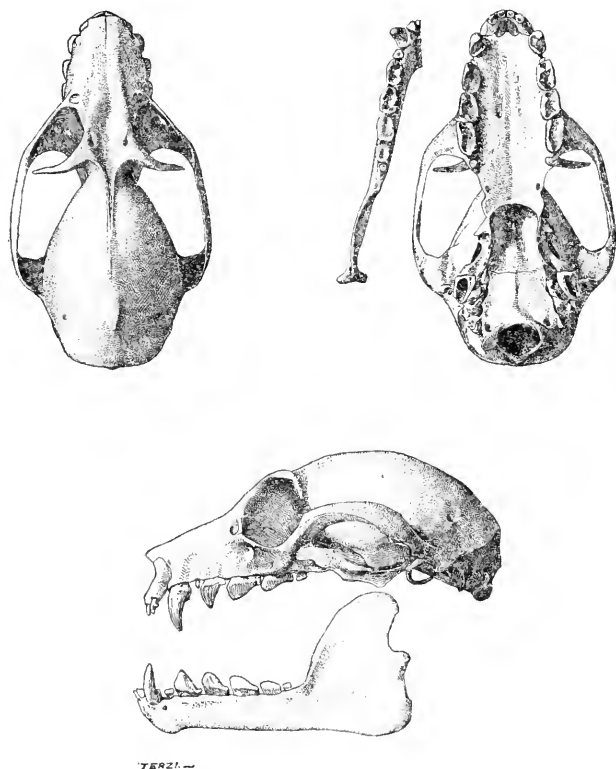


Fig. 13.—*Pteropus solitarius*, ♂, type of species. Alor.  
No. 98.11.3.16.  $\frac{1}{4}$ .

of neck rich orange-buff, slightly contrasting with surrounding fur. Foreneck golden ochraceous-buff, distinctly brighter than breast. Base of fur of mantle and sides of neck seal-brown; on the fore-neck the seal-brown colour is confined to the extreme bases of the hairs, next to the skin.—Occiput, crown, interocular space, sides of

head, chin, and throat nearly similar to central portion of mantle, though slightly darker, more tinged with tawny.

*Measurements.* Below and on p. 272.

*Specimen examined.* The type.

*Range.* Alor Island (Ombay), Lesser Sunda Islands.

*Type* in collection.

- a. ♂ ad. sk.; skull. Alor I., sea-shore; A. Everett [C.]. 98.11.3.16.  
April 15, 1897. (Type of species.)

*External measurements of Pteropus lombocensis and solitarius.*

	<i>Pt.</i> <i>lombocensis.</i> 7 ad. (Incl. type.)		<i>Pt.</i> <i>solitarius.</i> ♂ ad. Type.
	MIN.	MAX.	
	mm.	mm.	mm.
Forearm .....	113	122	108.5
Pollex, total length, c. u. ....	46	50.5	43.8
„ metacarpal .....	10.2	11	11.3
„ 1st phalanx .....	22	25.8	21.2
2nd digit, metacarpal .....	52.5	58	54.5
„ 1st phalanx .....	12	14.8	13.5
„ 2nd-3rd phalanx, c. u. ....	13.5	15.5	12
3rd digit, metacarpal .....	75	81	75.5
„ 1st phalanx .....	51	56.5	52
„ 2nd phalanx .....	79	84	75.5
4th digit, metacarpal .....	72.5	79	75.5
„ 1st phalanx .....	43	47.5	42.8
„ 2nd phalanx .....	44.5	50.5	...
5th digit, metacarpal .....	78.5	85	79.5
„ 1st phalanx .....	33.5	36.5	35.5
„ 2nd phalanx .....	26.5	32.5	...
Ear, length from orifice .....	...	27.5	...
„ greatest width, flattened .....	...	15.7	...
Front of eye to tip of muzzle .....	...	20	...
Lower leg .....	49	52	46
Foot, c. u. ....	37	41	35.2
Calcar .....	...	13.2	11.5

*Measurements of skulls and teeth of Pteropus lombocensis  
and solitarius.*

	<i>Pt. lombocensis.</i> Skulls: 7 ad. Teeth: 7 ad. (Incl. type.)		<i>Pt. solitarius.</i> ♂ ad. Type.
	Min.	Max.	
	mm.	mm.	mm.
Skull, total length to gnathion .....	...	55	53
" palation to incisive foramina .....	...	25.7	24.8
" front of orbit to tip of nasals .....	14.5	16	15.5
" width of brain-case at zygomata .....	20.2	22	21.2
" zygomatic width .....	29.7	31.2	30.2
" width across m <sup>1</sup> , externally .....	15	17	16
" lachrymal width .....	11	12.5	12.2
" width across canines, externally .....	11.2	12.1	11.2
" postorbital constriction .....	7	8	7.2
" interorbital constriction .....	7.2	8.8	7.8
" width of mesopterygoid fossa .....	7.2	7.4	7.7
" between p <sup>1</sup> -p <sup>1</sup> , internally .....	8.8	10.6	9.2
" between cingula of canines .....	5.7	6.8	6.2
" orbital diameter .....	12	12.5	11.9
Mandible, length .....	41	42.7	41.7
" coronoid height .....	21.2	23	22.2
Upper teeth, c-m <sup>2</sup> .....	20	21.2	20.2
Lower teeth, c-m <sub>3</sub> .....	22.2	23.7	21.8
Upper incisors, combined width .....	6	6.8	5.8
p <sup>1</sup> , length .....	3.8	4.3	4.1
" width .....	3	3.2	3
p <sup>2</sup> , length .....	4.3	4.8	4.7
" width .....	3.1	3.6	3.2
m <sup>1</sup> , length .....	5.2	5.6	5.2
" width .....	2.8	3	2.8
m <sup>2</sup> , length .....	1.3	1.8	1.8
" width .....	1.3	1.8	1.8
p <sub>1</sub> , length .....	1.8	2.2	2
" width .....	1.8	2.1	1.8
p <sub>2</sub> , length .....	3.9	4.2	4.1
" width .....	2.7	2.9	2.8
p <sub>1</sub> , length .....	4.1	4.7	4.2
" width .....	2.8	3	2.8
m <sub>1</sub> , length .....	4.5	4.9	4.2
" width .....	2.8	3	2.9
m <sub>2</sub> , length .....	3	3.2	3
" width .....	2.5	2.8	2.7
m <sub>3</sub> , length .....	1.1	1.6	1.3
" width .....	1.1	1.6	1.3

50. *Pteropus rodricensis*, Dobson.

*Pteropus rodricensis*, Dobson, Cat. Chir. B. M. p. 36.

*Pteropus rodricensis*, Dobson, l. s. c. (1878: Rodriguez); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 204 (1879: Rodriguez); Dobson, *Rep. Brit. Assoc.* 1878, p. 165 (1879: remarks on habitat); J. Anderson, *Cat. Mamm. Ind. Mus.* pt. i. p. 100 (1881: Rodriguez); Trouessart, *Cat. Mamm.* i. p. 79 (1897: Rodriguez).

*Pteropus rodricensis*, Dobson, *Cat. Chir. B. M.* pl. iii. fig. 3 (head) (1878); *id.*, *Phil. Trans.* clxviii. p. 457 (1879: Rodriguez).

*Pteropus* (Spectrum) *rodricensis*, Matschie, *Megachir.* p. 30 (1899); Trouessart, *Cat. Mamm., Suppl.* p. 54 (1904).

*Pteropus mascarinus*, Mason, *Ann. & Mag. N. H.* (7) xx. p. 220 (Sept. 1, 1907: Round 1., nr. Mauritius); K. Andersen, *tom. cit.* p. 351 (Oct. 1907: critical remarks).

*Diagnosis*.—Rostrum short, orbits small, mandible scarcely heavier posteriorly than usual.  $m_3$ ,  $m^2$ , and  $i_1$  conspicuously reduced. Ears small, nearly concealed in fur. Fur rather long, silky. Mantle orange-ochraceous, contrasting with uniform dark brownish back and underparts. Forearm 124.5–127 mm. *Hab.* Rodriguez.

*Skull*.—Deflection of brain-case moderate, alveolar line if projected backward passing through upper points of occipital condyles. Rostrum short, slightly compressed laterally; distance from tip of postorbital process to gnathion less than from former point to lambda; front of orbit vertically above front of  $m^1$ . Sagittal crest well developed but low. Coronoid moderate, coronoid height of mandible less than  $c-m_3$ .

*Teeth*.—Upper canines slightly recurved, cingulum well developed, forming a distinct shelf at inner base of teeth.  $p^1$  early deciduous, not detectable in any of the individuals examined, some of which are not quite full-grown. Posterior basal ledge of  $p^3$  and  $p^4$  well developed, forming a distinct short shelf, the postero-external corner of which (at least in  $p^4$ , as a rule also in  $p^3$ ) is raised into a minute pointed cusp; a similar postero-external cusp generally present in  $m^1$ . Antero-internal basal portion of  $p^4$  rather more differentiated than usual, forming one or two minute tubercles; corresponding portion of  $p^3$  and  $m^1$  showing traces of similar differentiation.  $m^2$  reduced, slightly larger than  $m_3$ , subequal in crown area to an upper incisor.— $i_1$  conspicuously reduced, one-fourth to one-sixth the bulk of  $i_2$ , which is of normal size. Cingulum of lower canines well developed, though narrower than in upper ones.  $p_1$  normal, about once and a half the bulk of  $i_2$ . Posterior basal ledge of  $p_3$ ,  $p_4$ , and  $m_1$  strongly developed, raised postero-externally into a well differentiated cusp; indication of a similar cusp generally detectable in  $m_2$ .  $m_3$  reduced, subequal in bulk to  $i_2$ .

*Palate-ridges* (one specimen, B.M. no. 76.3.11.1).—5+5+3. First ridge terminating laterally at front of canine; second at back of canine; third at front of  $p^3$ ; fourth at back of  $p^3$ ; fifth at front

of  $p^1$ ; sixth at back of  $p^1$ ; seventh at middle of  $m^1$ ; eighth at back of  $m^2$ ; ninth and tenth behind  $m^2$ ; eleventh to thirteenth situated at palatal border.

*Ears*.—Small, almost hidden in the long fur; when pressed forward falling short of hinder corner of eye by about 11 mm. Shape as in *Pt. niger*: tip sharply pointed, outer margin distinctly concave below tip. Hinder face of conch clothed with thinly spread short hairs on basal two-thirds, tip naked.

*Interfemoral*.—Central portion 2-3.5 mm. in depth, completely hidden by the fur.

*Fur*.—Rather long, silky; directed backward, but not closely adpressed on back, spreading on nape of neck. Approximate length of hairs at middle of back 21 mm., middle of mantle 23 mm., middle of belly 20 mm. Width of hairy space across middle of back 45-47 mm.

Above, humerus and proximal third of forearm clothed with short, densely set, adpressed hair; femur and proximal half of tibia long-haired; on the distal half of the tibia the hairs become gradually shorter and more thinly spread, especially along the median line of the tibia. Feet practically naked, some scattered hairs only detectable on close examination. Interfemoral in middle, and along inner side of femur and proximal three-fourths of tibia, densely covered with long hair. Margin of lateral membrane, between fifth digit and hind limb with thinly spread, rather long hairs.—Below, humerus, proximal part of forearm, femur, and proximal third of tibia furred. Dense woolly fur on antebrachial membrane, and lateral membrane along forearm and between humerus and femur. Distal two-thirds of tibia and lateral interfemoral practically naked.

*Colour*.—♀ ad. skin; teeth almost unworn; B.M. 76.3.15.15: Back, rump, thighs, and furred part of tibia uniform dark vandyck-brown, darkest on back and tibiae, slightly lightened with mars-brown on middle of rump.—Breast, belly, and flanks darker than back, between vandyck-brown and seal-brown, shading to almost pure seal-brown on chest, and washed with mars-brown in anal region; dark fur everywhere thinly sprinkled with long glossy buffy hairs.—Mantle rich orange-ochraceous, shading posteriorly through ochraceous-buff into buff or cream-buff in shoulder region, and laterally, on sides of neck, into tawny; on the foreneck the deep tawny colour of the fur is more or less clouded with, or obliterated by, dark vandyck-brown. Concealed bases of hairs of mantle, sides of neck, and foreneck seal-brown.—Crown and interocular space dark ochraceous, or rather ochraceous darkened with brownish, owing to the pale-coloured tips of the hairs being too short to completely cover the dark hair-bases; on the occiput the colour gradually shades into the orange-ochraceous of the mantle. Sides of head rich tawny russet, shading gradually into the pale seal-brown of throat and chin.

*Sexual differentiation*.—Canines longer and heavier in males. (No neck-tufts in either sex.)

*Measurements.* On pp. 278, 279.

*Specimens examined.* Those in the British Museum collection.

*Range.* Rodriguez; ? Mauritius (see remarks on "*Pt. mascarinus*" below).

*Type* in collection.

*Pt. rodricensis*, Dobson; 1878.—Type locality, Rodriguez. In the figure of the head given by Dobson (*l. s. c.* pl. iii. fig. 3) the ears are rather too narrow in their lower half and too strongly attenuated near the tip.

*Pt. mascarinus*, Mason; 1907.—Type locality stated to be Round Island, 15 miles N.E. of Mauritius; type presumably in private possession. Based on a single skull found in a fissure, in a superficial deposit of red earth, associated with bones of introduced animals: supposed by Mr. Mason, without any foundation in facts, to represent an extinct species. I have not seen the type skull; the description and measurements given by Mr. Mason indicate a species apparently indistinguishable from *Pt. rodricensis* (see Ann. & Mag. N. H. (7) xx. pp. 351–355; 1907).

a. ♂ ad. al.; skull.	Rodriguez (Transit of Venus Exp.; <i>J. Gulliver</i> ).	Royal Society [P.].	76.3.11.1. ( <i>Type of species.</i> )
b-e. ♂ yg. ad., ♂ pull., ♀ ad., ♀ yg. ad.; al.	Rodriguez (Transit of Venus Exp.; <i>J. Gulliver</i> ).	Royal Society [P.].	76.3.11.2-5.
f. ♀ yg. ad. al.	Rodriguez (Transit of Venus Exp.; <i>H. H. Slater</i> ).	Royal Society [P.].	76.3.15.13.
g. ♂ ad. skeleton.	Rodriguez (Transit of Venus Exp.; <i>H. H. Slater</i> ).	Royal Society [P.].	76.3.15.14.
h. ♀ ad. sk.; skull.	Rodriguez (Transit of Venus Exp.; <i>H. H. Slater</i> ).	Royal Society [P.].	76.3.15.15.

### 51. *Pteropus molossinus*, Temm.

*Pteropus molossinus*, Dobson, Cat. Chir. B. M. p. 30.

*Pteropus molossinus*, Temminck, Esq. Zool. p. 62 (1853: habitat unknown); Wagner, Schreier's Säug., Suppl. v. p. 595 (1853–55: hab. unknown); Peters, MB. Akad. Berlin, 1867, p. 332 (hab. unknown); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 431 (1870: ? Japan); Dobson, Cat. Chir. B. M. p. 30 (1878: hab. unknown); Trouessart, Rev. & Mag. Zool. (3) vi. p. 203 (1879: ? Japan); Peters, SB. Ges. nat. Fr. 1883, no. 1, p. 2 (Ponapé); Jentink, Cat. Ost. Mamm. p. 253 (1887: skull of type); id., Cat. Syst. Mamm. p. 139 (1888: Ponapé); Trouessart, Cat. Mamm. i. p. 78 (1897: Carolines); Matschie, Megachir. pl. vi. figs. 5, 5 a, 5 b, 5 c (head; skull) (1899); Miller, Fam. & Gen. Bats, p. 58 (1907).

*Pteropus* (Sericonycteris) *molossinus*, Matschie, Megachir. p. 32 (1899: Ponapé); Trouessart, Cat. Mamm., Suppl. p. 55 (1904: Ponapé).

*Pteropus breviceps*, Thomas, P. Z. S. 1882, p. 756, pl. lv. (animal; teeth) (1883: Mortlock; Ponapé); id., P. Z. S. 1887, p. 322, footnote (species withdrawn): Elera, Cat. Sist. Faun. Filipin. p. 5 (1895: Carolines).

*Diagnosis.*—Basicranial axis more deflected than usual; rostrum short and broad; sagittal crest none; coronoid low and sloping. Canines unusually heavy at base, crown much compressed laterally; upper cheek-teeth short, subsquarish;  $m_3$ ,  $m^2$ , and  $i_1$  much reduced;  $p_1$  large. Ears small, almost concealed in the fur. Tibia naked. Fur rather long, uniform vandyck-brown above and below (generally sprinkled with a few whitish hairs), face paler. Size very small: forearm 94–98.5 mm. *Hab.* Caroline Is.

*Skull.*—Brain-case high, domed; basicranial axis much deflected, alveolar line if continued backward passing through (or above) base of zygomatic arch and some point near middle of supraoccipital. Rostrum unusually short, stout; front of orbit above front of  $m^1$ . Orbits small, diameter (8.7–9 mm.) less than width of rostrum across alveolar borders of  $p^1$ – $p^1$  (9.5–10 mm.). Base of postorbital processes not, or only slightly, raised above level of frontal plateau, this latter therefore flat or only very slightly concave; postorbital processes thin, reaching halfway or two-thirds the distance between frontal and zygoma; no lower postorbital processes (on zygoma). Temporal fossa narrow; temporal crests in fully adults closely approximated, but not united to form a sagittal crest. Coronoid process very low, much sloping; condyle of mandible slightly above alveolar line, this latter projected backward touching lower margin of condyle.

*Teeth.*—Chief characters: upper canines peculiar; upper cheek-teeth shorter (more squarish) than usual; posterior ledges of cheek-teeth obsolescent in upper, distinct in lower jaw;  $i_1$  much reduced,  $p_1$  large,  $m^2$  and  $m_3$  very small.

Upper canines extremely heavy at base, antero-posterior basal diameter almost two-thirds of height of tooth from alveolar border; crown strongly compressed from side to side, hinder margin sharp, trenchant; vertical groove on front face unusually deep; cingulum strong, forming a sharply projecting ledge at lingual base of tooth.  $p^1$  small, deciduous, in cross section subequal to one-third or one-fourth of an upper incisor.  $p^3$ – $m^1$  shorter, but not much narrower than usual. Posterior basal ledge of  $p^3$  short, usually distinctly differentiated from tooth; in  $p^4$  and  $m^1$  fairly distinct at postero-internal corner of tooth, practically obliterated postero-externally.  $p^4$  subquadrate in outline, length of crown only slightly greater than breadth. Sometimes a faint indication of an antero-internal basal tubercle in  $p^3$ ,  $p^4$ , and  $p_3$ .  $m^2$  small, subcircular, equal in cross section to an upper incisor.

$i_1$  much reduced, in bulk from one-fourth to one-sixth of, in vertical extent considerably lower than,  $i_2$ . Lower canines heavy at base, compressed laterally; median vertical keel on lingual face unusually high and sharply defined; cingulum forming a broad ledge at posterior base of tooth and terminating abruptly in front as a minute cusp above the cutting-edge of  $i_2$ .  $p_1$  large, equal to  $m_2$ . Posterior ledge of  $p_3$ ,  $p_4$ , and  $m_1$  distinctly marked off postero-externally by a slight notch from base of outer main cusp (at least in  $p_3$  and  $p_4$ ); the ledge as a rule also traceable in  $m_2$ .  $m_3$  small, subcircular, equal to or smaller than  $i_2$ .



*Palate-ridges* (two specimens, Mortlock and Ponapé).—5+4+2. Arrangement as in *Pt. epularius* (p. 393).

*Ears*.—Very short, narrow, almost concealed in the fur; when laid forward covering about half the distance from ear to eye. Inner margin flatly convex from base to tip; outer margin strongly convex in lower two-thirds, almost straight (faintly convex) in upper third; tip subacute. Outer surface of conch covered with rather long hairs except at extreme tip; inner face with thinly spread shorter hairs (detectable only on close examination).

*Wings*.—Membranes arising close together at sides of spine (separated by an interspace of a few millimetres).

*Interfemoral*.—Undeveloped in centre.

*Fur*.—Rather long; erect on mantle and shoulders, directed backward but not adpressed (semierect) on back. Approximate length, back and mantle 17, belly 15 mm. Least width of furred area of back 36–39 mm. Tibia naked above.

*Colour*.—Adult male (al., Ponapé, teeth unworn; 82.10.27.6): Back and rump vandyck-brown, everywhere slightly sprinkled with silvery-white (or buffy-white) hairs; base of fur not differing.—Entire underparts, from throat to interfemoral, including flanks, similar to back, though somewhat washed with mars-brown in anal region.—Mantle and sides of neck slightly deeper in colour than back, between vandyck-brown and seal-brown, almost quite without intermixture of pale hairs. On each side of neck, closely in front of shoulder, a tuft of more rigid orange-buff unctuous hairs, tipped with the same colour as the surrounding fur, therefore easily overlooked when not searched for (sexual character).—Crown and sides of head similar to mantle. Face (*i.e.* interocular space, region round eyes, and sides of muzzle) conspicuously washed with ochraceous.

The individual variation in colour appears to be small; the general tinge is sometimes more inclining to mars-brown, sometimes more approaching seal-brown; the mantle is often precisely similar to (not slightly darker than) the back; the sprinkling with pale hairs is never very strong, often rather inconspicuous.

*Sexual differentiation*.—Males with a tuft of rigid, brighter-coloured glandular hairs on each side of neck; in females these tufts are entirely undeveloped or, occasionally, faintly indicated by a slight ochraceous tinge of the hairs on the sides of the neck in front of shoulders. Canines slightly heavier in males than in females.

*Measurements*. On pp. 278, 279.

*Specimens examined*. Nineteen, in the collections of the Leyden, Berlin, U. S. National\*, and British Museums; viz., one from unknown locality (type of species), seventeen from Ponapé, and one from Mortlock (type of *Pt. breviceps*).

*Range*. Caroline Islands: Mortlock, Ponapé.

*Type* in the Leyden Museum.

*Pteropus molossinus*, Temminck; 1853.—Based on one specimen from unknown locality. The type is an adult male (teeth unworn),

\* Two ♂ ad. skins with skulls, Ponapé, 12 Feb. 1900; U. S. Bureau of Fisheries; nos. 151558, 151559.

mounted, well preserved, colour almost unfaded; skull extracted (registered by Jentink, Cat. Ost. *l. s. c.* as the skull of a young male, probably owing to the temporal crests not being fused in the median line to form a sagittal crest; but this is a normal feature in the adult *Pt. molossinus*). The type skull is probably not the original of the figures in Matschie's 'Megachiroptera,' pl. vi. fig. 5.—Owing to its "pelage abondant et feutré," Temminck believed *Pt. molossinus*, like the richly-haired *Pt. dasymallus* and *pselaphon*, to be an inhabitant of "une des îles de l'Asie septentrionale"; following this hint, some later writers (see references above) gave as probable habitat of the species "?Japan." Its true habitat was not discovered until about thirty years after Temminck's description, when Finsch obtained a series of specimens in the island of Ponapé (Peters, 1883, *l. s. c.*).

*Pteropus breviceps*, Thomas; 1882.—Type locality: Mortlock I.; type in collection. Its identity with *Pt. molossinus* was pointed out by Thomas, in 1887 (*l. s. c.*).

a. ♀ ad. al.;	Mortlock, Caroline	Godeffroy Museum.	82.10.27.5.
skull.	Is. ( <i>Kubary</i> ).	(Type of <i>Pt. breviceps</i> , Thos.)	
b-d. ♂ ad., ♀ ad.,	Ponapé, Caroline	Godeffroy Museum.	82.10.27.6-8.
♀ pull. al.;	Is. ( <i>Kubary</i> ).		
skulls of b, c.			

*External measurements of Pteropus rodricensis and molossinus.*

	<i>Pt. rodricensis</i> . 3 ad. (Incl. type.)		<i>Pt. molossinus</i> . 6 ad. (Incl. type of species and of <i>Pt. breviceps</i> .)	
	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.
Forearm .....	124.5	127	94	98.5
Pollex, total length, c. u. ....	52	54.2	37	39
" metacarpal .....	...	...	9	9.5
" 1st phalanx .....	...	...	18	19
2nd digit, metacarpal .....	59.8	61	38	42
" 1st phalanx .....	14.8	16.7	11	12
" 2nd-3rd phalanx, c. u. ....	13	14.8	12	13
3rd digit, metacarpal .....	81	85.5	58.5	62
" 1st phalanx .....	59	60	43	45.5
" 2nd phalanx .....	83.5	84.5	64	69
4th digit, metacarpal .....	80.5	84	58	61.5
" 1st phalanx .....	48.5	51	36.5	39
" 2nd phalanx .....	47	47.8	39	42.5
5th digit, metacarpal .....	82	88	62.5	66
" 1st phalanx .....	38	39	28	30
" 2nd phalanx .....	37	38	29.5	32
Ears, length from orifice.....	21.5	22.5	15	17
" greatest width, flattened .....	13.7	14.2	9	10
Front of eye to tip of muzzle .....	19	20.8	15	16
Lower leg .....	55.5	58	43	45.5
Foot, c. u. ....	39.5	43	31	32
Calcar .....	13.5	15	7	9

*Measurements of skulls and teeth of Pteropus rodricensis  
and molossinus.*

	<i>Pt. rodricensis.</i> Skulls: 3 ad. Teeth: 3 ad. (Incl. type.)		<i>Pt. molossinus.</i> Skulls and teeth: 6 ad. (Incl. type of species and of <i>Pt. breviceps</i> .)	
	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	52.2	...	40.4	41.8
„ palation to incisive foramina .....	23.5	25	17.5	18.8
„ front of orbit to tip of nasals .....	16	17	12	13.3
„ width of brain-case at zygomatica .....	19.5	20.8	17.2	18
„ zygomatic width .....	23.2	30.8	24	25
„ width across $m^1$ , externally .....	14	15	11	12
„ lachrymal width .....	11.5	12.2	9.5	10
„ width across canines, externally .....	10.5	11.8	9.8	10.6
„ postorbital constriction .....	6.8	8.2	7	8
„ interorbital constriction .....	7.5	8.8	6.7	7.2
„ width of mesopterygoid fossa .....	6	6.7	5.2	5.8
„ between $p^1$ - $p^1$ , internally .....	8.4	9.2	7	8
„ between cingula of canines .....	...	...	5.8	6.2
„ orbital diameter .....	9.8	10.3	8.7	9
Mandible, length .....	41.2	41.2	29	31
„ coronoid height .....	18.8	20	12.8	13.8
Upper teeth, c- $m^2$ .....	18.5	19.8	13.8	14.8
Lower teeth, c- $m_3$ .....	22	22	15	16
Upper incisors, combined width .....	...	...	4.2	4.7
$p^3$ , length .....	3.7	3.8	2.8	3
„ width .....	2.6	2.7	2	2.1
$p^4$ , length .....	3.7	3.9	2.3	2.5
„ width .....	2.7	2.8	2	2.1
$m^1$ , length .....	3.9	4.1	2.8	2.9
„ width .....	2.1	2.5	1.8	2
$m^2$ , length .....	2	2	1	1.4
„ width .....	1.6	1.7	1	1.2
$p_1$ , length .....	1.8	2	1.8	2.2
„ width .....	1.6	1.8	1.5	1.8
$p_3$ , length .....	3.9	4.1	2.8	3.2
„ width .....	2.2	2.2	1.7	1.8
$p_4$ , length .....	3.8	4.1	2.4	2.8
„ width .....	2.3	2.5	1.8	1.8
$m_1$ , length .....	3.7	3.9	2.5	2.8
„ width .....	2.1	2.2	1.7	1.8
$m_2$ , length .....	2.8	3	1.9	2.1
„ width .....	2	2	1.5	1.6
$m_3$ , length .....	1.4	1.7	0.6	1.2
„ width .....	1.2	1.3	0.6	0.3

I. THE *PTEROPUS SAMOËNSIS* GROUP.

*Species*.—*Pt. nawaiensis*, *samoënsis*, *anetianus*.

*Range*.—South Polynesia : New Hebrides, Fijis, and Samoas.

*General characters* (compare fig. 14, p. 289, skull and dentition of *Pt. anetianus*).—Rostrum much shortened, coronoid high and steep. Posterior basal ledges of cheek-teeth strongly differentiated, in one species continued as a basal ledge on inner side of lower cheek-teeth;  $i_2$  and  $p_1$  larger than usual. Ears small; interfemoral practically undeveloped in centre; fur rich, sometimes unusually long and spreading; tibia always clothed above. Colour dark brownish above and beneath, sprinkled with longer pale-coloured hairs; mantle tawny or buffy. Males without glandular neck-tufts. Size moderate (forearm 124–145 mm.).

*Specific differentiation*.—In dentition these three Polynesian species mark three progressive stages of specialization: in all, the posterior ledges of the cheek-teeth are strongly developed, though still more so in *samoënsis* (Samoas) and *anetianus* (New Hebrides) than in *nawaiensis* (Fijis); in *nawaiensis*  $i_2$  is rather larger, in *samoënsis* and *anetianus* much larger than usual in the genus; in *nawaiensis*  $p_1$  is approximately normal, in *samoënsis* and *anetianus* much enlarged; in *nawaiensis* there is no trace of a lingual ledge in the lower cheek-teeth, in *samoënsis* the posterior basal ledge is sometimes continued forward along the lingual face of  $p_4$  and  $m_1$  as an obsolescent rim, in *anetianus* this rim, in  $p_4$ ,  $m_1$ , and  $m_2$ , has developed into a broad, well-defined ledge, a character unique in the genus (but reoccurring in *Acerodon*).

*Affinities of group*.—Probably the South Polynesian representative of the *Pt. lombocensis* group, with the typical species of which (*Pt. lombocensis* and *solitarius*) it accords in all important cranial characters, the heavy dentition, the distribution of the fur, and general pattern of colour; a beginning enlargement of  $p_1$  is already seen in one species of the *lombocensis* group (*Pt. molossinus*), a strong development of the posterior basal ledges of the lower cheek-teeth in another species of the same group (*Pt. rodricensis*), and a pronounced reduction of the ears and lengthening of the fur in both of these species. The two related groups have followed different lines of specialization: in the *lombocensis* type  $m_3$ ,  $m_2$ , and  $i_1$  are reduced; in the *samoënsis* type these teeth are normal, but  $i_2$  and  $p_1$  enlarged and the basal ledges of the cheek-teeth unusually strong.

52. *Pteropus nawaiensis*, Gray.

*Pteropus samoënsis* (pt.), Dobson, Cat. Chir. B. M. p. 35.

*Pteropus nawaiensis*, Gray, Cat. Monk. &c. p. 107 (1870: Nauai & Ovalau, Fiji Is.).

*Pteropus vitiensis*, Gray, Cat. Monk. &c. p. 109 (1870: Ovalau, Fiji Is.).

*Pteropus samoënsis* (nec Peale), Dobson, l. s. c. (pt.) (1878: Ovalau;

Nauai); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 204 (pt.) (1879: Nauai; Ovalau); *id., Ann. Sci. Nat.* (6) Zool. viii. Art. 12, p. 16 (pt.) (1879: remarks on distr.); *Thomas, P. Z. S.* 1880, p. 11 (Fiji Is.); *Trouessart, Cat. Mamm.* i. p. 79 (pt.) (1897: Fiji Is.). *Pteropus* (*Spectrum*) *samoënsis* (pt.), *Matschie, Megachir.* p. 22 (1899: Viti Levu; Ovalau); *Trouessart, Cat. Mamm., Suppl.* p. 51 (1904: Fiji Is.).

*Diagnosis.*—Rostrum short and broad, coronoid high.  $i_2$ ,  $p^1$ , and  $p_1$  larger than usual, posterior basal ledges of  $p^3$ ,  $p_3$ , and  $p_4$  strong. Tibia thickly clothed above. Colour of fur dark brownish above and beneath, lightened with buffy or wood-brown tips to the hairs, but very variable, according to greater or less predominance of dark brown or buffy (wood-brown) element; mantle and crown buffy or tawny; face mixed blackish, greyish, and buffy. Size below medium: forearm 124–131.5 mm. *Hab.* Fiji Is.

*Skull.*—Rostrum short and stout; length from front of orbit to tip of muzzle much less than width of brain-case at root of zygomata, only a little more than maxillary width externally across  $m^1$ – $m^1$ ; front of orbit vertically above back of  $p^1$  or front of  $m^1$ . Sagittal crest well developed. Postorbital processes long and slender, extending two-thirds or three-fourths the distance from frontal to zygoma; corresponding processes of zygoma small or undeveloped. Coronoid process of mandible high, coronoid height larger than or equal to length of lower tooth-row,  $c$ – $m_3$ .

*Teeth.*—Chief characters: see diagnosis of species.—Upper canines short, stout, distinctly recurved; cingulum strong, forming a well-defined ledge on inner base of tooth.  $p^1$  larger than usual, not rarely equal in size to  $i_1$ , as a rule with crown distinctly differentiated from shaft; present in all specimens examined, most of which are fully adult, but none very aged. Posterior basal ledge of  $p^3$  large, sharply marked off by a notch from main cusp of tooth postero-externally, where it develops a small projecting tubercle. Posterior ledge of  $p^1$  smaller and much less distinctly marked off from tooth, though generally a minute notch is detectable postero-externally; the ledge is in some individuals slightly more projecting backward on postero-internal than on postero-external corner of tooth.  $m^1$  almost twice as long as broad.  $m^2$  subequal to  $p_1$ .— $i_2$  twice or three times the bulk of  $i_1$ . Lower canines short, stout, recurved; cingulum very strong, forming a broad ledge.  $p_1$  once and a half to twice the size of  $i_2$ . Posterior basal ledge of  $p_3$  and  $p_4$  very strong, sharply marked off from teeth by a notch postero-externally; in  $m_1$  and  $m_2$  the ledge, though easily observable, is indistinctly differentiated from the teeth. Cingulum of  $p_3$  distinctly projecting antero-internally but without any trace of minute tubercle (cf. *Pt. anetianus*).  $m_3$  normal, somewhat smaller than  $p_1$ .

*Palate-ridges.*—5+5+3. First ridge terminating laterally at front of canines; second at back of canines; third at front of  $p^3$ ; fourth at back of  $p^3$ ; fifth at middle of  $p^1$ ; sixth at middle (or front) of  $m^1$ ; seventh at front of  $m^2$  (or back of  $m^1$ ); eighth to tenth behind  $m^2$ ; eleventh to thirteenth situated at palation border.

*Ears*.—Short, half exposed. Inner margin convex from base to tip, outer margin convex in lower, almost straight in upper half; tip rounded off. Naked posteriorly, except at base.

*Wings*.—Membranes about 26 mm. apart at origin from sides of back.

*Interfemoral*.—Extremely short or undeveloped in centre.

*Fur*.—Length moderate: about 16 mm. at middle of back, 17 at middle of mantle, 18 at middle of belly. Straight and directed backward, but not closely adpressed, on back. Least width of furred area of back about 50 mm.

A thin line of short adpressed hairs along upperside of humerus. Proximal third of forearm covered with short sparse hair above. Tibia densely clothed above with long hairs, quite or almost to ankle. Beneath, antibrachial membrane, lateral membrane along outer side of forearm to some distance from carpal joint, and membrane between humerus and femur, densely covered with woolly hair. Underside of tibia hairy for proximal third.

*Colour*.—♀ ad. skin, teeth slightly worn; Nauai, Fiji, November; type of species, 56.9.4.2:—Back and rump approximately Prout's brown, conspicuously varied with wood-brown, and slightly sprinkled with silvery whitish-grey. Individual hairs (excepting the whitish hairs, which are uniform from base to tip) dark vandyck-brown, almost seal-brown, at base, pale wood-brown at tip; dark base of fur partly exposed on back, quite or almost concealed on rump.—Breast and belly between vandyck-brown and seal-brown (base of fur), strongly lightened with glossy golden buffy wood-brown tips to the hairs, and somewhat sprinkled with silvery greyish-white hairs. General effect darkest along centre of breast and belly, owing to pale hair-tips being short or absent; palest, golden buffy wood-brown varied with dark brownish, on flanks, sides of breast, and belly, owing to pale hair-tips quite or almost concealing dark base of fur. Anal region washed with mars-brown.—Mantle buffy, slightly tinged with ochraceous-buff, shading almost to cream-buff posteriorly, and to ochraceous on sides of neck. Concealed bases of hairs everywhere seal-brown. Foreneck mixed ochraceous and dark brown, not essentially different from sides of breast and belly.—Buffy colour of mantle extending forward on occiput, crown, and interocular space; all hairs seal-brown at concealed bases. Face and sides of head whitish-grey conspicuously mixed with blackish hairs, extending backward above the eye as an ill-defined superciliary stripe. Chin and throat seal-brown, slightly sprinkled with greyish-white hairs.

♂ ad. skin, teeth slightly worn; Ovalau, Fiji, August; type of *Pt. vitiensis*, Gray, 58.12.27.3:—Not essentially different from the above, but conspicuously darker, and mantle richer in colour.—Back and rump vandyck-brown, varied with ochraceous wood-brown (approaching golden cinnamon), particularly on sides of back along membranes, and slightly sprinkled with silvery greyish-white hairs. Individual hairs seal-brown at base, ochraceous wood-brown at tip, producing a dark brown varied with ochraceous wood-brown

along middle of back, and an ochraceous wood-brown slightly darkened with brownish on sides of back, where the dark hair-bases are almost concealed.—Breast and belly rather similar to back, the admixture of golden ochraceous wood-brown being strongest on sides of breast and flanks, thinnest along middle of breast, belly, and anal region.—Mantle rich tawny, approaching ochraceous-rufous, lightening to ochraceous-buff posteriorly, and darkening to chestnut on sides of neck. Foreneck dark cinnamon-rufous, varied with dark brown and sprinkled with buffy hairs, thus not contrasting with, but only somewhat richer in colour than, sides of neck. Base of hairs of mantle and sides of neck seal-brown.—Tawny colour of mantle extending forward on occiput, lightening on crown, interocular space, and temporal region to golden buffy or ochraceous-buff; concealed bases of hairs darker. Face, superciliary stripe, chin, and throat blackish sprinkled with greyish and ochraceous.

Palest extreme in the series (♀ imm. skin; Viti Levu, June; 79.4.8.2):—Differs from the above in the excessive development of the pale element of the coloration.—Back and rump almost cream-buff, owing to the light tinge and unusual length of the pale hair-tips, which completely or almost completely conceal the seal-brown base of the fur.—Breast, belly, and flanks buffy, slightly mixed with brown on belly; base of fur dark brown.—Mantle cream-buff, shading to buff on sides of neck; base of hairs seal-brown. Fore-neck similar to breast.—Occiput, crown, and interocular space buffy, many of the hairs, particularly anteriorly, without dark bases. Face, chin, and throat mixed blackish, buffy, and greyish.

Of the three specimens described above the second represents the darkest extreme in the series examined, the first an intermediate colour variation, the third an extremely pale variety. The individual colour variation in this species, however great it appears on comparison of the extremes, depends solely on the greater or less development of the pale element of the colour, and the paler (buffy, cream-buff) or richer (tawny) tinge of the mantle. The variations are independent of the habitat of the individuals: the palest individual (79.4.8.2) is from Viti Levu; the same island is represented by a specimen similar to the type of *Pt. nawaiensis*, from Nauai, and to a specimen from Ovalau (58.12.27.4); the type of *Pt. vitiensis*, also from Ovalau, is, however, the darkest specimen in the series.—Of the series examined, two individuals are females, both of them with pale-coloured (buffy, ochraceous-buffy) mantle; four are males, in two the mantle is rich tawny, in the third it approaches, in the fourth it is similar to, that of the females. It would seem, therefore, that the richer or paler tinge of the mantle has little, if anything, to do with the sex.

*Measurements.* On pp. 291, 292.

*Specimens examined.* The British Museum material.

*Range.* Fiji Islands: Vanua Levu, Viti Levu, Ovalau, Nauai.

*Type* in collection.

*History in literature.*—Two specimens in the collection are labelled in Gray's handwriting *Pt. nawaiensis*; one, from Nauai (collected

by Rayner; 56.9.4.2), must be taken as the type of the species; the other, from Ovalau (Rayner; 58.12.27.4), was described by Gray as a "variety" of *Pt. nawaiensis* (Cat. Monk. &c. p. 107). The two skull-measurements given by Gray are incorrect. By all subsequent writers *Pt. nawaiensis* has been united with *Pt. samoënsis*, a species which it resembles rather closely in external characters, but from which it differs remarkably in dentition.

*Pteropus vitiensis*, Gray; 1870.—Type locality, Ovalau, Fiji; type in collection. Indistinguishable from *Pt. nawaiensis*. A description of the colour of the fur is given above, p. 282.

- |                                   |  |                               |                             |
|-----------------------------------|--|-------------------------------|-----------------------------|
| a. ♂ ad. sk.; skull.              | Savu, Vanua Levu, Fiji ( <i>H. J. Fenu-cane</i> ).   | R. Geographical Society [P.]. | 99.3.7.1.                   |
| b, c. ♂ ad., ♀ imm. sks.; skulls. | Nuza Malo R., Viti Levu, Fiji; June, 1875.           | Baron v. Hügel [P.].          | 79.4.8.1, 2.                |
| d. ♂ ad. sk.; skull.              | Ovalau, Fiji; Aug. 1856 ( <i>Dr. F. M. Rayner</i> ). | Lords of the Admiralty [P.].  | 58.12.27.3.                 |
| e. ♂ imm. sk.; skull.             | Ovalau; Aug. 1856 ( <i>Dr. F. M. Rayner</i> ).       | Lords of the Admiralty [P.].  | 58.12.27.4. }<br>59.7.14.1. |
| f. ♀ ad. sk.; skull.              | Nauai, Fiji; Nov. 1855 ( <i>Dr. F. M. Rayner</i> ).  | Lords of the Admiralty [P.].  | 56.9.4.2.                   |
|                                   |  | (Type of species.)            |                             |

### 53. *Pteropus samoënsis*, Peale.

*Pteropus samoënsis* (pt.), Dobson, Cat. Chir. B. M. p. 35.

*Pteropus samoënsis*, Peale, *U.S. Expl. Exp.* viii. *Mamm.* p. 20, text-fig. (skull) (1848: Tutuila, Samoa Is.; habits); *Wagner, Schreber's Säug., Suppl.* v. p. 601 (1853-55: Samoa); *Cassin, U.S. Expl. Exp.* viii. (sec. ed.) p. 7, text-fig. (skull), *Atl. Mamm.* pl. ii. (whole fig.) (1858: Samoa; habits); *Peters, MB. Akad. Berlin*, 1867, p. 332 (1867: Samoa); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 444 (1870: Samoa); *Dobson, Cat. Chir. B. M.* p. 35 (pt.) (1878: Samoa); *Leche, Lunds Univ. Arsskr.* xii. p. 16 & seq. (1878: milk-teeth); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 204 (pt.) (1879: Samoa); *id., Ann. Sci. Nat.* (6) Zool. viii. Art. 12, p. 16 (pt.) (1879: remarks on distr.); *Zuckermandl, Riechcentrum*, p. 29 (1887: anatomy of brain); *Jentink, Cat. Ost. Mamm.* p. 253 (1887: Samoa); *id., Cat. Syst. Mamm.* p. 140 (1888: Samoa); *Trouessart, Cat. Mamm.* i. p. 79 (pt.) (1897: Samoa); *Matschie, Megachir.* pl. iii. figs. 1a, 1b, 1c, 1d, 1e (skull) (1899: Samoa); *Müller, Fam. & Gen. Bats*, p. 58 (pt.) (1907).

*Pteropus* (Spectrum) *samoënsis* (pt.), *Matschie, Megachir.* p. 22 (1899: Samoa); *Trouessart, Cat. Mamm., Suppl.* p. 51 (1904: Samoa).

*Pteropus whitmceei*, *Alston, P. Z. S.* 1874, p. 96, pl. xiv. (animal) (Samoa); *Whitmee, P. Z. S.* 1874, p. 666 (Samoa; habits).

*Pteropus fuscicollis*, *Nicoll, Zoologist*, (4) viii. p. 413 (1904: Tutuila; Upolu) (nom. nud.: ? misprint for *ruficollis*).



*Pteropus ruficollis* \*, *Nicoll, Three Voy. of a Naturalist*, p. 228 (1908: Tutuila; Upolu; habits) (nom. nud.).

*Diagnosis*.—Allied to *Pt. nawaiensis*, but dentition much heavier,  $i_2$  and  $p_1$  unusually large, posterior ledges of cheek-teeth, particularly in mandible, more sharply differentiated, posterior ledge of  $p_4$  and  $m_1$  sometimes extending forward along inner face of teeth as a more or less obsolescent rim. Fur longer, coloration essentially as in *Pt. nawaiensis*, but brownish of back generally of a darker tinge, mantle deeper tawny, face, chin, and throat more mixed with blackish. Size somewhat larger: forearm about 143.5 mm. *Hab.* Samoa Is.

*Skull*.—As in *Pt. nawaiensis*, but with markedly heavier mandible.—Deflection of brain-case moderate, alveolar line continued backward passing through upper part of occipital condyles. Rostrum short and stout, as in *Pt. nawaiensis*; front of orbit above posterior third or posterior point of  $p^4$ ; size of orbits as in *nawaiensis*. Sagittal crest strong. Coronoid process high, steeply ascending; coronoid height of mandible in aged specimens considerably more than length of lower tooth-row,  $c-m_3$ .

*Teeth*.—Upper incisors distinctly broader than in *Pt. nawaiensis*. Upper canines markedly stouter, recurved, cingulum very broad, forming a sharply projecting ledge at inner base of tooth; margin of cingulum with pronounced tendency to subdivide into a series of rounded tubercles.  $p^1$  less reduced than usual, equal to or larger than  $i_1$ , present in both of the skulls examined (as well as in three cotypes of the species, from Tutuila, in the collection of the U.S. Nat. Mus.).  $p^3$ ,  $p^4$ , and  $m^1$  considerably heavier than in *Pt. nawaiensis*. Posterior basal ledge of  $p^3$  strongly marked off from tooth by a notch postero-externally, where the ledge is raised as a small rounded tubercle. In  $p^4$  the ledge is rather more developed on postero-internal than on postero-external corner of tooth, making line of posterior margin of  $p^4$  more or less oblique on longitudinal axis of tooth.  $m^1$  very nearly twice as long as broad, with indistinctly differentiated posterior ledge.  $m^2$  normal, larger than  $m_3$ , smaller than  $p_1$ .

$i_1$  slightly reduced in size.  $i_2$  unusually large, four to five times the bulk of  $i_1$  (this strong contrast in size between  $i_2$  and  $i_1$  being chiefly due to actual enlargement of  $i_2$ , as easily seen on comparison with *Pt. nawaiensis*, but further emphasized by a slight reduction of  $i_1$ ). Lower canines recurved, stouter than in *Pt. nawaiensis*, cingulum forming a well-marked, broad ledge at inner and posterior base of tooth.  $p_1$  unusually large, much larger than (about one and a half times the bulk of)  $p_1$  in *Pt. nawaiensis*. Posterior basal ledge of  $p_3$  very strong, sharply separated postero-externally by a well-marked notch from outer longitudinal ridge of tooth; antero-internal cingulum of same tooth distinctly projecting but without trace of minute tubercle (cf. *Pt. anetianus*). Posterior basal ledge of  $p_4$  and  $m_1$  very broad, sharply cut off from outer and inner

\* Spelt *Pt. ruficollis* in the index to the book (pp. 242, 245).

longitudinal ridge of tooth, and showing a distinct tendency to extend forward for some distance as an obsolescent basal rim on lingual face of tooth; in three skulls (B. M. 93.11.29.1; U.S. Nat. Mus. 22562 and 37862, cotypes of species) this forwardly extending lingual rim is fairly distinct, though narrow and much less differentiated than in *Pt. aetianus*; in three skulls (B.M. 3.8.27.1 and 9.1.4.2; U.S. N. M. 37860, cotype) it is either indistinct (two) or indetectable (the third). Posterior ledge of  $m_2$  short, but generally distinctly marked off from tooth both externally and internally.  $m_3$  subequal to  $i_1$ .

*Ears*.—Short, half-exposed, falling short of hinder corner of eye by a space of about 11 mm. when laid forward. Inner margin convex from base to tip; outer margin flatly convex in lower two-thirds, flatly concave in upper third; tip rounded off. Naked posteriorly except at base.

*Wings*.—Membranes arising about 25 mm. apart from sides of back.

*Interfemoral*.—Undeveloped in centre.

*Fur*.—Longer than in *Pt. nawaiensis*, particularly on underside of body: about 18 mm. at middle of back, 20 at middle of mantle, 24 at middle of belly. Directed backward, but not closely adpressed on back. Least width of furred area of back about 45 mm.

Above, a narrow line of adpressed hairs along upperside of humerus. Elbow and base of forearm naked; a narrow line of rather long, very thinly spread, adpressed hairs commencing some distance in front of elbow and extending forward along upperside of forearm for about 35 mm. Proximal two-thirds of tibia hairy, thickly along inner side, thinly along median line of upper surface. Beneath, antibrachial membrane, lateral membrane along outer side of forearm to carpal joint, and between humerus and femur clothed with woolly hairs. Underside of tibia clothed for proximal half or third.

*Colour*.—Ad. skin, teeth slightly worn, Samoa Is., 93.11.29.1. Back almost seal-brown, gradually lightening to vandyck-brown on rump, slightly and inconspicuously sprinkled with greyish-white hairs.—Centre of breast and belly dark vandyck-brown, shading to more typical vandyck-brown in anal region; sides of breast and belly, including flanks, cinnamon-russet, thickly sprinkled with longer, coarse, buffy or buffy-grey hairs.—Mantle tawny, becoming darker (tinged with russet) on sides of neck; foreneck dark brownish mixed with tawny hairs, the general effect almost similar to that of sides of breast. Base of hairs of mantle and sides of neck seal-brown.—Tawny colour of mantle extending to occiput, lightening to ochraceous-buffy on crown. Interocular space and sides of face mixed buffy, greyish, and blackish; chin and throat blackish, mixed with pale greyish and buffy hairs.

A second skin (♂ imm., Upolu, April, 3.8.27.1) differs from the above in the paler, more buffy-russet, tinge of the breast and flanks, paler mantle, and much more blackish throat.

A very young (scarcely half-grown) female is seal-brown, thickly

sprinkled with buffy-grey on back and rump, mixed golden buffy-grey and dark brownish on breast, belly, and flanks; mantle, sides of neck, and foreneck dark chestnut, approaching vandyek-brown, somewhat sprinkled with silvery grey; head cream-buff, clouded with blackish on muzzle.

*Measurements.* On pp. 291, 292.

*Specimens examined.* The British Museum material; photographs of skulls of cotypes of species.

*Range.* Samoa Is.: Savaii, Upolu, Tutuila, Manua.

*Cotypes* in the U.S. National Museum (skins 8594 (not found), 8596, 8597, skulls 22562, 37860, 37862).

*Habits.*—*Pt. samoënsis* is chiefly nocturnal, but may very frequently be seen even at midday flying high in the air with a slow and regular flap of the wing, not unlike a small heron, and occasional short intervals of sailing (hence the native name "Manu lagi" or "Manu langi," *i. e.* animal of the heavens; its usual native name is, however, "Pea" or "Peba"). When on wing it carries its legs stretched out behind, which makes it appear to have a tail. It is very fond of the bread-fruit (*Artocarpus incisa*), of which it destroys a great quantity, and as the bread-fruit trees are chiefly about the villages, the natives kill a good many bats, partly to protect the fruit, partly as an article of food. In addition to the bread-fruit it feeds on the different species of bananas (chiefly *Musa chinensis*), the Papaw apple (*Carica papaya*), the Hog plum (*Spondias dulcis*), the *Eugenia malaccensis*, and the sweet oranges, for which latter it appears to have a great liking. The natives very easily tame this bat, "and after keeping it for a little time in captivity they allow it to go at liberty, but it never leaves the house and people it is accustomed to" (*Whitmee*). The quarrels of these bats in the evening and night are accompanied by the most horrid screeching noise.

*Pt. samoënsis*, Peale; 1848.—Type locality, Tutuila I., Samoa group. Photographs of the skulls and teeth of the three cotypes, kindly sent me by Dr. Lyon, agree to the smallest details with the British Museum specimens here referred to *Pt. samoënsis*.

*Pt. whitmeei*, Alston; 1874.—Based on an "adult" male (al.), in the possession of the late Canon Tristram, obtained in the Samoa Is. by the Rev. S. J. Whitmee. Alston considered this specimen adult, and separated it from *Pt. samoënsis* chiefly on account of its smaller size. The figure, description, and measurements leave no doubt that it is a young (not full-grown) *Pt. samoënsis*.

a. ♀ imm. al.	Samoa Is.	Mus. Godeffroy.	74.10.5.7.
b. ♀ pull. sk.	Samoa Is.	Rev. S. J. Whitmee	78.1.25.1.
		[P.]	
c. Ad. sk.; skull.	Samoa Is.	Canon H. B. Tristram	93.11.29.1.
		[E.]	
d. ♀ imm. al.; skull.	Samoa Is.	R. Army Medical College [P.]	9.1.4.2.
e. ♂ imm. sk.; skull.	Apia, Upolu, Samoa Is., 700'; 27 April, 1903.	Earl of Crawford	3.6.27.1.
		[P.]	

54. *Pteropus anetianus*, Gray.

*Pteropus aneitianus*, Dobson, Cat. Chir. B. M. p. 29.

Smaller species of *Pteropus*, MacGillivray, *Zoologist*, xviii. pp. 7135, 7136 (Sept. 1860: *Aneiteum*; habits).

*Spectrum anetianum*, Gray, Cat. Monk. &c. p. 101 (1870: *Aneiteum*).

*Pteropus aneitianus*\*, Dobson, Cat. Chir. B. M. p. 29, pl. iv. fig. 2 (teeth) (1878: *Aneiteum*); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 203 (1879: *Aneiteum*); *id.*, *Ann. Sci. Nat.* (6) Zool. viii. Art. 12, p. 16 (1879: remarks on distr.); Jentink, Cat. Ost. Mamm. p. 253 (1887: *Aneiteum*); *id.*, Cat. Syst. Mamm. p. 139 (1888: *Aneiteum*); Trouessart, Cat. Mamm. i. p. 78 (1897: *Aneiteum*); Miller, *Fam. & Gen. Bats*, p. 58 (1907).

*Pteropus* (*Spectrum*) *anetianus*\*, Matschie, *Megachir.* p. 22 (1899); Trouessart, Cat. Mamm., Suppl. p. 51 (1904: *Aneiteum*).

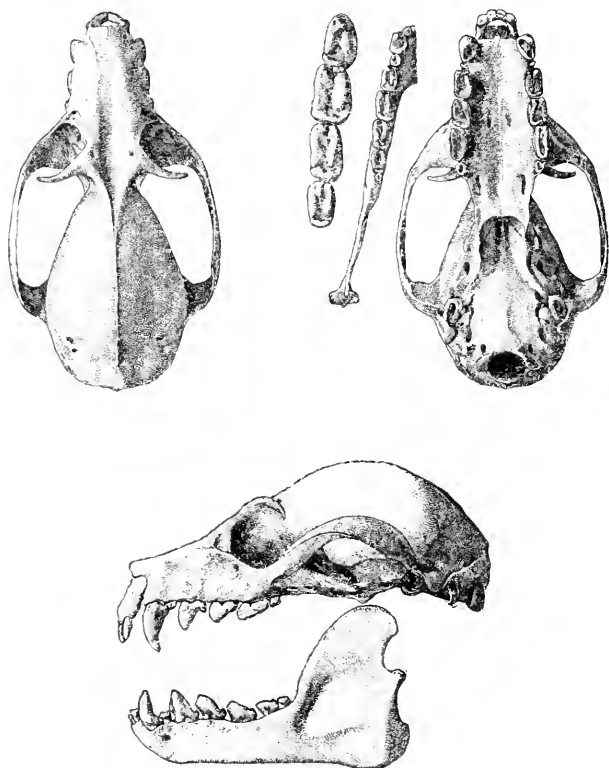
*Diagnosis*.—Allied to *Pt. samoënsis*, which it resembles in most cranial and dental characters (short rostrum, large  $i_2$  and  $p_1$ , very strong posterior ledges of cheek-teeth), but with posterior ledge of  $p_4$ ,  $m_1$ , and  $m_2$  extending forward on lingual face of tooth as a broad, well-defined shelf. Externally (fur, colour) much like *Pt. dasymallus*. Size below medium: forearm 123.5–130 mm. *Hab.* *Aneiteum*, New Hebrides.

*Skull* (fig. 14).—General shape as in *Pt. nawaiensis* and *samoënsis*; size as *nawaiensis*, smaller than *samoënsis*.—Deflection of brain-case moderate, alveolar line if projected backward passing through middle or upper half of occipital condyles. Rostrum very short, still a little shorter than in *Pt. samoënsis*, stout; length from front of orbit to tip of nasals subequal to (rather less than) three-fourths the width of the brain-case at root of zygomata; width of rostrum externally across alveolar borders of  $p^1$ – $p^1$  subequal to orbital diameter; front of orbit vertically above middle of  $p^4$ . Size of orbits as in the allied species. Sagittal crest well developed. Zygomatic arch unusually deep (vertical extent); in none of the skulls examined (eight) any trace of postorbital processes on zygomatic arch. Coronoid process extremely high, its front margin steeply ascending; coronoid height of mandible much more than length of lower tooth-row,  $c$ – $m_2$ .

*Teeth* (fig. 14).—Chief characters: see diagnosis of species.—Upper incisors as in *Pt. samoënsis*. Upper canines short, stout, recurved; inner cingulum very strong, forming a broad shelf with raised margin, the latter in most specimens simple, in others indistinctly subdivided into a series of small rounded tubercles.  $p^1$  as in *Pt. nawaiensis* and *samoënsis*, less reduced than usual, sometimes terete, but generally with crown rather distinctly differentiated from shaft, present in all skulls (eight) examined, none of which

\* Spelt *aneitianus* by most of the authors referred to above, by one (Trouessart, 1897, 1904) *aneitanus*, and by two (Matschie, Miller) *anetianus*. The latter is the earliest (Gray, 1870), and technically therefore only admissible, form of the name.

have the teeth much worn. Posterior basal ledge of  $p^3$  very strong, sharply separated postero-externally by a well-marked notch from base of outer main cusp; postero-external corner raised into a small rounded tubercle; postero-internal margin of ledge continuous with hinder margin of inner main cusp; antero-internal basal portion of  $p^3$  often more differentiated than usual, forming a small "heel,"



TERZI.

Fig. 14.—*Pteropus anetianus*, ♂. Aneiteum. No. 7.1.1.255. ♀, with left  $p_3$ ,  $p_4$ ,  $m_1$ , and  $m_2$  enlarged (♂, linear).

with or without minute tubercle. Posterior ledge of  $p^4$  well developed, sharply separated postero-externally by a distinct notch from base of outer main cusp; the ledge is much more developed on postero-internal than on postero-external corner of tooth, making

the former projecting considerably backward and inward, and line of hinder margin of ledge oblique on longitudinal axis of tooth; antero-internal basal projection smaller than in  $p^3$ .  $m^1$  very nearly twice as long as broad; posterior ledge well developed, but indistinctly differentiated from tooth, though generally a small postero-external notch between ledge and outer main cusp is present.  $m^2$  normal, larger than  $m_3$ , smaller than  $p_1$ .

$i_1$  normal.  $i_2$  larger than usual, though not quite as much enlarged as in *Pt. samoënsis*, three to four and a half times the bulk of  $i_1$ . Lower canines short, very stout, recurved, cingulum forming a broad ledge at inner and posterior base of tooth.  $p_1$  as in *Pt. samoënsis*, unusually large, twice to twice and a half the bulk of  $i_2$ . Posterior basal ledge of  $p_3$ ,  $p_4$ ,  $m_1$ , and  $m_2$  very large, sharply cut off postero-externally by a notch from outer main cusp (the notch always well marked in  $p_3$  and  $p_4$ , less so and sometimes only indicated in  $m_1$  and  $m_2$ ); in  $p_1$ ,  $m_1$ , and  $m_2$  the ledge extends forward, as a broad sharply defined shelf, on lingual face of tooth, gradually decreasing in width anteriorly, but generally traceable to front end of tooth; this lingual continuation of the ledge is sometimes indicated also in  $p_3$ . Antero-internal basal portion of  $p_3$  and  $p_4$  forming a small projecting heel, generally with minute rounded tubercle.  $m_3$  normal, equal to or slightly smaller than  $i_2$ .

*Palate-ridges.*— $5 + 5 + 3$ . Arrangement quite as in *Pt. nawaiensis* (above p. 281).

*Ears* (dried skins).—As in *Pt. nawaiensis* and *samoënsis*.

*Wings.*—About 25 mm. apart at origin from sides of back.

*Interfemoral.*—Undeveloped in centre.

*Fur.*—Long, soft, silky; spreading on back and rump; unusually long hairs thinly spread everywhere among the ordinary fur of the upper and under side. Approximate length of hairs at middle of back 31 (longest hairs) and 17 mm. (shortest), at middle of mantle 31 and 20, at middle of belly 25 and 17. Least width of furred area of back about 70 mm.

Above, humerus and proximal half or two-thirds of forearm clothed with long dense adpressed hairs. Fur of back extending on lateral membrane almost to a line between elbow and knee. Tibia densely covered above with long hairs to ankle; a very narrow line of short hairs traceable to base of first phalanx of second or third toe.—Beneath, basal half of forearm thinly haired. Underside of antebrachial membrane, of lateral membrane along outer side of forearm to carpal joint, and between humerus and femur, covered with densely set woolly hairs. Underside of tibia hairy for proximal third or half.

*Colour.*—♂ ad. skin, teeth slightly worn; 7.1.1.256.—Back and rump vandyck-brown, strongly lightened by buffy tips to the hairs. Individual hairs seal-brown at base, shading gradually to dark vandyck-brown in middle portion; tips golden buffy or ochraceous-buffy, in many hairs tinged with tawny. Pale hair-tips on back in most places rather too short, on rump sufficiently long, to

completely cover the vandyck-brown subapical portion.—Breast, belly, and flanks much more uniform in colour: vandyck-brown, washed with mars-brown on sides of breast and belly, anal region, and flanks. Most hairs dark vandyck-brown or approximately seal-brown at base, mars-brown at tip.—Mantle rich chestnut-tawny in front (back of neck), between ochraceous-buff and buff posteriorly (shoulders), these anterior and posterior portions of the mantle rather strongly contrasting with each other, though not separated by any definite line of demarcation; colour gradually darkening to chestnut vandyck-brown on sides of neck, this again on foreneck to dark vandyck-brown. Concealed base of fur of mantle and sides of neck seal-brown.—Chestnut tawny colour of nape passing on occiput and crown into Prout's brown washed with tawny and sprinkled with buffy hairs. Interocular space, sides of head, chin, and throat seal-brown, slightly mixed with tawny hairs.

Individual variation in colour.—Not great, chiefly depending on the paler or darker buffy tinge, and the greater or less length of the hair-tips on back and rump. The extreme in light colour (so far as the small series goes) is shown in specimen 54.8.25.2 (♀ ad., teeth well worn; cotype of species): back and rump pale buffy, somewhat varied with mars-brown; the extreme in dark colour by

*External measurements of Pteropus nawaiensis, samoënsis,  
and anetianus.*

	<i>Pt. nawaiensis. 4 ad. (Incl. type.)</i>		<i>Pt. samoënsis. Ad.</i>	<i>Pt. anetianus. 3 ad. (Incl. cotypes.)</i>	
	Min.	Max.		Min.	Max.
	mm.	mm.	mm.	mm.	mm.
Forearm .....	124	131.5	143.5	123.5	130
Pollex, total length, c. u. ....	49.2	55	53.2	51	53.5
"  metacarpal .....	11.2	12.8	12.2	11.8	12.5
"  1st phalanx .....	26.2	27.7	28.8	25.5	26.8
2nd digit, metacarpal .....	58	65.5	71	58	60.8
"  1st phalanx .....	13	17.5	19.8	16	17
"  2nd-3rd phalanx, c. u. ....	13.7	14.8	15.8	13	13.5
3rd digit, metacarpal .....	81	87	99	80	82.3
"  1st phalanx .....	60	65	73	61.5	66
"  2nd phalanx .....	84.8	92	105	84.5	90.5
4th digit, metacarpal .....	81	85.5	96	78.5	81
"  1st phalanx .....	51	54.5	58.8	51.2	56
"  2nd phalanx .....	50	52.5	56.5	49.5	50.5
5th digit, metacarpal .....	85.5	92	105	85.5	89
"  1st phalanx .....	38	39.5	43	39.5	41.8
"  2nd phalanx .....	34.8	39	42	40	41.8
Lower leg .....	53.8	56.5	? 60	53	55.5
Foot, c. u. ....	...	...	...	38	42
Calcaneus .....	...	13	...	...	...

*Measurements of skulls and teeth of Pteropus nawaiensis,  
samoënsis, and anetianus.*

	<i>Pt. nawaiensis.</i> Skulls: 4 ad. Teeth: 4 ad., 2 imm. (Incl. type.)		<i>Pt. samoënsis.</i> Skull: 1 ad. Teeth: 1 ad., 1 imm.		<i>Pt. anetianus.</i> Skulls: 6 ad. Teeth: 6 ad., 2 imm. (Incl. cotypes)	
	Min.	Max.	Min.	Max.	Min.	Max.
Skull, total length to gnathion .....	mm.	mm.	mm.	mm.	mm.	mm.
.. palation to incisive foramina .....	255*	260*	261*	55.7	58	58
.. front of orbit to tip of nasals .....	26.8	27.8	28.3	26.2	27	27
.. width of brain-case at zygomata .....	17	18.3	18.5	15.2	16.2	16.2
.. zygomatic width .....	21.2	23	...	21	22	22
.. width across m <sup>1</sup> , externally .....	31.2	35.5	...	31.7	32.7	32.7
.. lachrymal width .....	15.8	17	17.2	14.8	15.8	15.8
.. width across canines, externally .....	12.5	13.8	13.8	12.8	13	13
.. postorbital constriction .....	11.3	13	12.8	11	13.7	13.7
.. interorbital constriction .....	6.8	7.8	8.2	6	7	7
.. width of mesopterygoid fossa .....	8	8.8	9	7.8	8.5	8.5
.. between p <sup>4</sup> -p <sup>4</sup> , internally .....	6.7	7	7.2	6.8	7.5	7.5
.. between cingula of canines .....	9.7	10	10	8.7	9.5	9.5
.. orbital diameter .....	5.8	7.3	6.7	5.5	7.2	7.2
Mandible, length .....	11.8	12.8	12.2	11.8	12.1	12.1
.. coronoid height .....	44	48	49.2	42.8	44.8	44.8
Upper teeth, c-m <sup>2</sup> .....	25.2	25.5	28.7	25	27	27
Lower teeth, c-m <sub>3</sub> .....	21.2	23.8	23.2	20.8	22	22
Upper incisors, combined width .....	23.2	25.3	25.7	22.8	23.7	23.7
p <sup>3</sup> , length .....	6.2	6.3	...	6.8	6.1	7
.. width .....	4	4.2	4.7	4.8	4.2	4.6
p <sup>4</sup> , length .....	2.8	3	3.2	3.7	2.8	3
.. width .....	4	4.5	4.8	4.8	4.2	4.7
m <sup>1</sup> , length .....	2.9	3.2	3.6	3.8	3	3.2
.. width .....	5	5.7	5.8	6	5	5.4
m <sup>2</sup> , length .....	2.7	3	3.2	3.2	2.7	2.8
.. width .....	2	2.7	2.6	2.7	1.9	2.1
p <sub>1</sub> , length .....	1.7	2	2	2	1.7	2
.. width .....	2	2.2	2.2	2.8	2.2	2.7
p <sub>3</sub> , length .....	2	2.2	2.5	2.7	2	2.2
.. width .....	4.1	4.2	4.3	4.8	4.5	4.8
p <sub>1</sub> , length .....	2.5	2.7	2.8	2.8	2.7	3
.. width .....	4.1	4.7	4.6	4.8	4.2	4.8
m <sub>1</sub> , length .....	2.7	2.8	2.9	3	2.7	2.8
.. width .....	4.2	4.8	5	5.1	4.5	4.9
m <sub>2</sub> , length .....	2.6	2.8	3	3	2.5	2.7
.. width .....	3.5	3.8	3.8	4	3.7	3.8
m <sub>3</sub> , length .....	2	2.5	2.8	2.8	2.2	2.5
.. width .....	1.8	2.2	2.2	2.2	1.7	1.8
.. width .....	1.4	1.8	1.8	1.9	1.4	1.7

\* Estimate.



no. 56.7.7.2 ( $\sigma$  ad., teeth somewhat worn): back and rump vandyck-brown powdered with dark buffy (owing to extreme shortness of pale hair-tips), and washed with mars-brown laterally along membranes. Occiput and crown often conspicuously varied with silvery grey hairs. The mantle and underparts show little variation, except in the slightly darker or slightly paler shade of the colours.

*Measurements.* On pp. 291, 292.

*Specimens examined.* The British Museum series.

*Range.* The island of Aneiteum, New Hebrides.

*Cotypes* in collection.

*Habits.*—This species seems to be confined to the windward side of the island of Aneiteum and not to intrude upon the districts frequented by the much larger *Pt. geddiei* on the leeward side of the same island. Besides feeding on the fruit of trees, it is said to be fond of the berries of a *Vaccinium*, a low bush growing abundantly on the lower slopes of the hills. Native name “Nalivatran” (in contradistinction to *Pt. geddiei*, which is called “Nawathelgau”). (J. MacGillivray, *l. s. c.*)

<i>a, b.</i>	$\sigma$ imm., $\phi$ ad. sks.; skulls.	Aneiteum, N. Hebrides; Nov. 1853 ( <i>J. Mac-</i> <i>Gillivray</i> ).	Lords of the Admiralty [P]. ( <i>Cotypes</i> of species.)	54.8.25.1, 2.
<i>c, d.</i>	$\sigma$ ad., 1 ad.; skulls.	Aneiteum ( <i>J. Mac-</i> <i>Gillivray</i> ).	Lords of the Admiralty [P].	54.8.25.3, 4.
<i>e.</i>	$\sigma$ ad. sk.; skull.	Aneiteum; Nov. 1853 ( <i>J. MacGillivray</i> ).	Lords of the Admiralty [P].	{ 56.7.7.2. 57.12.24.1.
<i>f.</i>	$\phi$ imm. skull.	Aneiteum.	Purchased (Cuming).	61.5.22.1.
<i>g.</i>	$\sigma$ ad. sk.; skull.	Aneiteum.	Tomes Coll.	7.1.1.256.
<i>h.</i>	$\sigma$ ad. sk.; skull.	New Hebrides.	Tomes Coll. (Verreaux).	7.1.1.256.

## J. THE *PTEROPUS PSELAPHON* GROUP.

*Species.*—Six: *Pt. insularis*, *phæocephalus*, *pselaphon*, *pilosus*, *tuberculatus*, and *leucopterus*.

*Range.*—Micronesia: Bonin, Volcano, Pelew, and Caroline Islands (perhaps extending to the Mariannes); Philippines.

*General characters* (compare fig. 15, p. 302, skull and dentition of *Pt. pselaphon*).—Skull of the typical species (*Pt. pselaphon*, *pilosus*, *tuberculatus*) very similar to that of the *Pt. samoënsis* type: rostrum short and stout, coronoid very high and steeply ascending. Upper incisors large; cingulum of incisors and canines very strongly or even excessively developed, that of upper canines often divided into separate tubercles; (in one species, *Pt. tuberculatus*, a small cusp-like projection on hinder trenchant margin of upper canines above middle of teeth;)  $i_2$  and  $p_1$  enlarged; posterior basal ledges of cheek-teeth very large and sharply marked off from teeth; inner longitudinal ridge of  $m_1$  often more or less distinctly divided into an anterior and posterior portion. Ears short; fur rich,

spreading, everywhere more or less thickly mixed with longer, coarser, paler-coloured hairs; tibia thickly furred above. Fur dark brownish above and beneath, sprinkled with paler hairs; mantle deep tawny, or dark-coloured like back. The Caroline and Philippine species are in certain respects slightly aberrant. Size medium or small (forearm 101-152 mm.).

*Differentiation of species.*—The three typical species of this group, viz. *Pt. pselaphon* (Bonin and Volcano Is.), *pilosus* (Pelew Is.), and *tuberculatus* (uncertain habitat, probably either Vanikoro or Mariannes), differ from each other only in characters of minor importance: details of dentition, length and colour of fur, and size. The single Philippine species (*Pt. leucopterus*) is closely related to *Pt. pselaphon* and *pilosus*, from which it differs chiefly in the peculiarly shortened, subsquarish shape of the molariform teeth and (probably as a consequence of this) weaker and more sloping coronoid process; the division of the inner ridge of  $m_1$  into an anterior and posterior portion, generally so well pronounced in *Pt. pselaphon*, is in *Pt. leucopterus* fairly well marked in the same tooth and in  $m_2$ , sometimes also slightly indicated in the outer ridges of these teeth. The two species inhabiting the Central Carolines (*Pt. insularis* and *phaeocephalus*) present most of the cranial and dental characters of the group fully developed (very broad rostrum, large incisors, broad cingulum of upper incisors, excessively broad cingulum of canines with rim of cingulum divided into small tubercles, large  $p_1$ , strong posterior basal ledges of premolars), but  $i_2$  is not enlarged, the cheek-teeth on the whole considerably reduced in size, the coronoid process therefore weak, the tibia naked above, the colour not unlike that of certain races of *Pt. hypomelanus* (dark above and beneath with bright mantle and pectoral patch), and the size unusually small.

*Affinities of group.*—Closely related to the South Polynesian *Pt. samoënsis* group. The characters of the skull are nearly identical in both groups, those of the dentition similar in many important points (heavy teeth, strong ledges, enlargement of  $i_2$  and  $p_1$ , &c.), and the distribution of the fur the same.—Both in skull and dentition (large upper incisors, very broad cingulum of upper incisors and canines, splitting of cingulum of upper canines into separate tubercles, development in one species of a secondary cusp in upper canines, enlargement of  $i_2$  and  $p_1$ , tendency to splitting of ridges of certain lower molars, shortening of all molariform teeth in one species) the *pselaphon* group shows decidedly leanings towards the highly specialized genus *Pteralopex* (Solomon Islands).

55. *Pteropus insularis*, *Homb. & Jacq.*

*Pteropus keraudreni* (pt.), Dobson, *Cat. Chir. B. M.* p. 63.

*Pteropus insularis*, *Hombon & Jacquinot, Voy. Pole Sud, Mamm.* pl. v. (animal; skull) (1842: Ruck); *ibid.*, *op. cit.* iii. p. 24 (1853: Ruck); *Gervais, Hist. Nat. Mamm.* i. p. 188 (1854: Carolines); *Peters, MB. Akad. Berlin*, 1869, p. 331 (re-examination of cotypes); *id.*, *SB. Ges. nat. Fr.* 1883, no. 1, p. 2 (Ruck); *Oustalet, N. Arch. Mus. d'Hist. Nat.* (3) vii. pt. 2, pp. 151, 152 (1895: re-examination of cotypes); *Elera, Cat. Sist. Faun. Filipinas*, p. 6 (1895: Carolines); *Trouessart, Cat. Mamm.* i. p. 83 (pt.) (1897: Carolines).

*Pteropus* (Spectrum) *insularis* (pt.), *Matschie, Megachir.* p. 28, pl. v. figs. 6-10 (skull: Ruck; *nec* figs. 11-12) (1899: Ruck); *Trouessart, Cat. Mamm., Suppl.* p. 53 (1914: Ruck).

*Pteropus keraudreni* (pt., *nec* Q. & G., *nec* Gray), *Peters, MB. Akad. Berlin*, 1867, p. 331; *Dobson, Cat. Chir. B. M.* p. 63 (*nec* var. *a.*, p. 65) (1878); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 203 (1879: Carolines).

*Pteropus lanigera* (sic), *H. Allen, Proc. Amer. Phil. Soc.* xxviii. no. 132, p. 70 (1890: Samoa, *errore*); *Trouessart, Cat. Mamm.* i. p. 83 (1897: Samoa); *Miller, Fam. & Gen. Bats*, p. 58 (1907).

*Diagnosis*.—Rostrum broad, nearly parallel-margined, orbits small, sagittal crest low or incomplete, coronoid process low and sloping. Cingulum of canines and upper incisors unusually broad,  $p_1$  large, posterior ledges of  $p^3$ ,  $p_3$ , and  $p_4$  strong,  $p^3$ ,  $p^4$ ,  $p_3$ , and  $p_4$  with distinct antero-internal basal ledges. Ears moderate, tibia naked above. Back dark brown, mantle varying from buffy to deep tawny; a buffy pectoral patch contrasting with dark brown belly and sides of breast. Size small: forearm 101-106 mm. *Hab.* Ruck group, Central Carolines.

*Skull*.—Brain-case moderately deflected, alveolar line if continued posteriorly passing very nearly through upper point of occipital condyle. Rostrum broad and low, lateral margins viewed from above only slightly converging anteriorly (subparallel); width of rostrum across alveolar borders of  $p^1$ - $p^1$  (10 mm.) much greater than depth at middle of  $p^4$  (8-8.3 mm.). Orbits small, diameter (9-9.2 mm.) less than width of rostrum across  $p^1$ - $p^1$  (10 mm.); front of orbit above or very slightly in front of middle of  $m^1$ . Postorbital processes thin, reaching little more than half the distance from frontal to zygoma; corresponding processes on zygoma undeveloped; distance from tip of postorbital process to gnathion greater than from former point to lambda; frontal region between bases of postorbital processes nearly flat. Temporal ridges in one adult skull, of three examined, rather closely approximated, but not fused in median line; in two adult skulls fused and forming a low sagittal crest in frontal and interparietal, but slightly separated in parietal region. Coronoid process low, narrow antero-posteriorly, and sloping; coronoid height of mandible subequal to length of upper tooth-row,  $c$ - $m^2$ , much less than  $c$ - $m_3$ ; condyles not much above level of alveolar line, this latter projected backward nearly touching lower margin of condyle.

*Teeth*.—Upper incisors relatively large, slightly spaced; posterior basal ledges unusually well marked. Lower incisors typical, slightly spaced,  $i_2$  not larger than usual, about twice the bulk of  $i_1$ . Cingulum of upper and lower canines excessively broad; in upper canines forming a broad semicircular ledge at inner and posterior base of crown with projecting rim of ledge subdivided by shallow notches into a number of rounded tubercles; in lower canines much broader at posterior than at inner base of crown; crown of upper and lower canines, viewed in profile, recurved with cingulum distinctly visible at posterior base as a sharply projecting ledge or cusp; vertical groove on front face of upper canines deep and broad, terminating above tip of tooth.  $p^1$  spiculiform, present in all adult skulls examined. Upper postcanine tooth-rows subparallel, *i. e.*, less converging postero-anteriorly than usual.  $p_1$  unusually large, twice to twice and a half the bulk of  $i_2$ . Posterior basal ledge of  $p^3$  strong and well marked off from tooth postero-externally; corresponding ledge of  $p^4$  somewhat ill-defined; antero-internal base (cingulum) of  $p^3$  and  $p^4$  more developed than usual, forming a low, distinctly projecting ledge in front of inner main cusp of teeth. Posterior ledge of  $p_3$  extremely strong, forming a relatively long ledge, sharply marked off from base of outer main cusp; corresponding ledge of  $p_4$  shorter, but well-defined; antero-internal cingulum of  $p_3$  and  $p_4$  developed into a low, distinctly projecting basal ledge.  $m^2$  subequal to an upper incisor.  $m_3$  subequal to  $i_2$ , much smaller than  $p_1$ .

*Palate-ridges*.— $5+4+2$ , approaching  $6+3+2$ , owing to the sixth ridge being only very slightly divided in middle. First ridge terminating laterally at front of canine; second at back of canine; third at front of  $p^3$ ; fourth at back of  $p^3$ ; fifth at back of  $p^4$ ; sixth at front or middle of  $m^1$ ; seventh at front or middle of  $m^1$ ; eighth and ninth behind  $m^2$ ; tenth and eleventh situated near palation border.

*Ears*.—Moderate, exposed, not reaching back of eye. Inner margin convex from base to tip; outer margin convex in lower half or two-thirds, flatly concave or nearly straight in upper half or third; tip of conch rather broadly rounded off.

*Wings*.—Membranes arising within about 15 mm. of each other from sides of back.

*Interfemoral*.—Extremely short or undeveloped in centre.

*Fur*.—Moderate; soft, silky, and directed posteriorly on back. Approximate length, back 14–16, mantle 17–18, belly 15–17 mm. Least width of furred area of back about 27–30 mm.

Distal half of humerus, the whole of the forearm and tibia practically naked above. Underside of humerus and tibia naked.

*Colour*.—Whole series examined:—Back and rump a dark shade of Prout's brown, sometimes approaching seal-brown, in some specimens thinly, in others scarcely perceptibly sprinkled with silvery greyish-white hairs. Base of fur nearly seal-brown.—centre of breast bright buff, forming a more or less well-defined patch contrasting with dark sides of breast and belly. The size of

this bright pectoral patch varies greatly individually, but in none is it wanting; in one specimen it occupies only the middle of the breast, being little larger than an almond, in others it extends over the whole of the breast, excluding flanks; in one specimen the bright buffy colour is darkened to tawny cinnamon. Belly, anal region, sides of breast (in specimens with small pectoral patch), and flanks similar to back or dark vandyck-brown, in any case rather thinly sprinkled with long, pale greyish or buffy hairs.—Mantle varying from golden buffy (palest extreme) to deep tawny, sometimes interrupted in median line by a stripe of dark brown extending forward from back to occiput. Bright colour of mantle confined to apical half of hairs, basal half seal-brown. Sides of neck similar to mantle, varying from ochraceous-buffy to deep tawny, with extreme base of hairs seal-brown. In females (males not examined) a thin tuft of soft, bright yellowish-buffy glandular hairs on each side of neck, not much differing in colour from surrounding fur.—Crown mixed buffy and dark brown. Sides of face, chin, and throat blackish, thinly sprinkled with buffy or greyish hairs.

*Measurements.* On pp. 299, 300.

*Specimens examined.* Seven, in the collections of the Paris (two, cotypes of species, Ruck), Berlin (one, Ruck, no. 5698), U.S. National (two, Uala I., Ruck group, 151563, 151564), and British Museums (two, Ruck); photographs of skull and dentition of type of *Pt. laniger*.

*Range.* Ruck group, Central Caroline Islands: Ruck and Uala\*.

*Cotypes* in the Paris Museum.

*Pteropus insularis*, Hombron & Jacquinot; 1842.—Type locality, Ruck (Hogolen). Cotypes, two adult mounted skins, nos. 53 A and 53 B; cotype 53 A is the original of Hombron and Jacquinot's pl. v. (coloured figures of animal, front and back views); the skull of this specimen, which is preserved in the Muséum d'anatomie comparée, Paris, and marked A. 6770, is the original of Hombron and Jacquinot's figures of the skull in lateral, upper, lower, and front views; the skull of cotype 53 B is *in situ*.—By subsequent authors *Pt. insularis* has alternately been considered identical with *Pt. keraudreni*, Q. & G., i. e., *Pt. mariannus*, Desm. (Peters, 1867, *l. s. c.*), or a variety of that species (Dobson, 1878, *l. s. c.*; but of the six specimens registered by Dobson under the heading of his variety *a*, none is *Pt. insularis*), or a distinct species (Peters, 1869 and 1883; Oustalet, 1895; Matschie, 1899), but even in the last case it has constantly been placed near *Pt. mariannus*, a species with which it in reality has no closer affinities.

*Pteropus laniger*, H. Allen; 1890.—Original description based on two specimens in Ward's Natural History Establishment, Rochester, New York, and stated to have come from the "Samoa Islands." One cotype is now in the U.S. National Museum (skull

\* Uala or Uola, "a volcanic island in the atollie lagoon of the Ruck group" (Dr. M. W. Lyon, *in litt.*), not to be confused with Ualan (Kushai), Eastern Carolines.

37815, skin 19066), the fate of the other cotype appears to be unknown. Said by H. Allen to be "most closely allied to *Pt. phæocephalus*," without information why it was considered different from this species. By Matschie (1899, *l. s. c.*) put down, with a query, under *Pt. insularis*.—Photographs of the type-skull, kindly sent to me by Dr. M. W. Lyon, show a perfect resemblance to *Pt. insularis* in the characters of the skull and dentition. Dr. Lyon has, further, compared the type of *Pt. laniger* with skin and skull of a *Pt. insularis* from Uala, Ruck group (U.S. 151563), and arrived at the conclusion that "the two specimens no doubt represent the same species; they could hardly resemble each other more closely and at the same time be different individuals" (*in litt.*). From this evidence it appears safe to assume that the type of *Pt. laniger* is a *Pt. insularis* with wrong locality.

*a, b.* 2 ♀ ad. al.; Ruck, Central Caro- Purchased (A. Owston). 98.1.2.1,2.  
skull of *a.* lines.

### 56. *Pteropus phæocephalus*, *Thos.*

*Pteropus phæocephalus*, *Thomas*, *P. Z. S.* 1882, p. 756, pl. liv. (animal; teeth) (1883: Mortlock); *Oustalet*, *N. Arch. Mus. d'Hist. Nat.* (3) vii. pt. 2, p. 152 (1895: possible identity with *Pt. insularis*); ? *Elera*, *Cat. Sist. Faun. Filipinas*, p. 5 (1895: Carolines); *Trouessart*, *Cat. Mamm. i.* p. 83 (1897: Carolines).

*Diagnosis*.—Similar to *Pt. insularis*, but much paler. Forearm 105 mm. *Hab.* Mortlock I., Central Carolines.

*Colour* (type).—General colour of back and rump golden cream-buff, this tinge confined to tips of hairs; base of fur nearly vandyck-brown. Fur of interfemoral along inner sides of thighs and proximal half of tibia vandyck-brown varied with some buffy and silvery white hairs.—Centre of breast bright cream-buff, forming a patch contrasting with surrounding darker fur. Belly, anal region, sides of breast, and flanks dark mars-brown, mixed with buffy on sides of breast and thickly sprinkled with long silvery hairs on belly and anal region.—Mantle buffy with long vandyck-brown bases to the hairs, gradually shading into ochraceous-buffy on sides of neck, this tinge again into ochraceous on foreneck; fur of sides of neck and foreneck vandyck-brown only at extreme base. Median (spinal) tract of mantle somewhat darkened with russet, suggesting a dividing of mantle into a right and left half, as is often the case in *Pt. insularis*.—Occiput, crown, and interocular space mixed buffy and brownish with a distinct sprinkling with silvery hairs. Sides of face, chin, and throat dark vandyck-brown, approaching seal-brown, thinly sprinkled with silvery hairs.

*Measurements*. On pp. 299, 300.

*Specimen examined*. One, the type.

*Range*. Mortlock, Central Caroline Islands.

*Type in collection*.

*History in literature*.—The possible identity of *Pt. insularis* and *Pt. phæocephalus* was discussed by Oustalet, in 1895 (*l. s. c.*), on the

basis of the cotypes of the former and figures of the latter. The skull figured in Matschie's 'Megachiroptera,' pl. v. figs. 1-5, as "*Pt. phaeocephalus* (?)" (original, Berlin Museum, no. 4065, Ponapé, Finsch) is that of a species of the *Pt. mariannus* group, the same as figured under the name *Pt. insularis*, male, pl. v. figs. 11-12 (original, Berlin Museum, no. 5697, Ruck, Finsch); the skull of the true *Pt. insularis* is figured in the same plate, figs. 6-10 (original, Berlin Museum, no. 5698, Ruck, Finsch).

*Remarks.*—*Pt. phaeocephalus* is perfectly similar to *Pt. insularis* in skull, dentition, palate-ridges, and all external characters, except the much paler colour of the fur, particularly of the back. It is unlikely that the paler colour is due to fading in alcohol. If it is, the deterioration of the colour has taken place before the specimen came into the possession of the British Museum; the colour of the type is still quite in accordance with the description given by Mr. Thomas in 1882. So far, the evidence is in favour of the assumption that *Pt. phaeocephalus* (Mortlock group) is specifically distinct from *Pt. insularis* (Ruck group).

a. ♀ ad. al.; Mortlock, Central Carolines Godeffroy Museum. 82.10.27.4.  
skull. (Kubary). (Type of species.)

*External measurements of Pt. insularis and phaeocephalus.*

	<i>Pt. insularis</i> . 5 ad.* (Incl. cotypes.)		<i>Pt. phaeocephalus</i> . ♀ ad. Type.
	MIN.	MAX.	
	mm.	mm.	mm.
Forearm .....	101	109	105
Pollex, total length, c. u. ....	41	44	43.5
" metacarpal .....	9.5	11	10
" 1st phalanx .....	20	24	22.5
2nd digit, metacarpal .....	44.5	51	45
" 1st phalanx .....	12	12.5	12.5
" 2nd-3rd phalanx, c. u. ....	12.5	14	13.5
3rd digit, metacarpal .....	65	74	67.5
" 1st phalanx .....	47.5	51	47
" 2nd phalanx .....	73	77	67
4th digit, metacarpal .....	65	71	67
" 1st phalanx .....	41	44	41
" 2nd phalanx .....	42.5	45	42.5
5th digit, metacarpal .....	70.5	77	73
" 1st phalanx .....	32.5	34.5	30.5
" 2nd phalanx .....	31	33.5	32
Ears, length from orifice .....	21	22	22
" greatest width, flattened .....	12	12	12
Front of eye to tip of muzzle .....	17	18	16.5
Lower leg .....	47	48.5	47.5
Foot, c. u. ....	32	35	32.5
Calcaneus .....	10	12	13.5

\* Paris Museum, 53 A, 53 B (cotypes, Ruck); U.S. N. M. 151563 (Cala), B. M. 98.1.2.1, 2 (Ruck).

*Measurements of skulls and teeth of Pt. insularis and  
phæocephalus.*

	<i>Pt. insularis.</i> 3 ad.* (Incl. one cotype.)		<i>Pt. phæo- cephalus.</i> ♂ ad. Type.
	MIN.	MAX.	
Skull, total length to gnathion .....	45.2	46	45.2
„ palation to incisive foramina .....	19.2	19.8	19.8
„ front of orbit to tip of nasals .....	14	14.5	14
„ width of brain-case at zygomata .....	17.8	18.2	18.2
„ zygomatic width .....	25.5	26	...
„ width across m <sup>1</sup> , externally .....	12.5	13.7	13
„ lachrymal width .....	10.5	10.8	10.6
„ width across canines, externally .....	11	11.5	11
„ postorbital constriction .....	6.2	6.7	7.2
„ interorbital constriction .....	7	7.5	7.7
„ width of mesopterygoid fossa .....	5.8	6.2	5.8
„ between p <sup>4</sup> -p <sup>4</sup> , internally .....	7.7	8	8.2
„ between cingula of canines .....	6.2	6.2	6.3
„ orbital diameter .....	9	9.3	9
Mandible, length .....	34.8	35	34
„ coronoid height .....	15.8	16	15.5
Upper teeth, c-m <sup>2</sup> .....	15.8	16	15.7
Lower teeth, c-m <sub>3</sub> .....	17.7	18	17.6
Upper incisors, combined width .....	6	6.2	6
p <sup>3</sup> , length .....	2.9	3.2	3.1
„ width .....	2.4	2.7	2.7
p <sup>4</sup> , length .....	2.8	3	3
„ width .....	2.2	2.6	2.5
m <sup>1</sup> , length .....	3.3	3.7	3.5
„ width .....	2	2.3	2.2
m <sup>2</sup> , length .....	1.7	1.9	1.9
„ width .....	1.7	1.8	1.8
p <sub>1</sub> , length .....	2	2	2
„ width .....	2	2	2
p <sub>3</sub> , length .....	3.1	3.4	3.3
„ width .....	2.2	2.2	2.2
p <sub>4</sub> , length .....	2.9	3.1	3.1
„ width .....	2	2	2.1
m <sub>1</sub> , length .....	3	3.2	3.1
„ width .....	1.8	2	2
m <sub>2</sub> , length .....	2.2	2.6	2.5
„ width .....	1.7	1.9	2
m <sub>3</sub> , length .....	1.2	1.7	1.5
„ width .....	1.1	1.5	1.2

\* Paris Museum, 53 A (=A 6770, cotype, Ruck); U.S. N. M. 151563 (Uala); B. M. 98.1.2.1 (Ruck).



57. *Pteropus pselaphon*, Lay.

*Pteropus pselaphon*, Dobson, Cat. Chir. B. M. p. 26.

*Pteropus pselaphon*, Lay, *Zool. Journ.* iv. p. 457 (1829: Bonin Is.; habits); *Anonymous* [? Vigors & Gould], *Cat. An. Mus. Zool. Soc.* p. 11, no. 163 (1829: Bonin); Lesson, *Hist. Nat. Mamm.* (Compl. Buffon) v. p. 51 (1836: Bonin); Temminck, *Mon. Mamm.* ii. p. 70, pl. xxxvi. figs. 9, 10, 11 (skull), pl. xxxvii. (animal) (1837: Bonin); Waterhouse, *Cat. Mamm. Mus. Zool. Soc.* p. 13, no. 106 (1838: Bonin); Oken, *Allg. Naturg.* vii. Abth. ii. p. 990 (1838: Bonin); Waterh. *Suppl. Cat. Mamm. Mus. Zool. Soc.* p. 3, no. 106 (1839); J. Richardson, *Zool. Beechey, Mamm.* p. 11, pl. ii. (animal) (1839: Bonin; note on habits and anatomy, by Collie); Temminck, *Tijds. Nat. Gesch.* v. pt. 4, p. 282 (1839: Japan); Wagner, *Schreber's Säug., Suppl.* i. p. 350 (1839: Bonin); Temminck, *Fauna Japon, Mamm.* p. 13 (1842: Bonin); Lesson, *N. Tabl. R. Anim., Mamm.* p. 13, no. 175 (1842: Bonin); Gray, *List Mamm. B. M.* p. 37 (1843: Bonin); Schinz, *Syst. Verz. Säug.* i. p. 124 (1844: Bonin); Gray, *Zool. 'Samarang,' Vert.* p. 34 (1849: Bonin); Wagner, *Schreber's Säug., Suppl.* v. p. 598 (1853-55: Bonin); Giebel, *Säug.* p. 997 (1855: Bonin); Schlegel, *Dierkunde*, i. p. 53 (1857: Bonin); Gerrard, *Cat. Bones Mamm. B. M.* p. 57 (1862: Bonin); Peters, *MB. Akad. Berlin*, 1867, p. 323 (Bonin); Fitzinger, *SB. Akad. Wien*, lx. Abth. i. p. 430 (1870: Bonin); Dobson, *Cat. Chir. B. M.* pp. 26, 30 (1878: Bonin); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 204 (1879: Bonin); *id.*, *Ann. Sci. Nat.* (6) Zool. viii. Art. 12, p. 16 (1879: remarks on distr.); Jentink, *Cat. Ost. Mamm.* p. 253 (1887: Bonin); *id.*, *Cat. Syst. Mamm.* p. 139 (1888: Bonin); Tuckerman, *Journ. Morph. Boston*, iv. pp. 176, 193 (1891: tongue-structure); P. L. Sclater, *P. Z. S.* 1893, pp. 782, 1059 (Bonin); Trouessart, *Cat. Mamm.* i. p. 78 (1897: Bonin); Miller, *Fam. & Gen. Bats*, p. 58 (1907).

*Pteropus* (Spectrum) *pselaphon*, Matschie, *Megachir.* p. 27 (1899: Bonin); Trouessart, *Cat. Mamm., Suppl.* p. 53 (1904: Bonin).

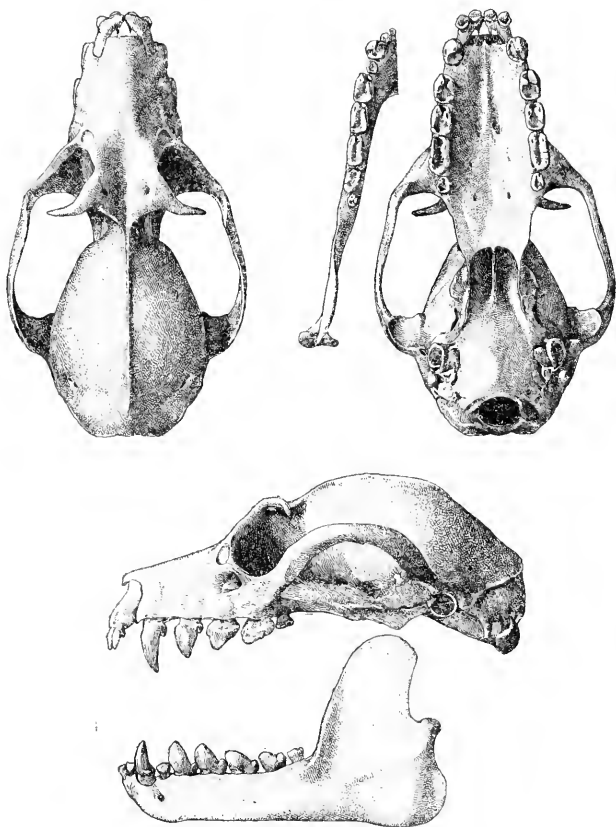
*Pteropus ursinus*, Temminck (ex Kittlitz, MS.), *Mon. Mamm.* ii. p. 70, footnote (1837: Bonin); Gervais, *Hist. Nat. Mamm.* i. p. 188 (1854: Bonin); Matschie, *Megachir.* pl. ix. figs. 1, 1a, 1b (skull) (1899: Bonin).

*Pselaphon ursinus*, Gray, *Cat. Monk. &c.* p. 110 (1870: Bonin); Seitz, *Mitth. D. Ges. Naturk. Ostasiens*, v. p. 364 (1892: Bonin).

*Diagnosis*.—Cranial rostrum short and stout; coronoid high and steeply ascending. Dentition unusually heavy; cingulum of incisors and canines strongly developed; large posterior ledges to cheek-teeth above and below;  $i_2$  and  $p_1$  large; a generally well-marked transverse depression in inner longitudinal ridge of  $m_1$ . Ears short, half exposed. Tibia densely furred; feet hairy above. Fur long, dense, semierect on back. Seal-brown (or dark vandyke-brown) above and beneath, more or less sprinkled with long, coarse, glossy greyish-white hairs; mantle not differing in colour. External dimensions below medium: forearm 132.5-141 mm. *Hab.* Bonin and Voleano Is.

*Skull* (fig. 15).—Rostrum very short and stout; length from front of orbit to tip of nasals equal to or smaller than maxillary

width externally across  $m^1-m^1$ ; width of rostrum externally across alveolar borders of  $p^1-p^1$  subequal to orbital diameter; front of orbit vertically above posterior half or posterior point of  $p^4$ . Zygomatic arches unusually flaring posteriorly, owing to width of temporal fossa (powerful temporal muscle). Sagittal crest very strong.



TERZI.

Fig. 15.—*Pteropus pselaphon*, ♀. Sulphur Island. No. 92.2.4.1. †.

Postorbital processes of frontals long; corresponding lower processes (on zygomatic arches) short even in individuals with worn teeth; upper and lower processes in aged individuals closely approximated or fused so as to completely encircle the orbit. Mandible extremely

heavy posteriorly, coronoid process high, broad (antero-posterior extent), steeply ascending; coronoid height of mandible considerably larger than length of lower tooth-row,  $c-m_3$ ; angular process heavier than usual.

*Teeth* (fig. 15; compare also figs. 9 B, B', p. 68, and figs. 10 B, B', p. 69). — Upper incisors unusually large; posterior cingulum excessively strong, forming a broad ledge; cingulum of  $i^2$  as a rule visible in front view of tooth, having the appearance of a small basal cusp on external side of  $i^2$ ; the same is often the case in  $i^1$ , though usually less distinctly. Upper canines short, recurved, extremely stout; cingulum excessively broad; raised margin of cingulum sometimes simple, but usually broken up in a series of more or less distinctly separated, rounded tubercles. Diastema  $c-p^3$  small.  $p^1$  rudimentary, terete, as a rule lost in individuals with worn teeth. Posterior basal ledge of  $p^3$  very strong, sharply marked off by a notch postero-externally from base of outer main cusp; on postero-internal face of tooth the margin of the ledge is generally continuous with, rather rarely separated by an obsolescent notch from, the posterior margin of the inner main cusp; antero-internal portion of  $p^3$  forming an indistinctly differentiated heel, the margin of which is sometimes simple, sometimes raised into one or two small rounded tubercles (cf. *Pt. rodricensis*). Posterior ledge of  $p^4$  strong, marked off from tooth by shallow notch postero-externally; antero-internal projection as in  $p^3$ , but smaller.  $m^1$  almost twice as long as broad; two, generally deep, transverse grooves in posterior half of outer ridge, suggesting a tendency of the ridge to break up into separate tubercles.  $m^2$  somewhat larger than  $m_3$ .

$i_1$  normal or, if anything, rather larger than usual.  $i_2$  large, two and a half or three times the bulk of  $i_1$ . Lower canines short, recurved, stout, with excessively broad and sharply marked cingulum.  $p_1$  unusually large (relatively as in *Pt. samoënsis* and *anetianus*), subequal to  $m_3$ , almost twice the size of  $i_2$ . Posterior ledge of  $p_3$ ,  $p_4$ , and  $m_1$  very strong, forming a broad transverse shelf, as a rule sharply separated by a notch postero-externally from outer main cusp (in  $p_4$  generally also postero-internally, from inner main cusp); antero-internal basal projection strongly differentiated in  $p_1$ , separated by a deep notch posteriorly from inner main cusp (giving the inner longitudinal ridge the appearance of being divided into a smaller anterior and larger posterior cusp). A generally shallow, but in some individuals very well marked, depression in margin of inner ridge of  $m_1$ , distinctly suggesting a tendency to subdivision of ridge into two tubercles (compare *Pt. leucopterus*); a similar depression sometimes faintly indicated in  $m_2$ .  $m_3$  normal.

*Palate-ridges*.—No special modifications. Formula  $5+5+3$ . Arrangement as in *Pt. nawaiensis* (above, p. 281).

*Ears*.—Short, subtriangular, half exposed. Inner margin evenly convex from base to tip; outer margin flatly convex at base,

distinctly concave in upper third; tip narrowly rounded off. Posterior face of couch hairy at base and along outer and inner margins; tip and median portion naked.

*Wings*.—About 30 mm. apart at origin from sides of back.

*Interfemoral*.—Undeveloped in centre.

*Fur*.—General aspect: unusually long, dense, rather coarse, spreading on back and rump, almost erect on mantle. Shorter ground-fur everywhere thickly mixed with very long, coarse hairs. Approximate length of longest hairs, back 30, mantle 30, middle of belly 26 mm. Width of furred area of back about 50 mm.

Above, humerus and proximal half or two-thirds of forearm thickly covered with rather long adpressed hairs. Tibia thickly clothed. Feet distinctly haired to base of claws. Interfemoral along inner side of tibia almost concealed by overhanging long hairs.

Beneath, proximal half of forearm thinly haired. Antebrachial membrane, and lateral membrane along outer side of forearm and between humerus and femur, clothed with woolly hairs. Proximal half or two-thirds of tibia thickly haired.

*Colour*.—Adults (three skins; 94.7.3.1-3): Prevailing colour above and beneath almost typically seal-brown, with a slight blackish-maroon gloss; underparts not appreciably paler; head and mantle not differing from back; rump generally similar to back, sometimes slightly washed with dark vandyck-brown. Back, rump, breast, belly, and flanks sprinkled with glossy silvery greyish-white (on the rump sometimes more buffy-white) hairs, the amount of sprinkling individually variable, always conspicuous, but never obliterating the general dark aspect of the coloration; sprinkling on breast and belly usually rather thicker than on back. Seal-brown of mantle thinly varied with short silvery greyish-white tips to the hairs; on the sides of the neck the pale hair-tips are longer, forming an ill-defined patch on each side; foreneck similar to breast. Head seal-brown, more or less sprinkled with silvery-white or buffy-white hairs (or tips to the hairs), particularly on sides of head.

Two immature individuals (male and female, practically full-grown: 5.1.4.1-2) have the general dark colour of the pelage conspicuously washed with dark vandyck-brown, especially on back, thighs, and tibiae; pale sprinkling inconspicuous on upper-side, more distinct on underparts (particularly in ♀); ill-defined lateral neck-patches as in adults. It is doubtful whether the vandyck-brown tinge of the colour is really due to the immature age of these specimens, rather than indicative of an individual variation occurring also in adults.

*Measurements*. On pp. 307, 308.

*Specimens examined*. The Leyden and British Museum specimens.

*Range*. Bonin Islands; Volcano Islands (Sulphur I.).

*Type* in collection.

*Habits*.—According to Tradescant Lay (1829, *l. s. c.*) this species subsists chiefly upon the fruit of the *Sapota* and *Pandanus*, "the

juice of which it sucks, carefully rejecting the fibrous parts; but since a certain portion of the latter must necessarily enter the mouth while the animal is feeding, this is rolled up in the hollow of the palate, and when the juices are abstracted it is removed from its lodgement by an oblique application of the tongue to make room for the next juicy morsel of parenchym." Considering the unusually heavy dentition of this species, its large temporal muscles, and correspondingly strong sagittal crest and coronoid process, it appears probable that the cheek-teeth act as powerful grinders to squeeze the juice and soft flesh from the tough fibrous parts of the fruits; otherwise it would be difficult to reconcile Lay's statement, that this bat "sucks" the juice of the fruits, with the actual characters of its teeth and skull.

*History in literature.*—First described in 1829, by Tridescant Lay, on the basis of specimens obtained in the Bonin Islands during the Voyage of H.M.S. 'Blossom' (Capt. Beechey). The plate given by Sir J. Richardson (Zool. Beechey, pl. ii.) is far from giving a correct idea of the colour of the fur (the seal-brown in this species soon fades to paler brown by exposure to light). Temminck's description was based on a specimen collected in the Bonins by Kittlitz; the single skull now in the collection of the Leyden Museum is not (as said by Jentink, *l. s. c.*) the original of Temminck's figures, Mon. Mamm. ii. pl. xxxvi. figs. 9-11. By Gray this species was catalogued under the name *Pselaphon ursinus*, evidently without the author having any intention to make it the type of a new genus, "*Pselaphon*" being no doubt simply a slip of the pen for *Pteropus*.

*Pteropus ursinus*, Temm.; 1837.—A manuscript name suggested by Kittlitz and first made known by Temminck, as an alternative name for "*pselaphon*," which he considered "*peu approprié*."

a. ♂ ad. sk.; skull.	Bonin Is. (Capt. Beechey's Voy.).	Sir J. Richardson [P.].	42.12.9.1.
	(Probably original of fig. 'Voy. Beechey,' pl. ii.)		
b. ♂ ad. sk.; skull.	Bonin Is. (Capt. Beechey's Voy.).	Haslar Museum [P.].	55.10.16.203.
c. Ad. sk.; skull.	Bonin Is. (Capt. Beechey's Voy.).	Zool. Soc. Coll. (Type of species.)	55.12.24.298.
d. Ad. skull.	[Bonin Is.] (Sabine & Belcher).	Zool. Soc. Coll.	55.12.26.91.
e. ♂ ad. al.	Bonin Is.	H. Pryer Coll.	84.12.10.2.
f-h. 2 ♂ ad., 1 ♀ jun. sks.; skulls.	Bonin Is.; 15 Nov. 1892, 8 Sept. 1893.	Hauston [C.].	94.7.3.1-3.
i, j. ♂ imm., ♀ imm. sks.; skulls.	Bonin Is.; 25-26 May, 1894 (H. Ogawa).	R. Gordon Smith, Esq. [P.].	5.1.4.1-2.
k. ♀ ad. al.; skull.	Sulphur I., Volcano Is. (P. A. Holst).	H. Seebohm, Esq. [P.].	92.2.4.1.

58. *Pteropus pilosus*, K. And.

*Pteropus keraudreni* (nec Q. & G.) var. *a* (pt.), Dobson, Cat. Chir. B. M. p. 65, specimen *b* (1878: Pelew Is.).

*Pteropus pilosus*, K. Andersen, Ann. & Mag. N. H. (8) ii. p. 369 (1 Oct. 1908: Pelew Is.).

*Diagnosis*.—Allied to *Pt. pselaphon*, but with rather larger orbits, much longer canines, larger  $i_2$  and  $p_1$ , much shorter fur, less thickly clothed forearm and tibia, naked feet, much paler colour, and larger external dimensions. Chocolate above, paler brown beneath, conspicuously sprinkled with long, coarse, buffy or whitish hairs; mantle deep tawny. Forearm 151.5 mm. *Hab.* Pelew Is.

*Skull*.—Characters and general size as in *Pt. pselaphon*, but orbits slightly larger (13.2 mm., as against 12.2–12.8 in *pselaphon*).

*Teeth*.—Essential characters as in *Pt. pselaphon*. Posterior cingulum of upper incisors less expanded than in *pselaphon*. Upper and lower canines considerably longer; upper canines from alveolar border to tip 9.2 mm., in *pselaphon* 7.7 mm.; shape of crown, and excessive development of cingulum as in *pselaphon*.  $p^1$  slightly larger, crown a little more differentiated from shaft.  $i_2$  markedly larger, more than three times the bulk of  $i_1$ .  $p_1$  much larger, about twice the size of  $m_3$ . Posterior basal ledge of  $p_3$ ,  $p_4$  and  $m_1$  extending inward distinctly beyond the line of the inner longitudinal ridge of the tooth, thus exhibiting a slight tendency to form a lingual ledge (compare *Pt. samoënsis* and *anetianus*). No transverse depression in inner ridge of  $m_1$ .

*Palate-ridges*.—5+5+3; arrangement as in *Pt. pselaphon* and *nawaiensis* (p. 281).

*Ears*.—Small, half exposed; falling short of hinder corner of eye by about 13 mm. Subtriangular in shape; inner margin evenly convex; outer margin very flatly convex (nearly straight) from base to tip; tip rounded off. Naked posteriorly, except at base.

*Wings*.—About 30 mm. apart at origin from sides of back.

*Interfemoral*.—Undeveloped in centre.

*Fur*.—Much shorter than in *Pt. pselaphon*; as in that species, everywhere mixed with longer, coarser (buffy or whitish) hairs. Approximate length of longest hairs, back 20, mantle 21, middle of belly 19 mm.

Above, humerus covered with rather long, thinly spread, adpressed hairs almost to elbow. Elbow naked; proximal third of forearm clothed with very thinly spread, adpressed hairs, the skin everywhere showing through. Proximal two-thirds of tibia furred, but hairs more thinly spread than in *pselaphon*; distal extremity and foot practically naked.—Beneath, hairing on membranes as in *pselaphon*. Proximal fourth of forearm and tibia very thinly haired.

*Colour*.—Type of species (♂ ad. al., teeth almost unworn): Back and rump chocolate, rather conspicuously sprinkled with long shiny whitish-grey or buffy-grey hairs.—Breast, belly, and flanks paler than upperside, between vandyck-brown and mars-brown,

thickly mixed with long, coarse, buffy hairs.—Mantle deep tawny (tawny tinged with russet), passing through a darker shade (chocolate-tawny) on sides of neck, to vandyck-brown on fore-neck; mantle slightly, sides of neck and foreneck more thickly sprinkled with coarse buffy hairs; base of hairs of mantle dark vandyck-brown.—Colour of mantle extending to occiput, lightening to golden buffy on middle of crown; interocular space, sides of crown, sides of head, chin, and throat dark vandyck-brown, thickly mixed with buffy or greyish-white hairs.

*Measurements.* Below and on p. 308.

*Specimen examined.* One, the type.

*Range.* Pelew Islands.

*Type* in collection.

a. ♂ ad. al.; skull. Pelew Is. Godeffroy Mus. 74.10.53.  
(*Type of species.*)

*External measurements of Pteropus pselaphon and pilosus.*

	<i>Pt.</i> <i>pselaphon.</i> ♂ ad. (Incl. type.)		<i>Pt.</i> <i>pilosus.</i> ♂ ad. Type.
	MIN.	MAX.	
	mm.	mm.	mm.
Forearm .....	132.5	141	151.5
Pollex, total length, c. u. ....	56	61.5	60.5
„ metacarpal .....	12	13.2	14.5
„ 1st phalanx .....	27	30	31.5
2nd digit, metacarpal .....	65	71.5	77
„ 1st phalanx .....	16	18.5	19.8
„ 2nd-3rd phalanx, c. u. ....	15	17.8	16.5
3rd digit, metacarpal .....	88	95	105.5
„ 1st phalanx .....	66	68	73
„ 2nd phalanx .....	88.8	94	108
4th digit, metacarpal .....	88.5	94.5	100.5
„ 1st phalanx .....	52	55.5	59.5
„ 2nd phalanx .....	51.5	54	54.8
5th digit, metacarpal .....	91.5	98.5	106
„ 1st phalanx .....	39	42	46
„ 2nd phalanx .....	35.8	40.5	37
Ear, length from orifice .....	23.7	24	25.5
„ greatest width, flattened ....	14	14.8	15.8
Front of eye to tip of muzzle .....	23	25	...
Lower leg .....	58	62.5	63
Foot, c. u. ....	45	48	46.5
Calcaneal .....	13.8	14	17

*Measurements of skulls and teeth of Pteropus pselaphon and pilosus.*

	<i>Pt. pselaphon.</i> Skulls: 6 ad. Teeth: 6 ad., 3 imm. (Incl. type.)		<i>Pt. pilosus.</i> ♂ ad. Type.
	MIN.	MAX.	
	mm.	mm.	mm.
Skull, total length to gnathion .....	63.5	69 *	69
„ palation to incisive foramina .....	30	31.5	...
„ front of orbit to tip of nasals .....	17.2	18.5	19.8
„ width of brain-case at zygomata .....	23.8	23.8	24
„ zygomatic width .....	35.8	38.2	...
„ width across $m^1$ , externally .....	18.2	19	18
„ lacrymal width .....	14	14.8	14
„ width across canines, externally .....	12.8	14	14
„ postorbital constriction .....	6.3	7.2	...
„ interorbital constriction .....	9.5	10	8.8
„ width of mesopterygoid fossa .....	7.5	7.8	...
„ between $p^1$ - $p^1$ , internally .....	10.8	11.8	9.8
„ between cingula of canines .....	6.8	7.7	7.2
„ orbital diameter .....	12.2	12.8	13.2
Mandible, length .....	51	52	52
„ coronoid height .....	28.5	30.2	29
Upper teeth, $c-m^2$ .....	23	24.2	25
Lower teeth, $c-m_3$ .....	25.7	27	27.8
Upper incisors, combined width .....	7.2	7.8	8
$p^3$ , length .....	4.8	5.2	5.1
„ width .....	3.7	3.8	3.2
$p^1$ , length .....	4.8	5.2	5.1
„ width .....	3.2	3.6	3.7
$m^1$ , length .....	5.7	6	5.8
„ width .....	3.1	3.2	3.2
$m^2$ , length .....	2.8	3.2	2.8
„ width .....	2	2.2	2.1
$p_1$ , length .....	2.2	2.7	2.8
„ width .....	2.1	2.6	2.8
$p_2$ , length .....	4.8	5.2	5.2
„ width .....	3	3.2	3
$p_3$ , length .....	5	5.3	5
„ width .....	2.9	3.1	3.1
$m_1$ , length .....	4.8	5.5	5.2
„ width .....	2.8	2.9	3
$m_2$ , length .....	4	4.2	4.2
„ width .....	2.7	2.8	2.8
$m_3$ , length .....	2.3	2.9	2
„ width .....	1.9	2.1	2

\* Estimate.



59. *Pteropus tuberculatus*, *Pet.*

*Pteropus tuberculatus*, Dobson, *Cat. Chir. B. M.* p. 58.

*Pteropus vanikorensis* (pt.), Quoy & Gaimard, *Voy. Astrolabe*, Zool. i. p. 77 (skull, excl. skins and pl. ix.) (1830: Vanikoro); Temminck, *Mon. Mamm.* ii. p. 78 (pt.: skull, not specimens) (1837: Vanikoro); Blainville, *Ostéogr. Mamm., Atl. Chéiropt.* p. 100\*, pl. vi. fig. 3 (skull) (1840: Vanikoro).

Roussette de Vanikoro, Jourdan, *Echo du Monde Sav.* iv. p. 156 (1837: dentition compared with that of *Acerodon*).

*Acerodon vanikorensis* (pt.), Lesson, *N. Tabl. R. Anim., Mamm.* p. 14, no. 194 (1842: Vanikoro).

*Pteropus tuberculatus*, Peters, *MB. Akad. Berlin*, 1869, p. 393 (habitat unknown); Dobson, *Cat. Chir. B. M.* p. 58 (1878: hab. unknown); Trouessart, *Cat. Mamm.* i. p. 82 (1897: hab. unknown); Matschie, *Megachir.* pl. viii. figs. 3, 3 a, 3 b (skull) (1899).

*Pteropus* (Spectrum) *tuberculatus*, Matschie, *Megachir.* p. 29 (1899: hab. unknown); Trouessart, *Cat. Mamm., Suppl.* p. 54 (1904: hab. unknown).

*Diagnosis*.—Similar in skull and dentition to *Pt. pselaphon* and *pilosus*, but with a small cusp-like projection on hinder trenchant margin of upper canine above middle of tooth. Fur shorter than in *pilosus*, mantle not paler than back. Size considerably smaller: forearm 119.5 mm. *Hab.* ? Vanikoro or Marianne Is.

*Teeth*.—Essentially as in *Pt. pselaphon* and *pilosus*, but some of the chief characters of the dentition in these species (strong development of cingulum in upper incisors, upper and lower canines; enlargement of  $i_2$  and  $p_1$ ; tendency in longitudinal ridges of cheek-teeth to break up into tubercles) still more pronounced.—Upper incisors large; cingulum excessively strong, forming a broad ledge on posterior face of teeth, in  $i^2$  extending a little beyond external vertical margin of tooth, so as to be visible in front view of incisor as a small basal cusp on external side. Upper canines long, recurved, stout (as in *pilosus*); cingulum as in *pselaphon*, subdivided into a series of small tubercles; a small, well-marked cusp-like projection on posterior trenchant edge of canine above middle of tooth. Inner longitudinal ridge of  $m^1$  and  $m_1$  with pronounced tendency to break up into small, rounded, incompletely differentiated tubercles.— $i_2$  very large, between four and five times the bulk of  $i_1$ .  $p_1$  unusually large, larger than  $i_2$ , and more than twice the size of  $m_3$ .—Other characters as in *pselaphon* and *pilosus*.

*Fur*.—As in *Pt. pilosus*, but rather shorter: approximate length of hairs, back 16, mantle 16 mm. Upperside of tibia covered for proximal half or two-thirds.

*Colour*.—The type and only skin known (Paris Museum) is probably faded by exposure to light. In its present condition the whole pelage above and beneath is some shade of russet-brown, darkest (almost vandyck-brown) on mantle, sides of neck, foreneck,

\* Spelt *Pt. vanikorensis*.

and face, palest (russet washed with a peculiar tinge of ochraceous) on back, breast, belly, and flanks.

*Measurements.* On pp. 313, 314.

*Specimens examined.* The mounted skin of the type of *Pt. tuberculatus*; an odd skull (Paris Museum, Reg. no. 6746), erroneously described by Quoy and Gaimard (*l. s. c.*) and figured by Blainville (*l. s. c.*) as the skull of *Pt. vanikorensis*.

*Range.* Probably either Vanikoro (Sta. Cruz Is.) or Guam (Marianne Is.).

*Type* in the Paris Museum.

*History in literature.*—An examination (Dec. 1907) of the material on which Quoy and Gaimard based their *Pt. vanikorensis*—viz., two mounted skins and an odd skull, stated to have been obtained in the island of Vanikoro (Feb.–March 1828) during the voyage of the ‘Astrolabe,’ and now in the collection of the Paris Museum—has satisfied me that the skins (skull of one *in situ*, skull of the other extracted in Dec. 1907) represent a species closely allied to *Pt. mariannus*, the skull (Reg. no. 6746) a totally different species, allied to *Pt. pselaphon* and *pilosus*, and later on described by Peters (1869, *l. s. c.*), on other material, under the name *Pt. tuberculatus*. The skull wrongly believed to be that of *Pt. vanikorensis* was figured by Blainville (1840, *l. s. c.*) under this latter name; a comparison of this figure with that of the skull of the type of *Pt. tuberculatus* published in Matschie’s ‘Megachiroptera’ (1899, *l. s. c.*) will show the perfect identity of the characters of the skull and teeth.—I retain the name *Pt. vanikorensis* for the species represented by Quoy & Gaimard’s skins.

That *Pt. tuberculatus*, the habitat of which was hitherto unknown, proves to be represented in the Paris Museum by a skull stated to have been obtained in Vanikoro, might seem to settle the question as to the true home of this rare species. But the evidence can hardly be considered perfectly conclusive; since Quoy and Gaimard were mistaken in referring the skull to *Pt. vanikorensis*, they may also have erred in stating that it was from Vanikoro. So much only is sure, that Vanikoro and Guam are the only places visited by the ‘Astrolabe’ in which it can have been obtained.

*Pt. tuberculatus*, Peters (1869, *l. s. c.*), was based on an adult female from unknown locality, in the collection of the Paris Museum (Reg. no. A. 40, mounted; skull extracted many years ago, for figuring by Peters, and again replaced in skin). Peters considered this species allied to *Pt. mackloti*, a view which, as already pointed out by Matschie (*l. s. c.*), has no foundation whatever; *Pt. tuberculatus* has no closer relatives among known species than *Pt. pselaphon* and *pilosus*.

60. *Pteropus leucopterus*, Temm.*Pteropus leucopterus*, Dobson, Cat. Chir. B. M. p. 32.

*Pteropus leucopterus*, Temminck, Esq. Zool. p. 60 (1853: ? Philippines); Wagner, Schreber's Säug., Suppl. v. p. 599 (1853-55: Philippines); Peters, M.B. Akad. Berlin, 1867, p. 323 (loc. unknown); Fitzinger, S.B. Akad. Wien. lx. Abth. i. p. 433 (1870: Philippines); Dobson, Cat. Chir. B. M. p. 32, pl. iv. fig. 1 (skull; teeth) (1878: Philippines; ? China); Trouessart, Rev. & Mag. Zool. (3) vi. p. 203 (1879: Philippines; ? China); Jentink, Cat. Ost. Mamm. p. 253 (1887: skull of type); id., Cat. Syst. Mamm. p. 140 (1888: Philippines, type); Elera, Cat. Sist. Faun. Filip. i. p. 5 (1895: Luzon; Cagayan); Trouessart, Cat. Mamm. i. p. 78 (1897: Philippines; ? China); Sanchez, An. Soc. Españ. Hist. Nat. xxix. pp. 241, 275, 288 (1900-1901: Philippines); K. Andersen, Ann. & Mag. N. H. (8) iii. p. 213 (1909: characters and affinities).

*Spectrum leucopteron*, Gray, Cat. Monk. &c. p. 102 (1870: Philippines).

*Pteropus* (*Spectrum*) *leucopterus*, Matschie, Megachir. p. 26 (1899: ? Philippines; ? China); Trouessart, Cat. Mamm., Suppl. p. 53 (1904: ? Philippines; ? China).

*Desmalopex leucopterus*, Miller, Fam. & Gen. Bats, p. 60 (1907).

*Pteropus chinensis*, Gray, Cat. Monk. &c. p. 111 (1870: China).

*Diagnosis*.—Allied to *Pt. pselaphon*, but coronoid lower and more sloping, molariform teeth above and below peculiarly shortened, those in upper jaw subquadrate. A shallow transverse depression always present in inner, sometimes also in outer, ridge of  $m_1$  and  $m_2$ , if fully developed rendering these teeth indistinctly quadritubercular in appearance. Forearm 136(?)–142.5 mm. *Hab.* Philippines.

*Skull* (fig. 16).—In most of its essential characters similar to skull of *Pt. pselaphon*. Rostrum short and stout, though (perhaps owing to reduced size of cheek-teeth) rather less so than in *Pt. pselaphon*; width of rostrum externally across alveolar borders of  $p^1$ – $p^1$  subequal to orbital diameter; front of orbit vertically above back of  $p^1$  (or interspace  $p^1$ – $m^1$ ). Orbits directed more upward than in *Pt. pselaphon*, but not more so than in certain other species of the genus, e. g. *Pt. giganteus* and *vampyrus*. Post-orbital processes of frontals long, in both of the British Museum skulls fused with corresponding smaller processes of zygoma, thus completely encircling orbit behind. Mandible much less heavy posteriorly than in *Pt. pselaphon*; coronoid process lower and more sloping, coronoid height of mandible less than  $c$ – $m_3$ ; angular process well pronounced; condyles distinctly above level of alveolar line; gonys (symphysis) lower and more sloping than in *Pt. pselaphon*.

*Teeth* (fig. 16).—Characters of upper incisors and canines as in *Pt. pselaphon* (incisors, if anything, still a little larger, and with cingulum still slightly broader).  $p^1$  rather less reduced than usual, equal to or slightly larger than  $i_1$ , crown slightly differentiated from shaft (cf. *Pt. lombocensis*).  $p^2$  normal in outline,  $p^1$  and  $m^1$  peculiarly short (antero-posteriorly), subquadrate, one-third to one-fourth

longer than broad. Posterior basal ledge well developed in  $p^3$ , in  $p^4$  and  $m^1$  more developed on postero-internal than on postero-external side of tooth; antero-internal base of  $p^4$  forming a distinctly projecting narrow ledge; a similar but still narrower ledge in  $p^3$  and  $m^1$ .  $m^2$  larger than usual, about one-third or two-fifths the bulk of  $m^1$ .

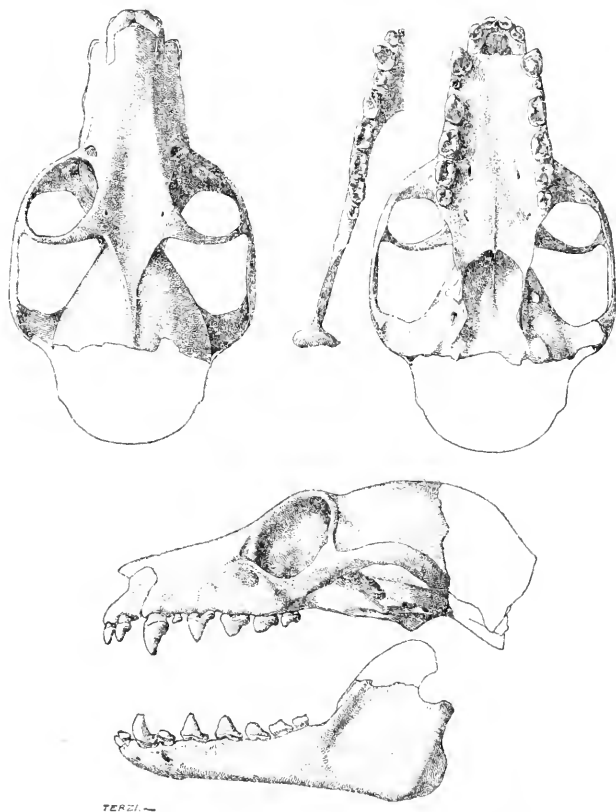


Fig. 16.—*Pteropus leucopterus*. Philippines. Type of *Pt. chinensis*. (Outline of occiput and top of coronoid process partly restored from a second skull, B. M. 62.1.14.3.)  $\frac{1}{2}$ .

$i_1$  normal;  $i_2$  unusually large, about five times the bulk of  $i_1$ . Lower canines as in *Pt. pselaphon*.  $p_1$  subequal to or slightly larger than  $i_2$  (relatively larger than in *Pt. pselaphon*, but not

larger than in *Pt. pilosus* and *tuberculatus*).  $p_3$  similar in outline to  $p_3$  of *Pt. pselaphon*;  $p_4$ ,  $m_1$ , and  $m_2$  shorter and slightly broader than in the related species. Posterior basal ledge of  $p_3$ ,  $p_4$ , and  $m_1$  well developed, though less strongly marked off from teeth postero-externally. A shallow transverse depression in margin of inner longitudinal ridge of  $m_1$  and  $m_2$ , subdividing ridge into two incompletely differentiated rounded tubercles (a similar depression sometimes faintly indicated in inner ridge of  $p_4$ ); a corresponding but still shallower depression sometimes present also in outer ridge of  $m_1$  and  $m_2$ .  $m_3$  rather larger than usual, subequal to  $i_2$ .

*Fur*.—Distribution of fur as in *Pt. pselaphon*; tibia thickly clothed above nearly to ankle. Longest hairs, back about 16–19, mantle 23–26, belly 17–20 mm.

*Colour*.—The few specimens known are apparently faded (back buffy drab, underparts dull drab, head and mantle pale drab).

*Measurements*. Below and on p. 314.

*Specimens examined*. Three, in the collections of the Leyden and British Museums, including the type of the species and the type of *Pt. chinensis*. These appear to be the only specimens on record.

*Range*. Philippines (Luzon).

*Type* in the Leyden Museum.

*External measurements of Pteropus tuberculatus and leucopterus.*

	<i>Pt. tuberculatus.</i> ♀ ad. Type.	<i>Pt. leucopterus.</i>	
		Ad. 62.1.14.3.	Ad. Type of <i>Pt. chinensis</i> .
	mm.	mm.	mm.
Forearm .....	119.5	142.5	? 136
Pollex, total length, c. u. ....	50	61	63
" metacarpal .....	12.5	15	16.5
" 1st phalanx .....	25	28.5	30.5
2nd digit, metacarpal .....	59.5	67.5	66
" 1st phalanx .....	14	16.5	17
" 2nd–3rd phalanx, c. u. ...	13.5	17	17
3rd digit, metacarpal .....	83	97	96
" 1st phalanx .....	65	79	...
" 2nd phalanx .....	...	...	103
4th digit, metacarpal .....	80.5	95	93
" 1st phalanx .....	53.5	57.5	57
" 2nd phalanx .....	56.5	61	...
5th digit, metacarpal .....	88	97	102.5
" 1st phalanx .....	38.5	42	42
" 2nd phalanx .....	42	45	48
Lower leg .....	49	...	? 66
Foot, c. u. ....	...	47	...
Calcaneal .....	...	18	19

*Measurements of skulls and teeth of Pteropus tuberculatus and leucopterus.*

	<i>Pt. tuberculatus.</i> Ad. (Paris Mus., 6746.)	<i>Pt. leucopterus.</i>			
		♂ yg. ad. Type.	Ad. 62.1.14.3.	Ad. Type of <i>Pt. chinensis.</i>	
	mm.	mm.	mm.	mm.	
Skull, total length to gnathion .....	56.8	...	...	...	
„ palation to incisive foramina .....	25.7	...	29	29.5	
„ front of orbit to tip of nasals .....	15.5	...	21	21.8	
„ width of brain-case at zygomata .....	22.8	...	25.8	24.5	
„ zygomatic width .....	33	...	38	37	
„ width across $m^1$ , externally .....	15.8	...	19.5	18.5	
„ lachrymal width .....	13	...	...	16	
„ width across canines, externally .....	13.8	...	...	13.8	
„ postorbital constriction .....	7.7	...	9	9.2	
„ interorbital constriction .....	8.5	...	9.8	10.8	
„ width of mesopterygoid fossa .....	7.2	...	9	8.8	
„ between $p^1$ - $p^1$ , internally .....	8.8	...	10.8	10.7	
„ between cingula of canines .....	7	...	...	7.2	
„ orbital diameter .....	11.7	...	14.2	14.2	
Mandible, length .....	43.2	...	52	51.5	
„ coronoid height .....	25	...	24.5	...	
Upper teeth, c- $m^2$ .....	21.5	...	24	23.8	
Lower teeth, c- $m_3$ .....	23.8	...	27	26.7	
Upper incisors, combined width .....	7	8.8	8.2	8	
$p^3$ , length .....	4	4.8	4.8	4.7	
„ width .....	3.2	3.2	3.5	3	
$p^4$ , length .....	4	4.7	4.9	4.1	
„ width .....	3.3	3.8	3.8	3.2	
$m^1$ , length .....	4.9	4	4.3	3.8	
„ width .....	3	3.3	3.7	3.1	
$m^2$ , length .....	2.1	3	3	3	
„ width .....	1.8	2.8	3	2.4	
$p_1$ , length .....	2.8	3.2	3	3	
„ width .....	2.5	2.7	2.8	2.7	
$p_3$ , length .....	4.5	4.8	4.6	4.7	
„ width .....	2.8	2.7	2.8	2.7	
$p_4$ , length .....	4	5	5.1	4.5	
„ width .....	2.8	3	3	3	
$m_1$ , length .....	4.5	4.7	4.7	4.2	
„ width .....	2.8	3.1	3.2	2.8	
$m_2$ , length .....	3.2	3.9	4	3.2	
„ width .....	2.5	2.8	3	2.8	
$m_3$ , length .....	2.1	2.9	2.3	2.2	
„ width .....	1.8	2.2	2.3	2.1	

*Pteropus leucopterus*. Temminck; 1853.—Type locality, “incertaine, l'on présume l'une des îles Philippines.” Type, a young adult male (nearly full-grown, forearm 130 mm.), mounted, faded, skull separate.

*Pteropus chinensis*, Gray; 1870.—The type, an unregistered skin and skull, came to the Museum from Robert Fortune, who, in 1843–45, travelled in the northern provinces of China as a collector for the Horticultural Society of London; hence it was, very naturally, believed by Gray to be from “China.” But the fact was overlooked that Fortune also made an excursion to Luzon (January to early in March, 1845; see his ‘Three Years’ Wanderings in the Northern Provinces of China,’ pp. 332–345, 1847); when to this is added that no species of *Pteropus* is known to occur in China, and that the type of *Pt. chinensis* differs in no noteworthy character from that of *Pt. leucopterus*, there can be no reasonable doubt that it was obtained by Fortune during his stay in Luzon.

*Remarks*.—On the differential characters and affinities of this species, see also Ann. & Mag. N. H. (8) iii. pp. 213–218 (Feb. 1909).

a. Ad. sk.; skull.	Philippines.	Purchased (Verreaux).	62.1.14.3.
b. Ad. sk.; skull.	[Luzon.]	R. Fortune [C.].	Unregistered.
		(Type of <i>Pt. chinensis</i> , Gray.)	

#### K. THE *PTEROPUS TEMMINCKI* GROUP.

*Species*.—*Pt. temmincki*, *capistratus*, *personatus*.

*Range*.—Austro-Malaya: Celebes, Timor, Moluccas, Bismarek Archipelago.

*General characters*.—Skull delicately built, rostrum short and slender, orbits unusually large (diameter greater than lachrymal width of skull), postorbital much greater than interorbital width, sagittal crest undeveloped or low, coronoid process of mandible sloping. Dentition weak, sometimes excessively weak; posterior basal ledges of premolars distinct but short. Ears small, rather broadly rounded off above; tibia hairy above. Colour peculiar: silvery buffy or silvery whitish, with concealed bases of hairs strongly contrasting seal-brown; mantle generally golden buffy; head sometimes with dark longitudinal stripes. Males without glandular neck-tufts. Size very small (forearm 86–116 mm.).

*Differentiation of species*.—The three species differ chiefly in dentition, the colour of the head, and in size. In *Pt. temmincki* (Timor and Amboina groups) and *Pt. capistratus* (Bismarek Archipelago) the teeth are unmodified in size, in *Pt. personatus* (Celebes, Moluccas) excessively reduced. In *Pt. temmincki* the head is uniform in colour; *Pt. capistratus* and *personatus* are unique in the genus in having the head marked with broad longitudinal dark brown stripes, somewhat different in number and arrangement in the two species (in all forms of this group the fur, though superficially unusually pale, is contrasting seal-brown at base; the peculiar head-stripes in *Pt. capistratus* and *personatus* are produced by the seal-brown colour, in certain sharply defined longitudinal areas on the head,

extending to the tips of the hairs, instead of being restricted to their concealed bases). *Pt. personatus* is the smallest known species of the genus, *Pt. capistratus* conspicuously larger, *Pt. temmincki* intermediate. Although occurring in the Moluccas and Bismarck Archipelago, this group is apparently unrepresented in New Guinea.

*Affinities of group.*—The known species of this group stand somewhat isolated in the genus: it is scarcely possible to point out, with any degree of probability, their closest relatives among living species. The characters of the skull are mostly those usually, in this genus, found in species with weak or degenerate dentition, those of the dentition rather generalized, except of course in the excessively narrow-toothed *Pt. personatus*. That the three species are closely interrelated is beyond all doubt, and the group would seem, provisionally at least, to find its natural place in the vicinity of the other Pteropi with short rostrum and clothed tibiae. To the strong reduction of the cheek-teeth in *Pt. personatus* there are parallels in certain other groups of the genus (*hypomelanus* group: *Pt. subniger*; *scapulatus* group: *Pt. scapulatus* and *woodfordi*), and even in a different genus (*Rousettus lanosus*); the peculiarity is probably in all cases due to adaptation to a special kind of food.

#### 61. *Pteropus temmincki*, *Pet.*

*Pteropus temmincki* (pt.), Dobson, Cat. Chir. B. M. p. 40.

*Pteropus griseus* (*nec E. Geoff.*), Temminck, *Mon. Mamm.* ii. p. 81 (pt.), pl. xxxvi. figs. 14, 15 (skull) (*nec* pl. xxxv. fig. 6, pl. xxxvi. figs. 12, 13) (1837: Samao, nr. Timor: Amboina); *S. Müller*, in Temminck, *Nat. Gesch. Nederl. Overz. Bez.*, *Zoögd.* p. 59 (pt.) (1839-44: Amboina); *Schinz*, *Syst. Verz. Säug.* i. p. 128 (pt.) (1844: Amboina); *Gray*, *Zool. 'Samarang.'* *Vert.* p. 11 (pt.) (1849: Amboina; Timor); *Wagner*, *Schreber's Säug., Suppl.* v. p. 602 (pt.) (1853-55: Amboina); *Gervais*, *Hist. Nat. Mamm.* i. p. 187 (pt.) (1854: Amboina); *Gerrard*, *Cat. Bones Mamm. B. M.* p. 57 (1862: Ceram); *Finsch*, *Neu-Guinea*, p. 150 (pt.) (1865: Amboina); *Gray*, *Cat. Monk. &c.* p. 110 (1870: Timor); *Rosenberg*, *Malay. Arch.* p. 322 (1878: Ceram).

*Pteropus temmincki*, *Peters*, *MB. Akad. Berlin*, 1867 (May), p. 331 (Amboina; Samao); *Dobson*, *Cat. Chir. B. M.* p. 40 (1878: Ceram; Timor); *Trouessart*, *Rev. & Mag. Zool.* (3) vi. p. 205 (pt.) (1879: Amboina; Ceram); *Jentink*, *Cat. Ost. Mamm.* p. 254, nos. *b-f* (1887: Samao; Amboina; Ceram); *id.*, *Cat. Syst. Mamm.* p. 140 (pt.) (1888: Amboina; Ceram); *Trouessart*, *Cat. Mamm.* i. p. 79 (pt.) (1897: Amboina; Ceram); *Matschie*, *Megachir.* pl. vi. figs. 4, 4 *a*, 4 *b* (skull) (1899: Amboina); *Miller*, *Fam. & Gen. Bats*, p. 58 (pt.) (1907).

*Pteropus* (*Sericonycteris*) *petersi*, *Matschie*, *Megachir.* p. 31 (1899: Amboina); *Trouessart*, *Cat. Mamm., Suppl.* p. 54 (1904: Ceram; Amboina).

*Pteropus petersi*, *Willink*, *Nat. Tijds. Nederl. Ind.* lxx. p. 275 (1905: Ceram; Amboina).

*Diagnosis.* - Skull delicate, orbits unusually large, rostrum short



and slender, sagittal crest none. Dentition weak, but structure of teeth unmodified; posterior ledge of cheek-teeth distinct, but not very strongly marked off from teeth. Ears small, broadly rounded off at tip, half exposed. Tibia furred above. Fur unusually pale-coloured (silvery buffy-white or silvery cream-buff) with concealed bases of hairs contrasting seal-brown; mantle rich ochraceous-buff; head not striped. Size small: forearm 94.5-101 mm. *Hab.* Ceram, Amboina, Timor.

*Skull*.—Deflection of brain-case slightly greater than usual, alveolar line if projected backward passing through middle of vertical portion of supraoccipital. Rostrum short, slender, somewhat compressed laterally. Orbits unusually large, larger than or equal to lachrymal width of skull; front of orbit above middle or posterior half of  $p^1$ . Sagittal crest undeveloped, the temporal crests remaining separated (usually widely separated); postorbital therefore always considerably broader than interorbital constriction. Coronoid process weak, front margin considerably sloping backward; coronoid height of mandible much less than length of lower tooth-row ( $e-m_3$ ), generally even less than maxillary tooth-row.

*Teeth*.—Weak. Upper canines very slender, slightly recurved, vertical groove on front face deep; ingulum moderate.  $p^1$  rudimentary, terete, deciduous. Posterior basal ledge of  $p^3$  and  $p^4$  well developed, rather indistinctly marked off from teeth (postero-external notch ill-defined or wanting), in  $p^4$  more developed on postero-internal than on postero-external corner of tooth.  $m^2$  slightly larger than  $p_1$  and  $m_3$ .— $i_2$  twice to twice and a half the bulk of  $i_1$ .  $p_1$  about twice the size of  $i_2$ . Posterior ledge of  $p_3$ ,  $p_4$ , and  $m_1$  moderate; a small notch between ledge and base of outer main cusp generally present in  $p_3$  and  $p_4$ , sometimes in  $m_1$ .  $m_3$  subequal to  $p_1$ .

*Ears* (dried skins).—Small, half exposed. Scarcely any emargination of outer margin below tip; tip broadly rounded off. Naked posteriorly, except at base.

*Fur*.—Moderately long, soft, silky; directed posteriorly on back, but not closely adpressed. Length at middle of back about 12, mantle 13, middle of belly 11 mm. Above, humerus and proximal half of forearm furred, the hairs decreasing in length and becoming more thinly spread distally; tibia densely furred to ankle.

*Colour* (cotypes, perhaps slightly faded).—Back and rump silvery buffy-white or silvery cream-buff, with a slight wash of pale cinnamon laterally, along membranes.—Breast, belly, and flanks silvery greyish-white faintly tinged with cream-buff.—Mantle, sides of neck, and foreneck rich ochraceous-buff (or with leanings to ochraceous).—Occiput similar to mantle; crown, sides of head, chin, and throat similar to underparts, or with a slightly more pronounced buffy wash.—Concealed bases of hairs everywhere dark brown (approximately seal-brown); on back and rump the dark bases are much longer than the pale-coloured tips, towards the mantle the dark bases decrease, the light tips increase in length; on mantle and head the pale tips are equal in length to or longer than the

concealed dark bases; a similar increase in the length of the pale-coloured tips is seen on the underparts, from the anal region forward.

*Measurements.* On pp. 322, 323.

*Specimens examined.* The material in the Leyden, Berlin, and British Museums, including the cotypes of *Pt. temmincki* and *Pt. petersi*.

*Range.* Ceram; Amboina; Timor.

*Cotypes* in the Berlin Museum.

*Pteropus griseus*, Temm. (nec Geoff.); 1837.—*Pteropus griseus*, Temm., 1825, is a redescription of *Pt. griseus*, Geoff., 1810, accompanied by a copy of Geoffroy's plate.—*Pt. griseus*, Temm., 1837 (*l. s. c.*), is a mixture of two very different species, viz. (1) the true *Pt. griseus*, Geoff. (see that species, p. 139): (2) a species later on described by Peters as *Pt. temmincki*; of Temminck's original material (1837) of this part of his *Pt. griseus* are now in the Leyden Museum one skeleton from Samao (Cat. Ost. p. 254. *Pt. temmincki*, specimen *b*), two skulls from Amboina (*ibid.*, *d* and *f*), and one from Ceram (*ibid.*, *e*); skull *f* is the original of Temminck's figures, Mon. Mamm. ii. pl. xxxvi. figs. 14–15.

*Pteropus temmincki*, Pet.: 1867.—Based on three mounted specimens (skulls separate) from Amboina, all acquired by the Berlin Museum from the Leyden Museum, viz. Berl. Mus. nos. 2633 (♂ ad., S. Müller), 3473 (♂ ad., Rosenberg), and 4964 (♂ ad., Bernstein); the skull of this specimen is the original of Matschie's 'Megachiroptera,' pl. vi. fig. 4): they are all marked by Peters himself as cotypes of *Pt. temmincki* (by an asterisk after the name on the printed label). I have examined these skins and skulls (skull 2633 excepted) and found them in every respect similar to a British Museum specimen from Ceram: this latter, as bought of Frank, is probably also a duplicate from the Leyden collection.—On the basis of the three Berlin specimens referred to above Peters wrote (1867, *l. s. c.*) that Temminck's *Pt. griseus* (1837) is "sehr verschieden von dem Geoffroy'schen *Pt. griseus*, den Temminck unter dem Namen *Pt. pallidus* beschrieben hat." This statement requires some modification: Peters had only seen Amboina specimens of Temminck's "*griseus*" (1837), which in fact are different from Geoffroy's *griseus*, but he had not seen Temminck's Timor (Samao) specimens, some of which are the true *griseus*, Geoff.; and Temminck's *Pt. pallidus* is not Geoffroy's *Pt. griseus*, but a distinct (though allied) species. It should be mentioned that Peters refers to Temminck's skull figures in Mon. Mamm. ii. pl. xxxvi. figs. 12–13 (which are the true *Pt. griseus*, Geoff.) as representing *Pt. temmincki*; but this is undoubtedly a slip for figs. 14–15.

*Pteropus petersi*, Matschie; 1899.—Accidental renaming of species due to a mistaken identification of Peters's *Pt. temmincki*. Matschie rightly points out that of the four skull figures of "*Pt. griseus*" given by Temminck (pl. xxxvi. figs. 12–15), figs. 12–13 (from a Samao skull) differ markedly from figs. 14–15 (Amboina skull) and undoubtedly represent a species different from this latter: but he

wrongly transfers the name *Pt. temmincki* from the Amboina species, to which it was given by Peters, to the Samoa species, *i. e.* the true *Pt. griseus*, Geoff., and describes the Amboina species as new under the name *Pt. petersi*. The cotypes of *Pt. petersi*, in the Berlin Museum, are the very three cotypes of *Pt. temmincki*; and the skull figure in Matschie's 'Megachiroptera,' pl. vi. fig. 4, which is drawn from one of the cotypes of *Pt. temmincki* (no. 4964) and on the plate (which was printed off in Peters's time) rightly marked with this name, is in the letterpress (p. 31) by Matschie referred to as *Pt. petersi*.

*Remarks.*—The unusually pale, silvery colour of the fur, which on spreading shows strongly contrasting seal-brown bases to the hairs, the unstriped head, the delicately built skull with very large orbits, and weak dentition, are the most conspicuous diagnostic characters of this species. It has close relatives in the Bismarck Archipelago (*Pt. capistratus*, head striped) and the Gilolo group (*Pt. personatus*, head striped, teeth much reduced). Externally, in general aspect, *Pt. temmincki* is rather similar to the small pale-coloured forms of the *Pt. hypomelanus* group (particularly *Pt. griseus*); these latter are readily distinguished by their larger skull, broader rostrum (lachrymal width greater than orbital diameter), heavier dentition, and naked tibiae.—Of the two Timor specimens catalogued below, one, an adult male (originally mounted), is much faded by exposure to light (skull like that of Amboina and Ceram specimens, teeth defective), the other is so young as to be scarcely identifiable with certainty.

a. Yg. ad. sk.; skull.	Ceram.	Purchased (Frank).	{ 46.2.16.4. 46.8.3.46.
b. ♂ ad. sk.; skull.	Timor.	Purchased (Frank).	58.11.18.2.
c. ♂ juv. sk.; skull.	E. Timor ( <i>Dr. A. R. Wallace</i> ).	Tomes Coll.	7.1.1.250.

## 62. *Pteropus capistratus*, *Pet.*

*Pteropus capistratus*, Dobson, Cat. Chir. B. M. p. 39.

*Pteropus capistratus*, *Peters*, *MB. Akad. Berlin*, 1876, p. 316, with plate (animal) (New Ireland); *Dobson*, *P. Z. S.* 1877, p. 116 (Duke of York I.); *id.*, *Cat. Chir. B. M.* p. 39 (1878: Duke of York I.); *id.*, *P. Z. S.* 1878, p. 315 (Duke of York I.); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 205 (1879: New Ireland; Duke of York I.; New Britain); *Peters & Doria, Ann. Mus. Civ. Genova*, xvi. p. 690 (1881: Duke of York I.); *Jentink, Cat. Syst. Mamm.* p. 140 (1888: New Britain); *Studer, Forschungsreise Gazelle*, iii. p. 244, pl. i. (animal) (1889); *Trouessart, Cat. Mamm.* i. p. 79 (1897: New Ireland; Duke of York I.; New Britain); *Matschie, Megachir.* pl. ii. figs. 1, 2 (animal), pl. iii. figs. 3a, 3b, 3c, 3d (skull) (1899: New Ireland); *Miller, Fam. & Gen. Bats*, pp. 56 (footnote), 58 (1907); *Elliot, Cat. Mamm. Field Col. Mus.* p. 491 (1907: Duke of York I.).

*Pteropus* (*Sericonycteris*) *capistratus*, *Matschie, Megachir.* p. 32 (1899: New Ireland; Duke of York I.; New Britain); *Trouessart, Cat. Mamm., Suppl.* p. 51 (1904: New Ireland; Duke of York I.; New Britain).

*Diagnosis.*—Allied to *Pt. temmincki*, but larger; three longitudinal stripes of dark vandyck-brown on face: a median between eyes and a subocular stripe on each side. Forearm 110.5–115.5 mm. *Hab.* Bismarek Archipelago.

*Skull and teeth.*—Essential characters of skull as in *Pt. temmincki*, but size somewhat larger; maxillary process of zygomatic arch considerably heavier; orbits relatively a little larger; temporal crests usually separated also in adults, sometimes closely approximated or even united to form a short, very low sagittal crest.—Teeth somewhat larger, but scarcely differing in structure.

*Fur.*—Length moderate; extremely soft and silky; directed backward and slightly adpressed on back, spreading on rump. Approximate length of hairs, back 10, mantle 14–16, belly 10 mm. Wings about 30 mm. apart at origin from sides of back. Width of furred area of back about 42 mm.

Above, proximal half or two-thirds of forearm covered with closely adpressed hairs. Fur of back extending laterally on membranes about 5–6 mm. beyond their line of origin from back. Tibia densely furred to some distance from ankle. Very thinly set, but rather long, whitish hairs along margin of membrane, above and below, between fifth digit and foot, and along inner margin of tibial interfemoral.

Below, membrane along outer side of forearm unusually densely haired; antibrachial membrane and lateral membrane between humerus and femur densely covered with woolly hairs. Tibia thinly furred proximally, naked distally.

*Colour* (series, incl. cotypes).—Back and rump silvery buffy-white or cream-buff, this colour confined to the shorter tips of the hairs; longer base of fur contrasting dark vandyck-brown or nearly seal-brown. Generally the dark base of the fur shows more or less through, making the silvery buffy colour more or less distinctly clouded with dark brownish, especially on rump, thighs, and tibiae, where not infrequently the dominant colour is vandyck-brown grizzled or powdered with silvery whitish.—Breast, belly, and flanks rather similar to upperside, but pale hair-tips generally shorter.—Mantle golden buffy, shading to creamy white posteriorly; sides of neck similar to mantle, shading to cream-buff strongly clouded with dark vandyck-brown on foreneck. Base of fur everywhere strongly contrasting seal-brown or dark vandyck-brown.—Head cream-buff or cream-white; a dark vandyck-brown longitudinal stripe from rhinarium backward along middle of forehead and crown, bending under a right angle vertically down temporal region (midway between eye and ear) to dark vandyck-brown throat; a similarly coloured longitudinal stripe on each side of head from muzzle backward below eye (but not touching lower eyelid) to vertical temporal stripe. Margins of upper and lower lips cream-buff or cream-white.

*Measurements.* On pp. 322, 323.

*Specimens examined.* The Berlin and British Museum series, including cotypes of species.

*Range.* Bismarek Archipelago: New Ireland, Duke of York I., New Britain.

*Cotypes* in the Berlin Museum.

*Pteropus capistratus*, Pet.; 1876.—Based on two young adult individuals, male and female, obtained in New Ireland during the 'Gazelle' Expedition; Berlin Museum nos. 4998 (♂) and 4999 (♀). The skull of no. 4999 is the original of the figure in Matschie's 'Megachiroptera,' pl. iii. fig. 3.

*Remarks.*—*Pt. capistratus* differs from the only other striped-headed species of the genus by the normal-sized (not excessively reduced) teeth, the different pattern of the stripes, and larger size.

*a. b.* 2 ad. sks.; skulls. New Ireland. Rev. G. Brown [C.]. { 77.7.18.2.  
78.2.5.4.

### 63. *Pteropus personatus*, Temm.

*Pteropus personatus*, Dobson. Cat. Chir. B. M. p. 38.

*Pteropus personatus*, Temminck, *Mon. Mamm.* i. p. 189 (1825: Ternate): Lesson, *Man. Mamm.* p. 111, no. 289 (1827: Moluccas); Desmarest, *Dict. Sci. Nat.* xvi. p. 365 (1827: Ternate); Is. Geoffroy, *Dict. Class. d'Hist. Nat.* xiv. p. 701 (1828: Ternate); J. B. Fischer, *Syn. Mamm.* p. 85, no. 13 (1829: Ternate); Lesson, *Hist. Nat. Mamm.* (Compl. Buffon) v. p. 53 (1836: Ternate); Temminck, *Mon. Mamm.* ii. p. 82 (1837); Wagner, *Schreber's Säug., Suppl.* i. p. 356 (1839: Ternate); S. Müller, in Temminck, *Nat. Gesch. Nederl. Overz. Bez., Zool.* pp. 20, 59 (1839-44: Ternate); Lesson, *N. Tabl. R. Anim., Mamm.* p. 13, no. 185 (1842: Ternate); Schinz, *Syst. Verz. Säug.* i. p. 128 (1844: Ternate); Gray, *Zool. 'Samarang,' Ver.* p. 12 (1849: Ternate); Wagner, *Schreber's Säug., Suppl.* v. p. 602 (1853-55: Ternate); Gervais, *Hist. Nat. Mamm.* i. p. 187 (1854: Ternate); Gistel, *Säug.* p. 998 (1855: Ternate); Schlegel, *Dierkunde*, i. p. 53 (1857: Ternate); Gerrard, *Cat. Bones Mamm. B.M.* p. 57 (1862); Finsch, *Nieu-Guinea*, p. 150 (1865: Ternate; Gilolo; Batchian); Gray, *P. Z. S.* 1866, p. 66, fig. 2 (head); Peters, *MB. Akad. Berlin*, 1867, p. 329 (pt.) (Ternate); Fitzinger, *SB. Akad. Wien*, lx. Abth. i. p. 448 (1870: Ternate); Gray, *Cat. Monk. Soc.* p. 111 (1870: Ternate); Schlegel, *Diercentuin Nat. Art. Maj., Mamm.* p. 66, c. fig. (group of pendent bats) (1872); Marchi, *Atti Soc. Ital. Sci. Nat.* xv. p. 516 (1872-73: structure of hairs); Dobson, *Cat. Chir. B. M.* p. 38 (1878: Ternate); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 205 (1879: Ternate); Jentink, *Cat. Ost. Mamm.* p. 253 (1887: Ternate: Ceram; Morotai); *id.*, *Cat. Syst. Mamm.* p. 140 (1888: Ternate; Ceram; Morotai); Flower & Lydekker, *Mamm.* p. 651, fig. 301 (head) (1891); Trouessart, *Cat. Mamm.* i. p. 79 (1897: Ternate); Seabra, *Jorn. Sci. Math. Lisboa*, (2) v. no. 19, p. 167 (1898: Ternate); Matschie, *Megachir.* pl. vii. figs. 5, 5a, 5b (skull) (1899); Willink, *Nat. Tijds. Nederl. Ind.* lxx. p. 274 (1905: Ternate; Morotai; Gorontalo); Miller, *Fam. & Gen. Bats*, p. 58 (1907).

*Pteropus* (Sericonycteris) *personatus*, Matschie, *Megachir.* p. 32 (1899: Ternate; Morotai; Gorontalo); *id.*, *Abh. Senckenb.* xxv. Heft ii. p. 270 (1900: Gorontalo: Ternate); Trouessart, *Cat. Mamm., Suppl.* p. 54 (1904: Ternate; Morotai; Gorontalo).

*Diagnosis*.—Allied to *Pt. temmincki*, but teeth excessively reduced in size. One longitudinal stripe of dark vandyck-brown through and above each eye. Size smallest: forearm 86–96 mm. *Hab.* Moluccas; N. Celebes.

*Skull and teeth*.—Essential characters of skull as in *Pt. temmincki*, but size somewhat smaller; deflection of basicranial axis greater (alveolar line projected backward passing through upper part of supraoccipital); orbits not quite as large as in *temmincki*; temporal crests separated: coronoid process of mandible very weak, front margin sloping backward.—Teeth excessively reduced in size (very much like those of *Pt. subniger*, though with still smaller  $m_2$  and  $m_3$ ), but not modified in structure; cingulum of upper and lower canines very weak.

*Fur*.—As in *Pt. temmincki* and *capistratus*, but rather shorter: length on back about 9, mantle 11, belly 8–9 mm.—Distribution of fur as in *Pt. capistratus*, but fur on upperside of tibia extending backward to ankle and in a thin line along upperside of metatarsus o base of phalanges; short scattered hairs on phalanges.

*Colour*.—In general aspect approaching that of *Pt. capistratus*, but pattern of head-stripes different.—Back and rump silvery white with a slight creamy tinge, this colour confined to the shorter tips of the hairs: long base of fur contrasting seal-brown or vandyck-crown. Dark base of fur showing slightly through on back, much more so on rump, thighs, and tibiae.—Breast, belly, and

*External measurements of Pteropus temmincki, capistratus, and personatus.*

	<i>Pt. temmincki</i> , 4 ad. (Incl. cotypes.)		<i>Pt. capistratus</i> , 4 ad. (Incl. cotypes.)		<i>Pt. personatus</i> , 7 ad. (Incl. type.)	
	Min.	Max.	Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.	mm.
Forearm .....	91.5	101	110.5	115.5	86	96
Pollex, total length, c. u. ....	41	43.5	45.8	49.5	37.8	43.5
„ metacarpal .....	9.8	10.8	10.5	12	9	10.2
„ 1st phalanx .....	22	23	23.5	26	19.5	22.5
2nd digit, metacarpal .....	47.2	51.8	55.5	58	43.5	50
„ 1st phalanx .....	11.5	14.5	12.2	15.2	11	14.2
„ 2nd–3rd phalanx, c. u. ....	10	12.5	10.5	13	10.5	14.2
3rd digit, metacarpal .....	67	70	75.5	76.5	59.8	69
„ 1st phalanx .....	49.5	53.5	54.5	58.2	46.7	50.5
„ 2nd phalanx .....	69	70	76.5	82.5	61	67
4th digit, metacarpal .....	65	69	75	76.5	59.8	65.8
„ 1st phalanx .....	38.5	43	42.8	46	35.5	40
„ 2nd phalanx .....	38.5	41	45	...	...	41
5th digit, metacarpal .....	70.5	72.5	81	83	62.8	69
„ 1st phalanx .....	29.5	32	32.5	35	27	29.5
„ 2nd phalanx .....	27.5	29	30	34.8	26	30
Lower leg .....	41	...	46.5	48	39	44
Foot, c. u. ....	...	...	...	...	31	33.5

*Measurements of skulls and teeth of Pteropus temmincki,  
capistratus, and personatus.*

	<i>Pt. temmincki.</i> Skulls: 5 ad. Teeth: 5 ad., 3 imm. (Incl. cotypes.)		<i>Pt. capistratus.</i> Skulls: 3 ad. Teeth: 3 ad. (Incl. cotypes.)		<i>Pt. personatus.</i> Skulls: 7 ad. Teeth: 7 ad. (Incl. type.)	
	Min.	Max.	Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	49	51	...	...	46	47.5
„ palation to incisive foramina ...	23	24	25.5	26.5	19	20.2
„ front of orbit to tip of nasals ...	15.2	17	17.2	17.7	15	16
„ width of brain-case at zygomatica.	19	20	21.2	...	17	18.8
„ zygomatic width.....	27	29	29	...	25.2	27.7
„ width across m <sup>1</sup> , externally .....	14	14.5	15	16.2	11.2	12.8
„ lachrymal width .....	11.7	12.8	12.2	13.7	10.2	12
„ width across canines, externally.	9.8	10.5	10.2	11	9.8	10.5
„ postorbital constriction.....	8.5	9.2	9	9.2	8.3	8.8
„ interorbital constriction .....	6.2	7.8	7.2	8	7	7.2
„ width of mesopterygoid fossa ...	6.7	6.8	8	...	6.2	6.7
„ between p <sup>1</sup> -p <sup>1</sup> , internally ....	7.7	8	8.2	9.5	7.5	8
„ between cingula of canines .....	5	5.5	5.8	6	6	6.2
„ orbital diameter.....	12.5	13	13.7	14.7	10.7	11.2
Mandible, length .....	37	39	40.8	42.7	33	36
„ coronoid height .....	18	18.5	19	21	15.2	16.5
Upper teeth, c-m <sup>2</sup> ..	18.5	19.5	20	21.2	14.8	15.8
Lower teeth, c-m <sub>3</sub> .....	20.7	21.8	22	23.7	16.2	18
Upper incisors, combined width .....	...	5.2	5	5.2	4.6	4.7
p <sup>3</sup> , length .....	3.2	3.8	3.7	4.2	2.7	3
„ width .....	2.3	2.8	2.8	3	1.8	2
p <sup>1</sup> , length .....	3.2	4	3.8	4.1	2.7	3
„ width .....	2.7	3	2.8	3	2	2.1
m <sup>1</sup> , length .....	4	4.7	4.7	5	2.8	3.2
„ width .....	2.5	2.8	2.7	2.8	1.8	2
m <sup>2</sup> , length .....	1.8	2.2	2.2	2.8	1	1.6
„ width .....	1.8	1.8	1.8	2	1	1
p <sub>1</sub> , length .....	1.8	2	2	2.1	1.4	1.7
„ width .....	1.5	1.8	1.8	1.8	1.1	1.2
p <sub>3</sub> , length .....	3.2	3.7	3.7	4.2	2.8	3.1
„ width .....	1.9	2.2	2.2	2.4	1.6	1.8
p <sub>4</sub> , length .....	3.5	4	3.6	4.2	2.7	2.9
„ width .....	2.2	2.5	2.4	2.6	1.8	1.9
m <sub>1</sub> , length .....	3.7	4	4.2	4.7	2.5	2.8
„ width .....	2.1	2.7	2.2	2.5	1.7	1.8
m <sub>2</sub> , length .....	2.9	3.2	3	3.4	1.8	2.1
„ width .....	2	2.2	2.1	2.2	1.4	1.6
m <sub>3</sub> , length .....	1.7	2	1.7	2.1	0.8	1.2
„ width .....	1.2	1.8	1.7	1.8	0.8	1

flanks buffy or pale wood-brown; base of fur (more or less completely concealed) contrasting seal-brown.—Mantle golden buffy or ochraceous-buffy, shading to cream-buff or silvery whitish posteriorly; sides of neck and foreneck buffy or ochraceous-buffy like front of mantle.—Colour of mantle extending forward on occiput and crown, lightening to cream-buffy on face. A dark vandyck-brown stripe on each side of muzzle from rhinarium to front of eye, continued backward as a superciliary stripe (touching upper front corner of eye) to temporal region, there bending vertically downward, midway between eye and ear, to throat, where it meets and unites with corresponding stripe from opposite side; a short narrow horizontal line of similar colour from hinder corner of eye to vertical temporal stripe; upper and lower eyelid dark vandyck-brown. Interocular space between supraorbital stripes, an elongate patch above and behind each eye, region below eyes, including margins of upper and lower lips, and chin, silvery-white or creamy-white.

*Measurements.* On pp. 322, 323.

*Specimens examined.* The Leyden and British Museum series, including type of species.

*Range.* Gilolo group (Morotai, Gilelo, Ternate, Batchian); Amboina group (Ceram); N. Celebes (Gorontalo).

*Type* in the Leyden Museum.

*Pteropus personatus*, Temm.: 1825.—Original description based on two specimens, obtained in Ternate by Reinwardt. Of these only one skin (with skull) is now in the Leyden collection (mounted male "a." with skull marked "d."); it is possible, however, that the other cotype is the skeleton marked "a." According to Jentink (see his Catalogues) the mounted male "d" (from Ceram, Reinwardt Coll.; with skull "g") is a cotype, but this is against Temminck's statement that both of his specimens were obtained by Reinwardt in Ternate.

a. Ad. sk.; skull.		Purchased (Verreaux).	{ 47.7.86. 49.8.16.2.
b, c. ♂ ad.. ♀ yg. ad.	Ternate.	Dr. A. R. Wallace [C.].	60.8.26.3.4.
sks.; skulls.			
d. Ad. sk.; skull.	Ternate (Dr. A. R. Wallace).	Tomes Coll.	7.1.1.251.

#### L. THE *PTEROPUS VAMPIRUS* GROUP.

*Species*—Five species (eleven forms): *Pt. giganteus* (two subspecies), *ariel*, *lylei*, *intermedius*, *vampyrus* (six subspecies).

*Range.*—The range of this group almost exactly covers the Oriental Region, as defined by Wallace; only in the south-east (Lesser Sunda Islands) one species crosses "Wallace's line" and extends to Timor. In India, Ceylon, the Maldivé Archipelago, Himalayas, northern and central Indo-China, and Java it is the only group of the genus represented; in southern Indo-China and the whole of the Indo-Malayan Archipelago, except Java, it occurs together with the western offshoots of the *Pt. hypomelanus* group.



*General characters.*—Skull unmodified Pteropine. Dentition relatively weak; posterior ledges of cheek-teeth practically obliterated; cingulum of canines narrow. Ears long, sharply pointed; inter-femoral unusually deep in centre; fur short, adpressed on back; tibia naked above. In most species, mantle light-coloured (buffy) contrasting with dark back, but in extreme north-eastern (Philippines) and south-eastern forms (Lesser Sunda Islands) a pronounced tendency to complete melanism. Males with heavier canines and rather more rigid fur of mantle, sometimes with well-defined neck-tufts. Size medium, large, or very large; two forms are the largest bats known, *Pt. v. vampyrus* and *pluton* (greatest length of forearm measured, 220 mm.), approached in this respect, but not equalled, only by *Pt. melanopogon*, *arvensis*, *papuanus*, and *nohibernicus*, and *Acerodon jubatus*.

*Differentiation of species.*—The five species are apparently modifications of only two, closely related types: the *vampyrus* type, represented by *Pt. giganteus*, *ariel*, *intermedius*, and *vampyrus*, and the *lylei* type, represented by a single species.—In *Pt. giganteus* (India, Ceylon, Himalayas, Assam) the mantle is buffy or tawny, strongly contrasting with blackish or dark brown back, underside of body as pale as mantle or washed with tawny or pale russet, but never as dark as back; this style of colour is quite similar to that of *Pt. rufus* and *comorensis*. In the Maldivé Archipelago *Pt. giganteus* is replaced by a slightly smaller, rather shorter-muzzled and larger-toothed form (*Pt. ariel*). *Pt. vampyrus* (Indo-Malayan Archipelago, including Malay Peninsula and Lesser Sunda Islands) differs from *Pt. giganteus* only in the rather larger, in some local races much larger, size and in having the underside of the body quite or very nearly as dark as the back. In so far there is a clear line of separation, in characters as in habitat, between *Pt. vampyrus* and *Pt. giganteus*, the former being a rather larger, dark-bellied Indo-Malayan, the latter a rather smaller, pale-bellied, Indian representative of the same type, and the two forms have in fact always been considered perfectly distinct species. But *Pt. intermedius*, which inhabits an intermediate area (Tenasserim), is, at least to some extent, intermediate also in characters; with the dark underside of a *Pt. vampyrus* it combines the smaller size of a *Pt. giganteus*. This may be an indication that a completer material from the whole region between the Malay Peninsula and Assam will show a gradual transition from *Pt. vampyrus* to *Pt. giganteus*.—*Pt. lylei* is chiefly characterized by its much smaller size, as compared with other forms of this group; it seems to be confined to Siam and Saigon, and is apparently the only species of the group recorded from these countries. It is possible that *Pt. lylei* represents a truly indigenous, continental type of the *vampyrus* group, as opposed to the much larger Indo-Malayan type, which in Tenasserim is represented by *Pt. intermedius*, in the Himalayas and India by *Pt. giganteus*.

*Affinities of group.*—See the *Pt. nohibernicus* group (p. 384).

64. *Pteropus giganteus*, Brünn.*Pteropus medius* (pt.), Dobson, Cat. Chir. B. M. p. 51.

(Synonyms under the subspecies.)

*Diagnosis*.—Skull typical Pteropine. Cingulum of canines very narrow: posterior ledges of cheek-teeth practically wanting. Ears very long, exposed, attenuated above, subacutely pointed. Tibia naked above. Fur rather short, more or less closely adpressed on back. Bright mantle contrasting with blackish or brownish back; breast and belly as bright as, or somewhat darker than, mantle, but never as dark as back. Size large: forearm 163.5–176.5 mm. *Hab.* Indian Peninsula, incl. Ceylon; Nepal, Assam, Manipur.

*Skull*.—Essential characters as in *Pt. rufus* and *comorensis*. Brain-case rather longer and narrower; rostrum somewhat heavier (less distinctly compressed); orbits a little larger: diameter contained 4.8–5 (in *rufus* and *comorensis* 5–5.4) times in total length of skull; mesopterygoid fossa broader. Postorbital processes strong, sometimes fused with corresponding processes on zygomatic arch: sagittal crest well developed; coronoid process relatively weak and somewhat sloping; coronoid height much less than length of lower tooth-row,  $c-m_3$ ; condyle of mandible considerably above level of alveolar line.

*Teeth*.—Chief characters: cingulum of upper and lower canines weak, forming only a very narrow rim; posterior basal ledges of cheek-teeth practically completely obliterated (sometimes traceable in  $p_3$ ); all cheek-teeth relatively smaller than in *Pt. rufus* and *comorensis*.— $p^1$  terete, spiculiform, deciduous;  $m^2$  larger than  $p_1$  and  $m_3$ ;  $i_2$  about twice the bulk of  $i_1$ :  $p_1$  twice the size of  $i_2$ ;  $m_3$  equal to or smaller than  $p_1$ .—On individual anomalies in dentition, see *suprà* p. 66, footnote.

*Palate-ridges*.—5+5+3. Position of ridges 1–6 quite as in *Pt. rufus* (p. 202); seventh terminating laterally at back of  $m^1$  or front of  $m^2$ ; eighth to tenth behind  $m^2$ ; eleventh to thirteenth situated at palation border. Sometimes a more or less incomplete, divided ridge, between the normal ninth and tenth ridge, is present: formula 5+6+3, compare *Pt. vampyrus* and *Pt. rufus*.

*Ears*.—Very long, exposed, reaching back of eye when laid forward. Inner margin flatly convex from base to tip; outer margin more strongly convex in lower two-thirds, rather abruptly concave in upper third; tip conspicuously attenuated, subacutely pointed. Naked posteriorly, except at base.

*Interfemoral*.—Unusually well developed in centre (depth about 18–25 mm.), posterior margin generally not quite concealed by overhanging hairs of rump and membrane.

*Wings*.—Arising about 26 mm. apart from sides of back.

*Fur*.—Length and quality somewhat varying according to the subspecies: very short, rather rigid, and closely adpressed on back in examples from the Indian Peninsula and Ceylon, moderate in length, softer, and less closely adpressed in specimens from

Nepal, Assam, and Manipur. Hairy space of back much restricted in width, owing to fur extending very little (about 10 mm.) beyond line of origin of membranes; width of furred area about 46 mm.

Above, proximal fifth of forearm thinly clothed with short adpressed hairs, excepting region round elbow, which is naked; in some specimens the whole of the forearm appears to be entirely naked. Tibia naked. Interfemoral hairy in centre and along inner side of femur and proximal half of tibia; broad inner margin of membrane naked.—Beneath, tibia naked. Length and distribution of woolly hairs on membranes as in *Pt. rufus*.

*Colour*.—Whole series of skins, males and females, adult and immature:—Back some shade of seal-brown, sometimes of a blackish tinge, sometimes more approaching dark vandyck-brown, nearly always very thinly and inconspicuously sprinkled with greyish-white hairs. In some individuals the rump is distinctly washed with vandyck-brown, this tinge extending occasionally also to sides of back along membranes.—Breast and belly always much paler than back, but actual tinge varying considerably individually: lightest extreme approaching golden buff, average specimens rather darker buffy, more or less washed or blotched with tawny or cinnamon-rufous, darkest extreme almost russet, lightened with buffy in centre of breast. Concealed bases of hairs always dark seal-brown. Flanks generally conspicuously darker than breast and belly, a shade of vandyck-brown lightened with buffy, tawny, or russet tips to the hairs.—Mantle always strongly contrasting with back, varying from golden buffy (lightest extreme), through ochraceous-buff and ochraceous, to tawny or even tawny clouded with cinnamon. Generally palest posteriorly in a transverse line across shoulders, but sometimes uniform in shade. Sides of neck generally of a rather deeper shade than, but occasionally similar to, mantle. Foreneck rather darker than, sometimes similar to, sides of neck. Hairs on sides of neck and foreneck generally with concealed seal-brown bases, but sometimes uniform bright-coloured to extreme base. On glandular neck-tufts in males, see below (secondary sexual characters).—Crown and interocular space rarely as bright as mantle, generally conspicuously darker, varying from ochraceous or deep ochraceous-buff to tawny or even russet or chocolate. Temporal region similar to or rather darker than crown. Muzzle, chin, and throat blackish, or blackish more or less lightened by admixture of vandyck-brown.

The two subspecies of *Pt. giganteus* are alike in colour.

*Secondary sexual characters*.—Males, adult as well as immature, differ from females in having a tuft of rigid glandular hairs on each side of neck, in front of antebrachial membrane. Hairs in these tufts not differing in length and scarcely in colour from surrounding fur, though sometimes slightly warmer in tinge and with a rather more pronounced oily gloss; therefore much more easily detectable by the hand (rigidity of hairs) than by the eye. The sex of a skin, if otherwise doubtful, can always be safely determined by the presence or absence of these neck-tufts. Dobson's

statement that "females are always darker in colour than males of the same age" (P. Z. S. 1873, p. 250) is not borne out by the series examined by me.

*Measurements.* See pp. 337, 338.

*Range.* Indian Peninsula, south to Ceylon, north and north-east to Nepal, Assam, and Manipur. (An isolated statement in literature (Mason, Rec. Ind. Mus. ii. pt. ii. p. 165, 1908) as to the occurrence of this species as a "straggler" in the Andamans has no foundation in fact and is in itself highly improbable.)

*Habits.*—The "Flying Fox" is one of the commonest mammals of India, and one of the most characteristic features of a tropical night. During daylight they rest on large trees, and it is a familiar sight in India to see some huge tree, in the centre of a village, on the skirts of a forest, or in the midst of a wide plain, garnished by hundreds of the dangling bodies of these animals. If not driven away, generation after generation resort to the tree once selected, until excess of numbers forces a part to select another. A person stationed near such a spot at the first break of dawn might see the Pteropi come stealing back to their retreat from all quarters. From the arrival of the first comer, until the sun is high above the horizon, a scene of incessant wrangling and contention is enacted amongst them, as each endeavours to secure a higher and better place, or to eject a neighbour from too close vicinage. In these struggles the bats hook themselves along the branches, scrambling about hand over hand with some speed, biting each other severely, striking out with the long claw of the thumb, and shrieking and cackling without intermission. Each new arrival is compelled to fly several times round the tree, being threatened from all points, and when he eventually hooks on, has to go through a series of combats, and be ejected several times before he makes good his tenure. This goes on till 8, 9, or 10 A.M., when they get sleepy, and hang side by side in peace, fanning themselves with their wings, which in repose they wrap round the head, slumbering with the chin on the breast. Their departure for their nightly rambles is unattended by any of this uproar. As the sun sinks below the horizon the Flying Foxes drop silently from the branches, one by one, and sail away into the coming gloom. They generally first shape their course to a tank or river, and sweeping down to the water's surface lap as they fly along, until their thirst is sated, when they wend their course to the trees the fruit of which may happen to be in season. They devour almost any ripe fruit, either wild or of the garden (oranges excepted), preferring the mowhooa berries, the figs of the bar, peepul, and goolar, the guava, plantain, and rose-apple; they are singularly fond of the flower-buds of the silk-cotton tree (*Eriodendron orientale*). They eat, when alighted, in silence, hanging head downward by one hind foot, the other being employed in holding the fruit, not by grasping but by sticking its claw in, in the fashion of a prong or fork. On captive specimens it has been observed that they chew the figs, until they have extracted the juice, when the remaining pulp is

ejected out of the mouth: glutinous and farinaceous food, such as plantains, they do not serve in this manner. They are strongly attracted to the cocoa-nut trees during the period when toddy is drawn for distillation, and exhibit at such times symptoms much resembling those of intoxication. On a few occasions (Calcutta, Aug. 1864 and Aug. 1869) this bat has been observed travelling in immense numbers, immediately after sunset, probably making for some fresh feeding-ground. The single young is born about the end of March and April, and continues a fixture on the mother till the end of May or early in June, when it is nearly as big as herself. (Tickell, Tennent, Jerdon, Day, Sterndale, J. Anderson; *ll. infra cit.*)

*Key to the Subspecies of Pteropus giganteus.*

- a. Fur shorter: 8-12 mm. on back.  
 (India, Ceylon) ..... *Pt. g. giganteus*, p. 329.  
 b. Fur longer: 15-18 mm. on back.  
 (Nepal, Assam, Manipur) ..... *Pt. g. leucocephalus*, p. 333.

64 a. *Pteropus giganteus giganteus*, Brünm.

- Mycket stöora Nattblackor, *Nils Matson (Köping), Reesa gen. Asia*, p. 132 (1667: Ind. Pen.; intoxication by Cocoa Palm juice).  
*Vespertilio Indica, Olearius, Gottorffsche Kunst-Kammer*, 2 ed. p. 24, pl. xv. fig. 1 (animal, long-tailed, with two sucklings) (1674).  
*Vespertiliones duo Indici, Jacobaeus, Museum Regium*, p. 12 (1699).  
*Vespertilio gigantea, Brünnich, Dyrenes Historie*, i. pp. 45, 59 (1782: Bengal).  
*Pteropus giganteus, Miller, Proc. Biol. Soc. Wash.*, xvi. p. 50 (1903: name revived); *id.*, *Fam. & Gen. Bats*, p. 58 (1907).  
 Chauve-souris de forte race, *Fouquet d'Obsonville, Essais philosophiques*, p. 76 (1783: India; habits).  
 Vampire Bat, *Shaw, Gen. Zool.* i. pt. 1, p. 144, pl. 44 (animal) (1800).  
*Pteropus medius, Temminck, Mon. Mamm.* i. p. 176 (1825: Calcutta; Pondichery); *Lesson, Man. Mamm.* p. 110, no. 284 (1827: Calcutta; Pondichery); *Desmarest, Dict. Sci. Nat.* xlv. p. 359 (1827: Calcutta; Pondichery); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 760 (1828: India); *J. B. Fischer, Syn. Mamm.* p. 82, no. 3 (1829: Calcutta; Pondichery); *Sykes, Cat. Mamm. Dakhn*, p. 4 (1831); *id.*, *P. Z. S.* 1831, p. 99 (Dakhn, Deccan); *Lesson, Hist. Nat. Mamm. (Compl. Buffon)* v. p. 49 (1836: Calcutta; Pondichery); *Waterhouse, Cat. Mamm. Mus. Zool. Soc.* p. 13, no. 99 (1838: Continental India); *Gray, Mag. Zool. & Bot.* ii. p. 502 (1838: Calcutta; Pondichery); *Oken, Atty. Naturg.* vii. Abth. ii. p. 990 (1838); *Elliot, Madras Journ. Lit. & Sci.* x. p. 94 (1839: S. Mahratta country); *Blyth, J. A. S. B. x.* p. 840 (1841: Travancore; Madras); *Peters, MB. Akad. Berlin*, 1867, p. 325 (Indian Peninsula); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 413 (1870: Calcutta; Pondichery; Madras; Bengal); *Gray, Cat. Monk. Sc.* p. 103 (pt.) (1870: Madras); *Dobson, J. A. S. B.* xli. pt. ii. p. 335 (1872: osteology); *id.*, *op. cit.* xli. pt. ii. pp. 196, 199 (1872: ear) (1873: Indian Peninsula, north to Kachhi; Ceylon); *id.*, *P. Z. S.* 1873,

- p. 250 (secondary sexual characters); *id.*, *Cat. Chir. Ind. Mus.* pp. 2-3 (pt.) (1874: Chutia Nagpur; Manbhum; Calcutta); *Gulliver, P. Z. S.* 1875, p. 493 (1875: size of red blood-corpuscles); *Dobson, Mon. As. Chir.* p. 18 c. fig. (head), pp. 22, 188-189 (pt.) (1876: Chutia Nagpur; Manbhum; Calcutta); *id.*, *Cat. Chir. B. M.* p. 51 (pt.) (1878: Indian Peninsula; ? Kelat; Ceylon); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 202 (pt.) (1879: India; Ceylon); *Ottery, P. Z. S.* 1879, p. 128 (eye-muscles); *Dobson, Rep. Brit. Assoc.* 1878, pp. 162, 165 (1879: remarks on distribution); *Trouessart, Ann. Sci. Nat.* (6) *Zool.* viii. Art. 12, p. 15 (1879: remarks on distribution); *Schmidt, P. Z. S.* 1880, p. 303 (duration of life in captivity); *Robin, Ann. Sci. Nat.* (6) *Zool.* xii. Art. 2, pp. 4 et seq. pl. ii. fig. 3, pl. iii. fig. 6, pl. iv. fig. 27, pl. v. fig. 33 (1881: anatomy); *J. Anderson, Cat. Mamm. Ind. Mus.* pt. i. p. 101 (pt.) (1881: Chutia Nagpur; Manbhum; Calcutta; habits); *Sigel, Zool. Garten*, xxiv. p. 183 (1883: habits and diseases in captivity); *Murray, Vert. Zool. of Sind*, p. 2 (1884: Jacobabad, Sind); *Gill, Stand. Nat. Hist.* v. p. 162 (1884: India: habits); *Murray, Indian Annals*, i. p. 25 (1887: use in medicine); *Jentink, Cat. Ost. Mamm.* p. 259 (1887: Bengal); *id.*, *Cat. Syst. Mamm.* p. 146 (pt.) (1888: Bengal; Calcutta; Hindostan; Ceylon); *H. Allen, Proc. Acad. Nat. Sci. Philad.* 1889, p. 236 (wing-membranes); *Wunderlich, Zool. Gart.* xxxii. no. 3, p. 81 (1891: breeding in captivity); *Blanford, Fann. Brit. Ind., Mamm.* pt. ii. p. 257 (pt.) (1891: India; Ceylon; habits); *Beauregard, C.R. Soc. Biol. Paris*, (9) iv. p. 915 (1892: internal carotid); *Mitra, J. Bombay N. H. Soc.* viii. p. 266 (1893: breeding in confinement); *Cattaneo, Atti Soc. Ligust.* iv. p. 142 (1893: anatomy of stomach); *Maggi, Rend. R. Ist. Lomb. Sci.* (2) xxvi. p. 710 (1893: ectocranial pituitary foramen); *Lydekker, R. Nat. Hist.* i. p. 253 (1893-94: India: habits); *Dixon, J. Bombay N. H. Soc.* iv. p. 103 (1894: feeding on fruit of *Strychnos nux-vomica*); *Bardleben, P. Z. S.* 1894, p. 35<sup>s</sup> (præpollex); *Beauregard, C.R. Acad. Sci. Paris*, cxviii. p. 1351 (1894: inner ear); *Maggi, Rend. R. Ist. Lomb. Sci.* (2) xxviii. p. 813 (1895: ectocranial pituitary foramen; interparietal); *P. L. Selater, List An. Zool. Gard.* 9 ed. p. 102 (1896); *Trouessart, Cat. Mamm.* i. p. 81 (pt.) (1897: India; Ceylon); *Seabra, Jorn. Sci. Math. Lisboa*, (2) v. no. 19, p. 167 (1898: Portuguese India); *Alcock, P. Z. S.* 1898, pp. 58 et seq., text-figs. (vascular system); *Matschie, Megachir.* p. 16, pl. ix. figs. 3, 3 a, 3 b (skull: Bengal) (1899: Bengal; Madras; Ceylon); *Wroughton, J. Bombay N. H. Soc.* xii. p. 717 (1899: Konkan); *Dalgleish, Zoologist*, (4) vii. p. 96 (1903: Darbhanga, Bengal; habits); *Trouessart, Cat. Mamm., Suppl.* p. 50 (pt.) (1904: India; Ceylon); *Witley, Spolia Zeyl.* ii. pt. v. p. 50 (1904: Barbeyrn I., off Colombo; habits); *Laveran, C.R. Soc. Biol. Paris*, i. p. 8 (1905: surra infection); *Fletcher, Spolia Zeyl.* iv. pt. xiii. p. 35 (1906: Barbeyrn I.; habits; external parasites); *Doflein, Ostasienfahrt*, pp. 450, 451, figs. (sleeping and flying) (1906: Ceylon); *Fletcher, Spolia Zeyl.* v. pt. xvii. p. 62 (1907: Barbeyrn I.; habits; external parasites).
- Pteropus edulis medius*, *Elliot, Madras Journ. Lit. & Sci.* x p. 95 (1839: S. Mahratta Country).
- Pteropus edwardsi* (*nec E. Geoff.*), *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 699 (pt.) (1828: Bengal); *J. B. Fischer, Syn. Mamm.* p. 81, no. 2 (1829: Bengal); *Lesson, Hist. Nat. Mamm.* (Compil.

- Buffon*) v. p. 46 (1836: Bengal); *Temminck, Mon. Mamm.* ii. p. 61 (1837: India; Ceylon); *Wagner, Schreber's Säug., Suppl.* i. p. 345 (pt.) (1839: Calcutta; Pondichery; Deccan; Ceylon); *Blyth, J. A. S. B.* xi. p. 95 (1842); *Lesson, N. Tabl. R. An., Mamm.* p. 12, no. 169 (1842: Calcutta; Maharashtra; Pondichery; Ceylon); *Gray, List Mamm. B. M.* p. 36 (pt.) (1843: Madras); *Blyth, J. A. S. B.* xii. p. 176 (pt.) (1843: Travancore; Madras); *Schinz, Syst. Verz. Säug.* i. p. 121 (pt.) (1844: India; Ceylon); *Gray, List Ost. Specim.* p. 10 (1847: Madras; Bengal); *E. Desmarest, Dict. Univ. d'Hist. Nat.* xi. p. 247\* (pt.) (1848: Calcutta; Pondichery); *Gray, Zool. 'Samarang,' Vert.* p. 11 (pt.) (1849: India; Ceylon); *Horsfield, Cat. Mamm. Mus. E. Ind. Co.* p. 28 (1851: India); *Kelaart, P. Z. S.* 1850, p. 156 (1851: Ceylon); *id., Prodr. F. Zeylon.* p. 27 (1852: Ceylon); *Wagner, Schreber's Säug., Suppl.* v. p. 595 (pt.) (1853-55: India; Ceylon); *Gervais, Hist. Nat. Mamm.* i. p. 188 (1854: India); *Tytler, Ann. & Mag. N. H.* (2) xiii. p. 376 (1854: Barrackpore, N. of Calcutta); *Giebel, Säug.* p. 995 (pt.) (1855: India; Ceylon); *Schlegel, Dierkunde*, i. p. 53 (1857: India); *Leith Adams, P. Z. S.* 1858, p. 512 (1859: Poonah, Deccan; habits); *Tennent, Ceylon*, i. p. 135 (1859: habits); *id., Nat. Hist. Ceylon*, p. 14 (1861: Ceylon; habits); *Gerrard, Cat. Bones Mamm. B. M.* p. 55 (pt.) (1862: Madras; Bengal); *Day, Land of the Permauls*, p. 439\* (1863: habits); *Blyth, Cat. Mamm. Mus. As. Soc.* p. 20 (1863: Calcutta); *Giebel, Zeitschr. ges. Naturw.* xxviii. p. 251 (1866: skull); *Jerdon, Mamm. India*, p. 18 (pt.) (1867: India; Ceylon; habits); *Albir, Bull. Soc. Philom. Paris*, (6) iv. p. 127 (1867: myology); *Cooke, Journ. Quekett Micr. Cl.* i. pp. 6, 55, pl. i. fig. 2 (1868-69: structure of hairs); *Humphry, Journ. Anat. Phys.* iii. pp. 294-319, pls. vi.-vii. (1869: myology of limbs); *Indian Sportsman [A. C. Macmaster], Notes on Jerdon's Mamm. India*, p. 6 (1870: habits); *Hutton, P. Z. S.* 1872, p. 691 (Neemuch, W. India); *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 515\*, pl. viii. fig. 1 (1872-73: structure of hairs); *Giebel, Brunn's Thier.* vi. Abth. 5, Lief. 1, pl. vi. figs. 9, 10 (1874: skull); *Aitken, J. Bombay N. H. Soc.* i. p. 144 (1888: Belapur, nr. Panvel; habits); *Gerstaecker, Skelet d. Högling's*, p. 13 (1887: vertebral column); *Herzfeldt, Zool. Jahrb., Anat.* iii. pt. 3, pp. 556 et seq. (1888: Jacobson's organ); *Brehm, Tierleben*, 3 ed. i. p. 344 (pt.) (1890: habits); *Elliot, Cat. Mamm. Field Col. Mus.* p. 490 (1907: Ceylon).
- Pteropus edwardsi* *vel* *nedius*, *Steradale, Mamm. India*, p. 37, c. fig. ("flying fox at home") (1884: India; Ceylon; habits).
- Pteropus* [sp.], *Anonymous, P. Z. S.* 1843, p. 96 (Ceylon).
- Pteropus edulis* (*nec E. Geoff.*), *Tickell, Calcutta Journ. N. H.* iii. p. 29 (pt.), pl. iii. (animal) (1843: India; habits); *Blyth, J. A. S. B.* xx. p. 155 (1851: Ceylon); *Wagner, Schreber's Säug., Suppl.* v. p. 594 (pt.) (1853-55: Bengal); *Shortt, P. Z. S.* 1863, p. 438 (1864: Couleeveram, nr. Madras; habits).
- Pteropus kelaarti* (pt.), *Gray, Cat. Monk. &c.* p. 104 (skin, not skull) (1870: Ceylon).

*Characters*.—Fur very short: rigid and closely adpressed on back; longest hairs of back about 8-12, mantle 10-14, belly 9-11 mm.

\* Misspelt *Pt. edwardsi*.

*Specimens examined.* Nineteen, in the collections of the Leyden and British Museums, including the cotypes of *Pt. medius* and *Pt. kelaarti*.

*Range.* Indian Peninsula, south of Punjab and Himalaya; Ceylon. One, as yet unverified, record from Kelat (Dobson, Cat. Chir. B. M. p. 52, footnote).

*Type* in the Copenhagen Museum.

*Vespertilio gigantea*, Brünnich; 1782.—Type locality, Bengal; type, a "skin, tolerably well-preserved, wings folded on breast, skull and skeleton of hand (not forearm) and foot *in situ*, labelled, in Reinhardt sen.'s handwriting, 'Orig[in]alstykke *Vesp. gigantea* Br. [Dyr. Hist.] p. 45-48; Bengalen'" (H. Winge, *in litt.*). Name revived by Miller (*l. s. c.*, 1903).

*Pteropus medius*, Temminck; 1825.—Based on two specimens in the Leyden and two in the Paris Museum, these four collected by Leschenault and Dussumier in the "environs de Calcutta et de Pondichéry," and on "quelques individus que j'ai vus à Londres." The two Leyden specimens still in existence (mounted skins, skulls *in situ*: Jentink, Cat. Syst. p. 146, *c* and *d*) may be regarded as the cotypes of the species.—Owing to the great resemblance of *Pt. "medius,"* in colour and most other external characters, to the Malagasy *Pt. "edwardsi"* (= *rufus*), authors soon commenced to confuse these two species and record *Pt. edwardsi* not only from Madagascar but from India as well (ls. Geoffroy, 1828; J. B. Fischer, 1829; Lesson, 1836; *l. s. c.*); and in 1837 Temminck himself put down his own *Pt. medius* as a synonym of E. Geoffroy's *Pt. edwardsi*. As a consequence of this mistake, the Indian species was, for the next following thirty years, almost constantly referred to in literature under the name "*Pt. edwardsi*" (see references above, pp. 329-331, in which the name *Pt. medius* is extremely rare between 1840 and 1870, whereas *Pt. edwardsi* during the same period is almost universally accepted as a name of the Indian species), until the distinctness of the two species was insisted upon, and "*medius*" revived as a name of the Indian form, by Gray (1870) and Dobson.

*Pt. kelaarti*, Gray; 1870.—Based on two specimens in the collection, viz., a skin with skull, and an odd skull. The skin described by Gray as *Pt. kelaarti* was obtained by Capt. J. Stevens in Ceylon (Reg. no. 48.12.22.1); the skull, believed by Gray to belong to this skin (which, however, had its own skull *in situ*, until extracted for me in 1907), is that of a *Pt. vampyrus*, probably the Javan form of this species (*Pt. v. vampyrus*). This fact explains why Gray found *Pt. kelaarti* externally similar to *Pt. "medius,"* but differing in skull and teeth.

a. ♂ ad. st.		India Museum [P.].	79.11.21.62.
b. Ad. skeleton.		Purchased (Warwick).	48.11.20.9.
c. Imm. skull.	(Voy. H.M.S. 'Rattlesnake.')	Capt. O. Stanley [P.].	50.7.20.56.
d. Imm. skeleton (mounted).	India.	Purchased (1857).	Not reg.
e. Ad. st.	India.	Purchased (T. Sherin).	44.28.1.



<i>f-h.</i> 3 ad. skulls.	Bengal.	Major-Gen. Hardwicke [P.].	106 <i>d, i, j.</i>
<i>i.</i> [♀] ad. sk.	Sangor, C. India;	India Museum [P.].	79.11.21.61.
skull.	1856 ( <i>Hooper</i> ).		
<i>j.</i> [♂] ad. sk.	Barol, nr. Neemuah, C. India, 1500'; Feb. 1879.	Col. J. W. Yerbury [P.].	94.11.6 3.
<i>k, l.</i> 2 skulls, ad. & imm.	Madras.	Sir W. Elliot [P.].	106 <i>c, f.</i>
<i>m, n.</i> [♂] imm., pull. sks.; skull of <i>m.</i>	Trevandrum, Travancore.	H. S. Ferguson, Esq. [P.].	94.7.1.2, 3.
<i>o.</i> [♀] ad. sk.; skull.	Trevandrum.	H. S. Ferguson, Esq. [P.].	95.10.9.1.
<i>p.</i> [♀] ad. sk.; skull.	Ceylon.	Capt. J. Stevens [P.]. ( <i>Cotype of Pt. kelaarti</i> , Gray.)	48.12.22.1.
<i>q.</i> [♀] ad. sk.; skull.	Ceylon; 27 June, 1843 ( <i>Dr. E. F.</i> <i>Kelaarti</i> ).	Zool. Soc. Coll.	55.12.24.296.
<i>r.</i> Ad. skull.	Ceylon.	Dr. Ontdaatje [C. & P.].	88.4.12.4.

#### 64 b. *Pteropus giganteus leucocephalus*, *Hodgson*.

*Pteropus medius* (*nec Temm.*), *Hodgson, P. Z. S.* 1834, p. 96 (Nepal); *Blyth, J. A. S. B.* xiii. p. 479 (1844: Nepal; Assam; Tipperah; ? Arrakan); *Gray, Cat. Monk. &c.* p. 103 (pt.) (1870: Nepal; Assam); *Dobson, J. A. S. B.* xlii. pt. ii. pp. 196, 199 (pt.) (1873: Himalaya; Burma); *id., Cat. Chir. Ind. Mus.* pp. 2-3 (pt.) (1874: Cachar; ? Pegu); *Blyth, J. A. S. B.* xlv., extra number, p. 14 (pt.) (1875: Burma); *Dobson, Mon. As. Chir.* pp. 18, 22, 188-189 (pt.) (1876: Cachar; ? Pegu); *id., Cat. Chir. B. M.* p. 51 (pt.) (1878: Nepal; Assam); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 202 (pt.) (1879: Himalaya); *J. Anderson, Cat. Mamm. Ind. Mus.* pt. i. p. 101 (pt.) (1881: Cachar; Manipur; ? Pegu); *Theobald, in Mason's Burma*, i. p. 423 (1882); *Thomas, P. Z. S.* 1886, p. 59 (Kochim-koolah, Manipur); *Scully, J. A. S. B.* lvi. pt. ii. no. 3, p. 236 (1887: Nepal, straggler); *Jentink, Cat. Syst. Mamm.* p. 146 (pt.) (1888: Nepal); *Blanford, Faun. Brit. Ind., Mamm.* pt. ii. p. 257 (pt.) (1891: Burma); *Trouessart, Cat. Mamm.* i. p. 81 (pt.) (1897: Nepal); *id., Cat. Mamm., Suppl.* p. 50 (pt.) (1904: Assam).

*Pteropus leucocephalus*, *Hodgson, J. A. S. B.* iv. no. 48, p. 700 (1835: Nepal, central region); *Ogilby, Madras Journ. Lit. & Sci.* xii. p. 146 (1840: probable identity with *Pt. medius*); *Hodgson, J. A. S. B.* x. p. 908 (1841: Tarai); *id., Calcutta Journ. N. H.* ii. p. 212\* (1842: Nepal); *id., op. cit.* iv. p. 286 (1844: Nepal); *id., Icon. ined.* (B.M. copy) pl. xiii. fig. I (animal); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 415 (1870: Nepal).

*Pteropus assamensis*, *McClelland, P. Z. S.* 1839, p. 148 (Assam); *Lesson, N. Tabl. R. An., Mamm.* p. 13, no. 180 (1842: Assam); *Schinz, Syst. Verz. Säug.* i. p. 121 (1844: Assam); *E. Desmarest, Dict. Univ. d'Hist. Nat.* xi. p. 248 (1848: Assam); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 420 (1870: Assam).

*Pteropus medius var. assamensis*, *Dobson, Cat. Chir. Ind. Mus.*

\* Misspelt *Pt. leucocephalus*.

- pp. 2-3 (1874: Sibsagar, Assam); *id.*, *Mon. As. Chir.* pp. 188-189 (1876: Sibsagar); *J. Anderson, Cat. Mamm. Ind. Mus.* pt. i. p. 102 (1881: Sibsagar).
- Pteropus rubricollis* (*nec E. Geoff.*), ["*McClelland, List of objects of Natural History collected in Assam*"; not found; ? MS.]; *Ogilby, Madras Journ. Lit. & Sci.* xii. no. 28, p. 146\* (1840: Assam) (nom. nud.); *Gray (ex McClelland), Cat. Hodgson Coll.* p. 3 (1846: in list of synonyms of "*Pt. edwardsi*").
- Pteropus edwardsi* (*nec E. Geoff.*), *Gray, List Mamm. B. M.* p. 36 (pt.) (1843: Nepal); *Blyth, J. A. S. B.* xii. p. 176 (pt.) (1843: Nepal); *Walker, Calcutta Journ. N. H.* iii. p. 255 (1843: Assam); *Gray, Cat. Hodgson Coll.* p. 3 (1846: Tarai); *id.*, *List Ost. Specim.* p. 10 (pt.) (1847: Nepal); *Wagner, Schreber's Säug., Suppl.* v. p. 595 (pt.) (1853-55: Nepal; Assam); *Gerrard, Cat. Bones Mamm. B. M.* p. 55 (pt.) (1862: Nepal); *Gray, Cat. Hodgson Coll.* 2 ed. p. 2 (1833); *Jerdon, Mamm. India*, p. 18 (pt.) (1867: Burma).
- Pteropus edwardsi vel medius*, *Sterndale, Mamm. India*, p. 37 (pt.) (1884: Burma).
- Pteropus edulis* (pt., *nec E. Geoff.*), *Wagner, Schreber's Säug., Suppl.* v. p. 594 (1853-55: Assam).
- Pteropus giganteus*, *Glover M. Allen, Bull. Mus. Comp. Zool. Harv. Coll.* lii. no. 3, p. 28, pl. —, figs. 2, 4 (skull) (1908: Kooloo Valley).

*Characters*.—Similar to *Pt. g. giganteus* in skull, dentition, and external characters (incl. colour of fur), but fur decidedly longer, softer, and less closely adpressed on back. Longest hairs, back 15-18, mantle 18-21, belly 16-20 mm.

*Specimens examined*. Twelve, in the collection of the British Museum, including the cotypes of *Pt. leucocephalus*.

*Range*. Kooloo; Nepal; Assam; Cachar; Manipur; ? Arrakan; ? Pegu.

*Cotypes* in collection.

*Pteropus leucocephalus*, Hodgson; 1835.—Type locality, Nepal (Katmandu) Valley. In the colour of the head, neck, and underparts this race is similar to *Pt. g. giganteus* (Dobson's statement, *Cat. Chir. B. M.* p. 52, that Hodgson's cotypes are paler than specimens from the Peninsula, is not borne out by the series in the collection).

*Pteropus assamensis*, McClelland; 1839.—Based on two specimens collected in Assam by Dr. John McClelland and formerly (see Horsfield's introductory note to McClelland's paper, *l. s. c.*) in the East India Company's Museum at the India House: the cotypes may have been lost; they are not among the specimens registered by Horsfield in his 'Catalogue of the Mammals of the India Museum' (1851), nor among the Mammals transferred from that Museum to the National Collection in 1879. McClelland's description admits, however, of no doubt as to the identification of *Pt. assamensis* (similar to "*Pt. edulis*" [= *giganteus*] "in habit, distribution of tint, and in the form of the ears," but fur longer, softer, and

\* Misspelt *Pt. rubicollis*.

more silky), and specimens from Assam and Manipur in the collection are indistinguishable from the cotypes of *Pt. leucocephalus*.—The bat described by Matschie under the name *Pt. assamensis*, McClelland (Megachir. p. 26, pl. iv. fig. 8, 1899), is *Pt. lylei*.

a. [♀] ad. sk.; skull.	Himalaya.	India Museum.	79.11.21.63.
b. Ad. skull.	Nepal.	B. H. Hodgson [C. & P.].	45.1.8.6.
c-e. 2♂ ad., 1♀ ad. sks.; skulls.	Nepal.	B. H. Hodgson [C. & P.].	45.1.8.273-275.
f. ♂ ad. nl.; skull.	Nepal.	B. H. Hodgson [C. & P.].	45.5.15.4.
g. [♀] imm. sk.; skull.	Nepal (Hodgson).	(c-f, cotypes of subspecies) India Museum.	79.11.21.60.
h. [♀] yg. ad. sk.; skull.	Assam.	Zool. Soc. Coll. (from Mr. Bartlett, in exchange, Nov. 1844).	55.12.24.297.
i. ♂ ad. sk.; skull.	Kochim-kooleh, Manipur; 7 Apr. 1881.	A. O. Hume [P.].	85.8.1.100.
j, k. 2♂ ad. al.; skulls.		Purchased (Jamrach).	79.3.31.2, 3.

#### 65. *Pteropus ariel*, G. M. Allen.

*Pteropus medius* (nec Temm.), Gardiner, Faun. & Geogr. Maldive & Laccadive Arch. ii. Suppl. ii. p. 1049 (1906: Maldives; habits).

*Pteropus ariel*, Glover M. Allen, Bull. Mus. Comp. Zool. Harv. Coll. lii. no. 3, p. 28, pl. —, figs. 1, 3 (July, 1908: Maldives).

*Diagnosis*.—Closely allied to *Pt. giganteus*, but rostrum broader anteriorly, dentition heavier, size slightly smaller, interfemoral shorter, second phalanx of fourth and fifth digits relatively longer. Colour of fur as in *Pt. giganteus*. Forearm about 160 mm. *Hab.* Maldivé Archipelago.

*Skull*.—Total length as small skulls of *Pt. giganteus*, but rostrum very short, broad, and less tapering anteriorly, the width across external surfaces of upper canines only slightly less than across lower edges of lachrymal foramina; palate relatively broader than in the continental species.

*Teeth*.—Heavier than in *Pt. giganteus*, notwithstanding small size of skull, but not differing in structure;  $p^3$ , length 5.7 mm. (4.2-5 in twenty-five skulls of *Pt. giganteus*), width 3.8 (3.1-3.7);  $p_3$ , length 5.6 (4.2-5.2), width 3.1 (2.8-3.4);  $m^2$  unusually large. For further details see measurements of teeth, p. 338.

*Wings*.—Second phalanx of fourth and fifth digits, in the single British Museum specimen as well as in the type (see Allen's measurements, l. s. c.), much longer than, in *Pt. giganteus* generally subequal to or shorter than, first phalanx of same digits.

*Interfemoral*.—In the single specimen examined considerably shorter than in *Pt. giganteus*; depth in centre 12 mm., against 17.5-25.

*Fur*.—Quality, distribution, and length of fur as in *Pt. g. giganteus*: longest hairs of back about 10 mm.

*Colour*.—Scarcely differing from that of *Pt. giganteus* (p. 327). Breast, belly, and flanks in single specimen examined as dark as in darkest individuals of continental species.

*Size*.—Apparently slightly smaller than *Pt. giganteus*: forearm 160 mm., against 163·5–176·5 in sixteen adult specimens of *Pt. giganteus*. For details see measurements, p. 337.

*Sexual differentiation*.—Male with glandular neck-tufts as *Pt. giganteus*. Females not seen.

*Measurements*. On pp. 337, 338.

*Specimen examined*. One, as registered below.

*Range*. Maldive Archipelago. According to Gardiner ubiquitous in the Maldives, but not found in Minikoi.

*Type* in the Museum of Comparative Zoology, Cambridge, Massachusetts (Reg. no. 10565).

*Habits*.—In the Maldives, “wherever a banyan tree grows, numbers of these bats may be found clinging to its branches. They rarely rest on other trees, preferring to undertake nightly migrations for food. At Limbo-Kandu (centre of the N. Mahlos Atoll) they commenced to disperse about 6 P.M., going to every island of its atoll. Coming singly out of the trees, each set off by itself on a straight course, continued as far as the eye could see. They could be heard returning in the darkness of the late hours of the night, only a few belated travellers being seen at dawn. The single journey must have been in some cases 15 to 20 miles, and even this was exceeded in parts of Miladumadulu. The same phenomenon was observed regularly at Hulule [Male Atoll], the dispersal taking place night after night during the half-hour before sunset, however clouded the weather might be. Their food consists principally of the fruits of the *Zizyphus*, *Terminalia*, *Calophyllum*, and banyan, but bread-fruit and *Pandanus* are also largely consumed; in times of stress the buds and centres of the last two are eaten. Many were seen with young in April, this being according to the natives a regular season for births.” (J. Stanley Gardiner, *l. s. c.*)

*Original description*.—Based on two specimens, skin and skull of an adult male, collected at Male Atoll, Maldives, by H. B. Bigelow (A. Agassiz Expedition), Dec. 24, 1901, type of species, and an immature female, same locality, paratype. The external measurements of the type, as given by G. M. Allen, agree very closely with those of the British Museum specimen: forearm of type 160 mm. (160 mm. in B. M. specimen), third metacarpal 105 (103), first and second phalanges of fourth digit respectively 64 (63) and 66 (68), corresponding phalanges of fifth digit 45 (47·5) and 52 (54). The type skull is described as “slightly narrower with narrower brain-case and more slender zygomata as compared with Indian specimens of *P. giganteus* from the Koolloo Valley”; greatest length “66” mm. (in the figure, stated to be natural size, it measures 70 mm.), zygomatic width “36·7” mm. (as in figure); the British Museum skull (somewhat aged, teeth worn) is as large (total length 71·5 mm.) as small skulls of *Pt. giganteus* (minimum 70·8 mm.), but, in strong contrast to the type, it has the zygomatic arches excessively flaring

posteriorly, the zygomatic width (44.5 mm.) being in fact greater than in any skull in the British Museum series of *Pt. giganteus* (36-43 mm.).

*Remarks.*—Though the single British Museum specimen from the Maldives is not completely matched by any specimen of *Pt. giganteus* in the Collection, it must nevertheless be admitted that its differences from certain extremes (in small size, short and broad rostrum, and large teeth) of the continental species are rather slight, and it is not unlikely that, on the basis of a sufficiently large series from the Maldives, *Pt. ariel* would prove to be only subspecifically distinguishable from *Pt. giganteus*.

a. ♂ ad. al.; Maldives [probably Hulule, J. Stanley Gardiner, 8.12.26.1.  
skull. Male Atoll]. Esq. [P.].

*External measurements of Pteropus giganteus and ariel.*

	<i>Pt. giganteus</i> . 16 ad. (Incl. cotypes of <i>Pt. medius</i> , <i>kelaarti</i> , and <i>leucocephalus</i> .)		<i>Pt. ariel</i> . ♂ ad.
	Mix.	Max.	
	mm.	mm.	mm.
Forearm .....	163.5	176.5	160
Pollex, total length, c. u. ....	66	75	67.5
"  metacarpal .....	14	18	15
"  1st phalanx .....	35.5	38	35
2nd digit, metacarpal .....	80	90.5	77
"  1st phalanx .....	18	22	17
"  2nd-3rd phalanx, c. u. ....	15.5	20.5	18.5
3rd digit, metacarpal .....	108.5	118	103
"  1st phalanx .....	80	89	77.5
"  2nd phalanx .....	112.5	125	113
4th digit, metacarpal .....	105.5	118	102
"  1st phalanx .....	64	72.5	63
"  2nd phalanx .....	63	74	68
5th digit, metacarpal .....	113	123.5	107.5
"  1st phalanx .....	47	54	47.5
"  2nd phalanx .....	50	57.5	54
Ears, length from orifice .....	33	36	32.5
"  greatest width, flattened .....	20	21	22
Front of eye to tip of muzzle .....	28	30	...
Interfemoral in centre, depth .....	17.5	25	12
Lower leg .....	79.5	87.5	77.5
Foot, c. u. ....	48.5	56	50
Calcar. ....	(20 *)	(26 *)	22

\* Approximate measurements from dried skins.

*Measurements of skulls and teeth of Pteropus giganteus and ariel.*

	<i>Pt. giganteus.</i> Skulls: 20 ad. Teeth: 20 ad., 5 imm. (Incl. cotypes of <i>Pt. kelaarti</i> and <i>leucocephalus</i> .)		<i>Pt. ariel.</i> ♂ ad.
	MIN.	MAX.	
	mm.	mm.	mm.
Skull, total length to gnathion .....	70.8	76	71.5
„ palation to incisive foramina ...	33.3	37	34.8
„ front of orbit to tip of nasals ...	23	26	23
„ width of brain-case at zygomata ..	24	26.8	26
„ zygomatic width .....	36.2	43	44.5
„ width across $m^1$ , externally .....	18.8	21.6	21.3
„ lachrymal width .....	15	17.5	17
„ width across canines, externally ..	12.8	15.7	16.2
„ postorbital constriction .....	7.8	9.7	9.7
„ interorbital constriction .....	9.6	11.2	10.8
„ width of mesopterygoid fossa ...	8.5	9.7	9.5
„ between $p^4$ - $p^4$ , internally .....	10.7	12.5	12.7
„ between cingula of canines .....	7	8.7	9.2
„ orbital diameter .....	14.7	15.3	15
Mandible, length .....	55	60.8	57
„ coronoid height .....	25.8	28.7	26.2
Upper teeth, $c-m^2$ .....	26.8	29.8	27
Lower teeth, $c-m_3$ .....	29.2	33.3	30
Upper incisors, combined width .....	6	7	7.5
$p^3$ , length .....	4.2	5	5.7
„ width .....	3.1	3.7	3.8
$p^4$ , length .....	4.7	5.2	5.5
„ width .....	3.3	3.8	4.1
$m^1$ , length .....	5	6.1	6.2
„ width .....	3.2	3.8	3.7
$m^2$ , length .....	2.7	3.2	3.5
„ width .....	2	2.7	2.7
$p_1$ , length .....	1.8	2.6	2.2
„ width .....	1.5	2.2	2.2
$p_3$ , length .....	4.2	5.2	5.6
„ width .....	2.8	3.4	3.1
$p_4$ , length .....	4.7	5.2	5.7
„ width .....	2.9	3.5	3.2
$m_1$ , length .....	4.7	5.5	6
„ width .....	3	3.5	3.2
$m_2$ , length .....	3.8	4.7	4.7
„ width .....	2.9	3.2	3.2
$m_3$ , length .....	1.7	2.8	2
„ width .....	1.6	2.2	2

66. *Pteropus lylei*, K. And.

*Pteropus medius* (pt.), Dobson, Cat. Chir. B. M. p. 52.

*Pteropus edwardsi* (nec *E. Geoff.*), Gray, P. Z. S. 1861, p. 136 ("Cambodja," mistake for Pechaburi, see specimen *a*, infra).

*Pteropus medius* (nec *Temm.*), Dobson, Cat. Chir. B. M. p. 52, specimen *a* (1878: "Pachora, Bombay," mistake for Pechaburi).

*Pteropus* (Spectrum) *assamensis* (nec *McClelland*), Matschie, *Megachir.* p. 26, pl. iv. fig. 8 (skull) (1899: Bangkok); *Trouessart, Cat. Mamm., Suppl.* p. 53 (1904: Bangkok).

*Pteropus lylei*, K. Andersen, *Ann. & Mag. N. H.* (8) ii. p. 367 (1 Oct. 1908: Pechaburi; Bangkok; Saigon).

*Diagnosis.*—Similar to *Pt. giganteus*, but much smaller; breast and belly usually blackish or seal-brown (as in *Pt. vampyrus*), but occasionally bright-coloured (as in *Pt. giganteus*). Forearm about 148–154 mm. *Hab.* Bangkok region and Cochin-China.

*Skull and teeth.*—Skull not differing in shape from that of *Pt. giganteus*, but much smaller: total length 61–66.5 mm., against 71–76 in *giganteus*; size of skull on the whole equal to, or still smaller than, that of *Pt. comorensis*, to which it bears much resemblance also in shape, though the orbits are a little larger, the mesopterygoid fossa broader, the coronoid process of mandible, probably owing to the weaker dentition, feebler and more sloping.—Structure of teeth to all details as in *Pt. giganteus*, but dentition on the whole remarkably weak, the individual teeth being relatively smaller than in *giganteus*.

*Fur.*—Short and closely adpressed on back, as in *Pt. g. giganteus*. Longest hairs on back about 10 mm., mantle 14, belly 10–12. Width of furred area of back 35 mm. (measurements from dried skins). Distribution of fur as in *Pt. giganteus*.

*Colour.*—Five skins, males and females, adult and immature: essentially as in the non-melanistic races of *Pt. vampyrus*, but some specimens with bright-coloured breast and belly, like *Pt. giganteus*.—Back seal-brown or dark vandyck-brown, distinctly grizzled with pale greyish hairs or tips to the hairs. Rump in some specimens more conspicuously suffused with typical vandyck-brown.—Breast, belly, and flanks seal-brown or blackish seal-brown sprinkled with some glossy blackish or maroon-blackish hairs; darkest in middle line of breast and belly, generally suffused with dull vandyck-brown on sides of breast and belly. A few pale greyish hairs detectable on close examination. In one specimen (Pechaburi, 61.10.18.3) the breast and belly are dull ochraceous-buff (somewhat approaching raw sienna), with seal-brown bases of the hairs showing through on belly and anal region.—Mantle varying from light ochraceous-buff to almost ochraceous, generally richest (ochraceous) in the centre, palest (buffy) posteriorly in a transverse line across shoulder region, shading into a deeper ochraceous on sides of neck and into tawny on foreneck; most of the hairs of mantle, sides of neck, and foreneck seal-brown at extreme base.—Crown, interocular space, and

temporal region similar to mantle, though generally of a deeper tinge; temporal region sometimes much clouded with russet or vandyck-brown. Muzzle, cheeks, chin, and throat blackish or seal-brown, contrasting with bright crown and foreneck.

*Sexual differentiation*.—As in *Pt. giganteus*.

*Measurements*. On pp. 341, 342.

*Specimens examined*. Nine, in the collections of the Berlin and British Museums.

*Range*. South Siam (Pechaburi; Bangkok); Saigon.

*Type* in collection.

a. [♀] imm. sk.; skull.	Pechaburi, S.W. of Bangkok.	Mouhot Coll.	61.10.8.3.
b. c. ♂ ad., ♀ ad. sks.; skulls.	Bangkok; 1903.	20 Aug. Th. H. Lyle, Esq. [P.].	4.4.7.1, 8.
d. ♀ ad. sk.; skull.	Bangkok; 1903.	20 Aug. Th. H. Lyle, Esq. [P.].	4.4.7.2. (Type of species.)
e. [♀] imm. sk.	Near Saigon.	M. Pierre [P.].	78.6.17.37.

### 67. *Pteropus intermedius*, K. *Anal.*

*Pteropus javanicus* (*nec Desm.*), *Blyth, J. A. S. B.* xiii. p. 478 (1844: Tenasserim).

*Pteropus medius* (*nec Temm.*), *Blyth, J. A. S. B.* xlv. extra number, p. 14 (pt.) (1875: S. Tenasserim); *Thomas, P. Z. S.* 1886, p. 67 (Amherst, nr. Moulmein); ? *Miller, Proc. Acad. Nat. Sci. Philad.* 1898, p. 316 (Trong, Lower Siam); *S. S. Flower, P. Z. S.* 1900, p. 339 (Moulmein); ? *Kloss, Journ. Fed. Mal. St. Mus.* ii. no. 3, p. 152 (1908: Trong).

*Pteropus intermedius*, *K. Andersen, Ann. & Mag. N. H.* (8) ii. p. 368 (1 Oct. 1908: Amherst).

*Diagnosis*.—Closely allied to *Pt. giganteus*, but slightly larger, and with breast and belly seal-brown or blackish like back. Forearm about 180 mm. *Hab.* Tenasserim; ? Lower Siam.

*Differential characters*.—In skull and dentition this species is scarcely distinguishable from *Pt. giganteus*; in all external characters, except the colour of the breast and belly, it is similar to that species, though apparently rather larger; but it resembles *Pt. vampyrus* in the blackish colour of the breast and belly. From the geographically nearest race of *Pt. vampyrus*, viz. *Pt. v. malaccensis*, it is readily distinguished by its much smaller size (forearm about 180 mm., against 195–209) and by having the foreneck nearly as bright-coloured as the mantle, in strong contrast to blackish breast and belly. From the Siamese *Pt. lyli* (forearm 148–154 mm.) it differs by its much larger size.

*Fur*.—Rather soft, but closely adpressed on back. Length of fur as in *Pt. giganteus leucocephalus*, or somewhat shorter; on back 15, mantle 18, belly 14 mm.

*Colour* (type).—Back seal-brown, with a few greyish-white hairs intermixed.—Breast and belly seal-brown with a slight tinge of chocolate on flanks and anal region. Mantle yellowish buff; sides



of neck similar, but somewhat washed with ochraceous; foreneck like sides of neck, but more distinctly blotched with ochraceous, thus in strong contrast to seal-brown breast. Hairs of mantle and foreneck uniform to extreme base; glandular hairs on sides of neck with long seal-brown bases.—Crown russet, approaching pale vandyck-brown; sides of head mixed blackish and vandyck-brown; chin and throat blackish seal-brown.

*Measurements.* Below and on p. 342.

*Specimen examined.* One, the type.

*Range.* Tenasserim (Moulmein); ? Lower Siam (Trough).

*Type* in collection.

a. ♂ ad. sk.; skull. Amherst, nr. Moulmein A. O. Hume, Esq. 85.8.1.101.  
(W. Davison). [P.] (Type of species.)

*External measurements of Pteropus lylei and intermedius.*

	<i>Pt. lylei.</i> 3 ad. (Incl. type.)		<i>Pt. intermedius.</i> ♂ ad. Type.
	MIN.	MAX.	
	mm.	mm.	mm.
Forearm .....	(148*)	(154*)	(179·5*)
Pollex, total length, c. u. ....	61·5	65	73·5
„ metacarpal .....	14	15	16·5
„ 1st phalanx .....	30·5	34	37·8
2nd digit, metacarpal .....	71·5	75	87
„ 1st phalanx .....	16·5	21	17·8
„ 2nd-3rd phalanx, c. u. ....	14	17	18·5
3rd digit, metacarpal .....	98·5	102·5	119·5
„ 1st phalanx .....	74·5	75	87·5
„ 2nd phalanx .....	103·5	109	121
4th digit, metacarpal .....	97	102·5	117·5
„ 1st phalanx .....	60	61	70
„ 2nd phalanx .....	58·5	63	69
5th digit, metacarpal .....	100·5	107·5	...
„ 1st phalanx .....	44·5	46·5	50
„ 2nd phalanx .....	45	47·5	54·5
Interfemoral in centre, depth .....	(12·5 †)	(12·5 †)	...
Lower leg .....	...	...	83·5
Foot, c. u. ....	50·5	54	54·5
Calcar .....	(17·5 †)	(18 †)	(24 †)

\* Estimate (radius broken or extracted).

† Approximate measurements from dried skins.

*Measurements of skulls and teeth of Pteropus lylei and intermedius.*

	<i>Pt. lylei.</i> Skull: 3 ad. Teeth: 3 ad., 1 imm. (Incl. type.)		<i>Pt. intermedius.</i> ♂ ad. Type.
	MIN.	MAX.	
	mm.	mm.	mm.
Skull, total length to gnathion .....	61	66.5	72.5
" palation to incisive foramina ...	29.2	32.2	36.2
" front of orbit to tip of nasals ...	20.2	...	24.7
" width of brain-case at zygomata.	22.8	23.8	26.7
" zygomatic width .....	35.5	37	40
" width across m <sup>1</sup> , externally .....	16.2	17.7	19
" lachrymal width .....	14.6	14.8	16.7
" width across canines, externally.	11.8	12	14.2
" postorbital constriction .....	8.4	9.5	10
" interorbital constriction .....	9.5	9.5	10
" width of mesopterygoid fossa ...	8	8.5	...
" between p <sup>4</sup> -p <sup>1</sup> , internally .....	10.5	10.8	11.8
" between cingula of canines .....	6.9	7	7.8
" orbital diameter .....	13.8	14	14.8
Mandible, length .....	49	51.8	57
" coronoid height .....	21.8	24	29.5
Upper teeth, c-m <sup>2</sup> .....	23.8	25.2	27
Lower teeth, c-m <sub>3</sub> .....	26.2	28.2	30
Upper incisors, combined width .....	5.5	6	6.8
p <sup>3</sup> , length .....	3.8	4	4.7
" width .....	2.7	2.8	3.2
p <sup>1</sup> , length .....	3.8	4	4.7
" width .....	2.8	2.9	3.5
m <sup>1</sup> , length .....	4.6	4.8	5.2
" width .....	2.8	3	3.2
m <sup>2</sup> , length .....	2.5	3	3.7
" width .....	2	2	2.7
p <sub>11</sub> , length .....	1.7	2	2
" width .....	1.6	1.7	2
p <sub>31</sub> , length .....	4	4.3	4.7
" width .....	2.1	2.5	3
p <sub>41</sub> , length .....	4	4.1	4.8
" width .....	2.7	2.8	3.2
m <sub>1</sub> , length .....	3.8	4.1	5
" width .....	2.5	2.6	3
m <sub>2</sub> , length .....	3.2	3.6	4.7
" width .....	2.2	2.5	3
m <sub>3</sub> , length .....	1.7	2.2	2.7
" width .....	1.6	1.9	2.3

68. *Pteropus vampyrus*, L.*Pteropus edulis* (pt.), Dobson, Cat. Chir. B. M. p. 49.*Pteropus pteronotus*, Dobson, *ibid.* p. 48.

(Synonyms under the subspecies.)

*Diagnosis*.—Similar to *Pt. giganteus*, but larger, and with breast and belly dark-coloured like back. Forearm (varying according to the geographical races) 182.5–220 mm. *Hab.* The Indo-Malayan subregion, south-east to Timor.

*Palate-ridges*.— $5+5+3$ , or  $5+5\frac{1}{2}$  or  $6+3$ , owing to occasional development of a more or less complete, but even when fully developed generally weaker, divided ridge between the normal ninth and tenth ridges; compare *Pt. giganteus* (p. 326) and *Pt. rufus* (p. 202).

*Sexual differentiation*.—Glandular neck-tufts less developed than in *Pt. giganteus*. In some males the glandular hairs are slightly more rigid than the surrounding ordinary fur, and the base of the hairs of a peculiar oily seal-brown tinge contrasting with the bright-coloured tips; but in a majority of adult males the difference in this respect from females is scarcely appreciable. Dobson's statement that males are brighter-coloured than females (Cat. Chir. B. M. p. 49) is erroneous.

*Range*. Malay Peninsula, Sumatra, Java, Bali, Lombok, Savu, Timor; Borneo (with Natunas), Philippines. The range of this species almost precisely covers the Indo-Malayan subregion, as defined by Wallace; only in the south-east it crosses "Wallace's line" and extends through the Lesser Sunda Islands to Timor\*.

*Habits*.—Not differing from those of the closely allied *Pt. giganteus* (p. 328).

\* There can be little doubt that a large form of the *Pteropus vampyrus* type occurs in the Andamans and that the same, or a closely allied, form inhabits the Nicobars. The synonymy of this form (or these forms) is as follows:—

*Pachysoma giganteum* (*nec* *Pteropus giganteus*, Brünm.), Fitzinger, *SB. Akad. Wien*, xlii. p. 390 (1861: Nicobars; nominal list of Mammalia of 'Novara' Expedition) (nom. nud.).

*Pteropus edulis* var. *b. Pachysoma giganteum*, Zeller, *Reise 'Novara,' Zool. i. Mamm.* p. 10 (1869: one specimen obtained. Car Nicobar, in dense forest, together with *Pt. melanotus*, Feb. 1858).

*Pteropus edulis*, Dobson, *Cat. Chir. B. M.* p. 50 (1878: one specimen, Andamans).

*Pteropus vampyrus*, Miller, *Proc. U.S. Nat. Mus.* xxiv. pp. 786, 792 (1902: remarks on earlier records from Andamans and Nicobars); Kloss, *Andamans & Nicobars*, p. 325<sup>1</sup> (1903: no new records).

*Pteropus celano*, Mason, *Rec. Ind. Mus.* ii. pt. ii. p. 165 (1908: no new facts).

"Gula, malis, maculaque inter frontem et oculos brunneo-nigris, genis, nucha et dorso superiore clare flavescens-castaneis, dorso reliquo, pectore et abdomine brunneo-nigris, pilis nonnullis albedo vel pallide cinereo terminatis" (*Zelebor. l. s. c.*; Car Nicobar specimen).

"A specimen of an apparently adult female (with much-worn teeth), from

<sup>1</sup> Misspelt *Pteropus vampyrus*.

*Subspecies.*—The six known races of *Pt. vampyrus* differ only in colour and size; none of them is sufficiently sharply differentiated from its nearest geographical neighbours to be regarded as a distinct species. If the colour is taken as the leading character, these forms fall into two primary groups: in the one (*Pt. v. malaccensis*, *vampyrus*, and *natunæ*) the fur of the upperside is similar in colour to that of *Pt. giganteus*, i. e. mantle bright-coloured contrasting with dark back; in the other (*Pt. v. pluton*, *edulis*, and *lanensis*) the fur is uniform dark-coloured above and beneath, or with only a trace of a brighter mantle. The former group (the races which in the colour of the fur come nearest to the continental *Pt. intermedius* and *giganteus*) occupies the whole western and central area of Indo-Malaya, viz. Malacca, Sumatra, Java, and Borneo with the Natuna Islands; while the chiefly or entirely melanistic forms are confined to the extreme north-eastern (Philippines: *lanensis*) and south-eastern (Lesser Sunda Islands: *pluton* and *edulis*) corners of this region. The colour characters hold good for the large majority of individuals, but a certain percentage, though very small indeed, of individuals of the generally bright-coloured races are melanistic, or *vice versa*.—If the size is taken as the leading character, the races of *Pt. vampyrus* fall, again, into two, but different, groups: in the one (*Pt. v. malaccensis*, *vampyrus*, and *pluton*) the individuals average much larger, in the other (*Pt. v. edulis*, *natunæ*, and *lanensis*) much smaller. The former group inhabits the quasi-continuous area from Malacca, through Sumatra and Java, to Bali and Lombok, the latter Timor, Borneo, and the Philippines.—If the six forms are reviewed in their geographical order, their differential characters present themselves as follows: Malacca and Sumatra (*malaccensis*): large, with bright-coloured mantle; Java (*vampyrus*): still larger, with bright-coloured mantle, but a small percentage melanistic as *pluton*; Bali and Lombok (*pluton*): size as *vampyrus*, colour melanistic (mantle darkened to dull russet, chestnut, or blackish); Savu and Timor (*edulis*): colour generally melanistic, size much reduced; Borneo and Natunas (*natunæ*): size small, mantle bright-coloured; Philippines (*lanensis*): size as *natunæ*, but colour generally melanistic.

---

the Andaman Islands, given to the writer [Dobson] by Mr. Francis Day (with forearm only 6''·5 long), has the fur very short (throughout, and the wings, inferfemoral membrane, and extremities almost devoid of hair; the head, under surface of the lower jaw, and throat very dark reddish brown, with some intermixed greyish or shining hairs; the back of the head, nape of neck, and shoulders reddish yellow, the breast and abdomen reddish brown; upper and lower incisors slender, cylindrical" (*Dobson, l. s. c.*).

The two specimens described above appear to be the only ones recorded in literature. In Zelebor's description of the Car Nicobar specimen, so far as it goes, there is nothing to show any difference from an ordinary, bright-mantled *Pt. vampyrus*. I have been unable to trace the fate of the Andaman specimen once in Dr. Dobson's possession; his private collection, now in the Dublin Museum, does not (I am informed by Dr. R. F. Scharff) contain any specimen of *Pt. vampyrus* from the Andamans.

*Earlier attempts at subdividing the species.*—In 1820, the elder Desmarest, basing entirely on information forwarded by Leschenault de la Tour to E. Geoffroy, rightly pointed out the difference in colour between the Java (*Pt. javanicus*, Desm.) and Timor forms (*Pt. edulis*, Geoff.), but only five years later the name *javanicus* was by Temminck put down as a synonym of *edulis*, and practically disappeared from literature. In 1837, Temminck himself called attention to the existence of a large (*Pt. edulis*) and small "species" (*Pt. funereus*, Temm.) of this type of bat; the former corresponds, to a certain extent, to the three large, the latter (*funereus*) approximately to the three small forms of *Pt. vampyrus*; though Temminck failed to give a correct account of the characters and range of these two species, and later authors, chiefly for this reason, evidently found considerable difficulty in discriminating them from each other, *Pt. funereus* survived in literature until definitely declared synonymous with *Pt. edulis* by Peters (1867) and Dobson (1878). Again, in 1853, Temminck separated the Bali and Lombok form as *Pt. pluton*; though clearly and correctly diagnosed, this "species" shared the fate of *Pt. funereus*. Lastly, in 1905, Mearns described the Philippine representative of *Pt. vampyrus*, on the basis of a single specimen, as a new species, *Pt. lanensis*.—The name *javanicus*, Desm., is technically a synonym of *vampyrus*, L., Temminck's *funereus* of *edulis*, Geoff.; Temminck's *pluton* and Mearns's *lanensis* are available as names of, respectively, the Bali-Lombok and Philippine forms.

*Key to the Subspecies of Pteropus vampyrus.*

- a. Non-melanistic forms: mantle generally some shade of buffy, much paler than, and strongly contrasting with, back.
  - a'. Averaging much smaller: forearm 182.5-196 mm. (Borneo; Natunas)... *Pt. v. natunæ*, p. 358.
  - b'. Averaging much larger: forearm 195-220 mm.
    - a<sup>2</sup>. Forearm 195-209 mm. (Malacca; Sumatra) ..... *Pt. v. malaccensis*, p. 346.
    - b<sup>2</sup>. Forearm 208-220 mm. (Java) .... *Pt. v. vampyrus*, p. 349.
- b. Melanistic forms: mantle generally blackish or vandyck-brown, similar in colour to, or not strongly contrasting with, back.
  - c'. Averaging much larger: forearm about 214-217 mm. (Bali; Lombok) .... *Pt. v. pluton*, p. 353.
  - d'. Averaging much smaller: forearm 182.5-201 mm.
    - c<sup>3</sup>. Mantle generally blackish. (Timor; Savu) ..... *Pt. v. edulis*, p. 356.
    - d<sup>2</sup>. Mantle generally with some trace of paler colour. (Philippines) ..... *Pt. v. lanensis*, p. 359.

68 a. *Pteropus vampyrus malaccensis*, K. And.

- Pteropus edulis* (nec E. Geoff.), Temminck, *Mon. Mamm.* i. p. 172, pl. xv. figs. 1, 2, 3 (skull; drawn from Leyden specimen "c": Sumatra) (1825); Lesson, *Man. Mamm.* p. 108, no. 277 (1827); J. B. Fischer, *Syn. Mamm.* p. 81, no. 1 (pt.) (1829: Sumatra); Lesson, *Hist. Nat. Mamm. (Compl. Buffon)* v. p. 56 (pt.) (1836: Sumatra); Waterhouse, *Cat. Mamm. Mus. Zool. Soc.* p. 13, no. 98 (1838: Sumatra); Gray, *Mag. Zool. & Bot.* ii. p. 502 (pt.) (1838: Sumatra); Oken, *Allg. Naturg.* vii. Abth. ii. p. 989 (pt.) (1833: Sumatra); Wagner, *Schreber's Säug., Suppl.* i. p. 342 (pt.) (1839: Sumatra); S. Müller, in Temminck's *Nat. Gesch. Nederl. Overz. Bez., Zoogd.* pp. 20, 58 (pt.) (1839-44: Sumatra); Lesson, *N. Tabl. R. An., Mamm.* p. 12, no. 168 (pt.) (1842: Sumatra); Schinz, *Syst. Verz. Säug.* i. p. 120 (pt.) (1844: Sumatra); Cantor, *J. A. S. B.* xv. p. 186 (1846: Penang; Singapore; Malay Pen.); E. Desmarest, *Dict. Univ. d'Hist. Nat.* xi. p. 247 (pt.) (1848: Sumatra); Gray, *Zool. 'Samarang,' Vert.* p. 11 (pt.) (1849: Sumatra); Wagner, *Schreber's Säug., Suppl.* v. p. 594 (pt.) (1853-55: Sumatra; Malacca); Gervais, *Hist. Nat. Mamm.* i. p. 186 (pt.) (1854: Sumatra; Banka); Tomes, *P. Z. S.* 1861, pl. i. fig. 5 (upper teeth); Fitzinger, *SB. Akad. Wien*, lx. Abth. i. p. 398 (pt.) (1870: Sumatra); Dobson, *Mon. Asiat. Chir.* p. 20 (1876: Sumatra); id., *Cat. Chir. B. M.* p. 50 (pt.) (1878: Sumatra; Isles of Kallam); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 201 (pt.) (1879: Sumatra); Thomas, *P. Z. S.* 1886, p. 73 (Klang, Selangore); Snelleman, in Veth's *Midden-Sumatra*, iv. pt. 1, p. 14 (1837: Sumatra; habits); Jentink, *Cat. Ost. Mamm.* p. 258 (pt.) (1887: Sumatra; Banka); id., *Cat. Syst. Mamm.* pp. 145, 146 (pt.) (1888: Malacca; Sumatra; Banka); id., *Notes Leyden Mus.* xi. p. 29 (1888: Tandjong-Morawa, E. Sumatra); id., in Weber's *Zool. Ergebn. Nied. Ost-Ind.* i. p. 96 (1890: Matna, nr. Ft. de Koek, Singkorah, Sumatra); Blanford, *Faun. Brit. Ind., Mamm.* pt. ii. p. 259 (pt.) (1891: Malay Pen.; Sumatra); Ridley, *Journ. Str. Br. R. As. Soc.* no. 25, p. 58 (1894: Pekan, Pahang); Kelsall, *op. cit.* no. 26, p. 16 (1894: Kuala Kabang, Johore); Trouessart, *Cat. Mamm.* i. p. 80 (pt.) (1897: Malacca; Sumatra); S. S. Flower, *P. Z. S.* 1900, p. 339 (Penang; Tapah; Klang; Singapore); Willink, *Nat. Tijd. Nederl. Ind.* lxx. p. 272 (pt.) (1905: Sumatra; ? Mentawai; Banka; Billiton); Kloss, *Journ. Fed. Mal. St. Mus.* ii. no. 3, p. 152 (1908: Malay Pen., "except the islands of Tioman, Permangil, and Aor").
- Pteropus javanicus* (nec Desm.), Anonymous [? Figors & Gould], *Cat. Mamm. Mus. Zool. Soc.* p. 10, no. 160 (1828: Sumatra); id., *Cat. An. Mus. Zool. Soc.* p. 11, no. 160 (1829: Sumatra).
- Pteropus funereus*, Temminck, *Mon. Mamm.* ii. p. 63 (pt.) (1837: Sumatra); Wagner, *Schreber's Säug., Suppl.* i. p. 346 (pt.) (1839: Sumatra); S. Müller, in Temminck's *Nat. Gesch. Nederl. Overz. Bez., Zoogd.* pp. 20, 58 (pt.) (1839-44: Sumatra); Lesson, *N. Tabl. R. An., Mamm.* p. 12, no. 70 (pt.) (1842: Sumatra); E. Desmarest, *Dict. Univ. d'Hist. Nat.* xi. p. 247 (pt.) (1848: Sumatra); Gray, *Zool. 'Samarang,' Vert.* p. 11 (pt.) (1849: Sumatra); Wagner, *Schreber's Säug., Suppl.* v. p. 596 (pt.) (1853-55: Sumatra); Gervais, *Hist. Nat. Mamm.* i. p. 187 (pt.)

- (1854: Sumatra); *Giebel, Säug.* p. 996 (pt.) (1855: Sumatra); *Schlegel, Dicrkunde*, i. p. 53 (pt.) (1857: Sumatra); *Fitzinger, SB. Akad. Wien*, xlii. p. 389 (1860: Sumatra); *id.*, *op. cit.* lx. Abth. i. p. 407 (pt.) (1870: Sumatra); *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 515 (pt.) (1872-73: Sumatra; structure of hairs).
- Pteropus edulis* var. a (*Pteropus funereus*), *Zeilebor, Reise 'Novara,' Zool.* i. *Säug.* p. 10 (1869: Sumatra).
- Vespertilio vampyrus* (nec L.), *Newbold, Madras Journ. Lit. & Sci.* vii. p. 69 (1838: Malay Pen.).
- Pteropus vampyrus*, ? *Thomas, Ann. Mus. Civ. Genova*, (2) xiv. p. 664 (1895: Si Oban, Mentawai); *Miller, Proc. Wash. Acad. Sci.* ii. p. 237 (1900: Linga Is.); *Bonhote, P. Z. S.* 1900, p. 875 (Jalor); *Rehn, Proc. Acad. Nat. Sci. Philad.* 1902, p. 136 (Batu Sangkar, Padang; Gunong Sugi, Lampong); *Bonhote, Fasc. Mal., Zool.* i. p. 14 (1903: Patani; Biserat); *Miller, Proc. U. S. Nat. Mus.* xxxi. p. 274 (1906: Linga Is.); *Bonhote, Journ. Fed. Mal. St. Mus.* iii. p. 4 (1908: Kuala Tembeling, Pahang R.); *Lyons, Proc. U. S. Nat. Mus.* xxxiv. p. 666 (1908: Pulo Payong, Salat Rupat, E. Sumatra).
- Pteropus vampirus*, *Ridley, Natural Science*, vi. p. 27 (1895: Malay Pen.; habits).
- Pteropus fuscus* (nec E. Geoff., nec Desm., nec Dobs.), *Blainville, Ost. Mamm.* i. *Chéiropt.* p. 100, pl. vi. fig. 1 (skull) (1840: Sumatra).
- Pteropus* [sp.], *Orley, Journ. Ind. Arch.* iii. p. 594 (1840: Singapore; Johore); *Rosenberg, Malay. Arch.* p. 101 (1878: Sumatra; habits).
- Pteropus celæno* (pt., nec Herm.), *Matschie, Megachir.* p. 15 (1899: Sumatra); *Trouessart, Cat. Mamm., Suppl.* p. 50 (1904: Malacca; Sumatra; Banka); *Schneider, Zool. Jahrb., Syst.* xxiii. pt. i. p. 75 (1905: Upper Langkat, Lower Langkat, Deli, Batu-Bara, Indragiri).
- Pteropus vampyrus malaccensis*, *K. Andersen, Ann. & Mag. N. H.* (8) ii. p. 368 (1st Oct. 1908: Malay Pen.; Sumatra; Linga Arch.; Banka).

*Diagnosis*.—Bright mantle strongly contrasting with dark back. Skull, total length 76·5-86·5 mm.; forearm 195-209 mm. *Hab.* Malay Peninsula, Sumatra, Linga Arch., Banka.

*Size*.—Averaging considerably larger than *Pt. v. edulis*, *natunae*, and *lanensis*, but smaller than *Pt. v. vampyrus* and *pluton*. See measurements, pp. 354, 355.

*Colour*.—Whole series examined, males and females (adult and immature):—Back blackish or blackish seal-brown, nearly always conspicuously sprinkled with greyish white, or buffy grey, or cinnamon, or russet. According to the tinge of the paler-coloured hairs, the general impression of the colour of the back and rump varies from blackish somewhat approaching very dark hair-brown, through blackish broccoli-brown, to blackish more or less thickly mixed with (sometimes partly or completely replaced by) cinnamon or russet. The cinnamon or russet admixture, if present, is generally much more pronounced on rump than on back, and on sides of back than on spinal tract, but sometimes it extends almost

uniformly over the whole of the fur behind the shoulders.—Breast, belly, and flanks blackish, but never uniform in colour: in most specimens thinly, in others moderately or even very thickly sprinkled with glossy silvery whitish, or pale greyish, or buffy-greyish hairs or tips to the hairs. Very often the anal region is conspicuously suffused with vandyck-brown or dark russet, or one of these colours tinged with chestnut; and sometimes this suffusion extends over the whole of the belly, breast, and flanks, or restricts the blackish area to a narrow median line on breast and belly.—Mantle varying from rich ochraceous-buff tinged with orange, to ochraceous, or tawny. On the sides of the neck this colour shades into ochraceous-rufous, chestnut-hazel, or chestnut. Foreneck in some specimens chestnut or dark ferruginous, but generally more or less heavily clouded with blackish, or blackish washed with dark chestnut; thus, partly owing to the darkening of the colour of the foreneck, partly to the paler sprinkling or brownish suffusion of the breast and belly, there is generally no strong contrast, sometimes scarcely any difference at all, between foreneck and breast. Hairs of mantle and sides of neck uniform to base, rarely with extreme base blackish.—Crown and temporal region in some specimens similar to mantle, but generally of a darker tinge: chestnut, or chestnut seal-brown, or blackish, in the latter case as a rule sprinkled with pale greyish. Chin and throat blackish or seal-brown, or chestnut seal-brown, generally uniform, sometimes thinly sprinkled with greyish.

*Specimens examined.* Twenty-six, from the collections of the Leyden (three, Sumatra; one, Banka), U.S. National (three, Linga Arch.\*), and British Museums (nineteen, see list below), including the type of the subspecies.

*Range.* Malay Peninsula, north at least to Jalor and Patani; Sumatra (generally distributed); Linga Archipelago; Banka.

*Type* in collection.

a. ♀ ad. sk.; skull.	Patani, Malay Pen.; 15 June, 1901.	H. C. Robinson & N. Annandale [P.].	3.2.6.14.
b. ♂ imm. sk.; skull.	Biserat, Jalor, Malay Pen.; 9 July, 1901.	H. C. Robinson & N. Annandale [P.].	3.2.6.13.
c. ♂ ad. sk.; skull.	Kuala Tembe- ling, Pahang, Malay Pen., 200'; 26 Aug. 1903.	H. C. Robinson, Esq. [C.]. (Type of subspecies.)	6.10.4.7.
d, e. 1 ♂ ad., 1 ad. sks.; skulls.	Klang, Selan- gore; 27 Mar., 30 Aug. 1879 (W. Davison).	A. O. Hume, Esq. [P.].	85.8.1.102, 103.
f. 3 ♂ fœt., 1 ♀ fœt. al.	Islet of Kallam, Straits of Ma- lacca.	India Museum [P.].	60.3.19.1338.

\* U. S. N. M. nos. 101360, 101391, 101393.



<i>j, k.</i> 2 ♂ ad. sks.; skulls.	Tanjong Sau, Batam; 10 July, 1908.	H. C. Robinson, Esq. [C. & P.].	Orig. nos. 866, 867*.
<i>l-n.</i> 2 ♂ imm., 1 ♀ imm. sks.; skulls.	Tanjong Turut, Batam; 11, 17 July, 1908.	H. C. Robinson, Esq. [C. & P.].	Orig. nos. 878, 976, 977*.
<i>o, p.</i> ♀ imm., ♂ ad. sks.; skulls.	Pasir Panjang, Bintang, 9, 10 June, 1908.	H. C. Robinson, Esq. [C. & P.].	Orig. nos. 759, 773*.
<i>q.</i> Jun. sk.; skull.	Sumatra.	India Museum [P.].	79.11.21.59.
<i>r.</i> ♀ imm. sk.; skull.	Padang Brah-rang, nr. Deli, Sumatra.	Theo. C. Barclay, Esq. [P.].	99.11.13.1.
<i>s.</i> ♂ ad. al.; skull.	Pajo, Sumatra.	Carl Bock, Esq. [C.].	79.7.2.3.
<i>t.</i> Ad. skeleton.		Purchased (Stevens).	46.4.23.2.
<i>u.</i> ♂ ad. skull.		W. Theobald, Esq. [C.].	56.5.6.49.
<i>v, w.</i> 2 ad. skulls.		Lidth de Jende Coll.	67.4.12.92, 93.

### 68 b. *Pteropus vampyrus vampyrus*, L. †

*Canis volans* Ternatanus Orientalis, *Seba, Thesaur.* i. pp. 91-92, pl. lvii. figs. 1, 2 (animal, female and male, both young) (1734).

*Vespertilio cauda nulla*, *Linn. Syst. Nat.* 2 ed. p. 37 (1740); *id.*, *op. cit.* 7 ed. p. 7 (1748); *Hill, Hist. Animals*, p. 564 (1752).

*Vespertilio cynocephalus* Ternatanus, *Klein, Quadr. Dispos.* p. 61 (1751).

Flädermöss, *Osbeck, Dagb. Ostind. Resa*, p. 105 (1757: Java).

*Vespertilio vampyrus*, *Linn. Syst. Nat.* 10 ed. i. p. 31 (pt.) (1758); *id.*, *op. cit.* 12 ed. i. p. 46 (pt.) (1766); *Fallas, Spic. Zool.*, Fasc. 3, p. 7 (1767); *P. L. S. Müller, Vollst. Natursyst.* i. p. 152 (pt.), pl. viii. fig. 1 (animal) (1773); *Forster, Indische Zool.* p. 39 (1781); *Boddaert, Elench. Anim.* i. p. 68 (pt.) (1785).

*Pteropus vampyrus* var. a (Die Roussette), *Beckstein, Pennant's Vierfüß. Th.* ii. pp. 616, 733, pl. liv. fig. 1 (animal, copy from Pennant) (1800).

*Pteropus vampyrus*, *Thomas, P. Z. S.* 1892, pp. 315, 316 (identification of *V. vampyrus*, L.; type fixed); *Müller, Fam. & Gen. Bats*, p. 58 (pt.) (1907).

Ternate Bat: The Roussette, *Pennant, Hist. Quadr.* ii. p. 548 (1781); *id.*, *op. cit.* 3 ed. ii. p. 304, pl. ciii. (animal) (1793).

*Vespertilio caninus* (pt.), *Blumenbach, Handb. Naturg.* 5 ed. p. 73 (1797).

*Vespertilio celæno* ‡, *Hermann, Obs. Zool.* p. 13 (1804: Batavia); *Oken, Lehrb. Naturg.* iii. Abth. ii. p. 935 (1816).

*Pteropus celæno*, *Schinz, Thierr.* i. p. 155 (1821); *Matschie, Megachir.* p. 15 (pt.) (1899: Java); *Trouessart, Cat. Mamm., Suppl.*

\* Awaiting registration (Feb. 1909).

† A few of the references to literature given under this heading apply to *P. vampyrus* in the full specific sense, rather than to the Javan race of the species.

‡ Misspelt *V. calano*. Desmarest, *Mamm.* i. p. 110, footnote. (1820); and *V. calano*, Gray, *Cat. Mork. &c.* p. 104 (1870).

- p. 50 (pt.) (1904: Java); *Elliot, Cat. Mamm. Field Col. Mus.* p. 490 (pt.) (1907: Java).
- ? *Vespertilio nudus*, *Hermann, Obs. Zool.* p. 15 (1804: habitat unknown); *Oken, Lehrb. Naturg.* iii. Abth. ii. p. 934 (1816).
- ? *Pteropus nudus*, *Schinz, Thierr.* i. p. 155 (1821); *J. B. Fischer, Syn. Mamm.* p. 82 (1829).
- Roussette kalou, *E. Geoffroy, Ann. Mus. d'Hist. Nat.* xv. p. 91, footnote (1810: Java).
- Pteropus edulis* (*nec E. Geoff.*), *Oken, Lehrb. Naturg.* iii. Abth. ii. p. 936 (pt.) (1816: Java); *Temminck, Mon. Mamm.* i. pl. xv. figs. 4, 5, 6 (skull, drawn from Leyden specimen "o": Java) (1825); *Gray, in Griffith's Anim. Kingd.* v. p. 54, no. 153 (1827: Java); *J. B. Fischer, Syn. Mamm.* p. 81, no. 1 (pt.) (1829: Java); *Kaup, Thierr.* i. p. 216 (1835); *Lesson, Hist. Nat. Mamm. (Compl. Buffon)* v. p. 56 (pt.) (1836: Java); *Gray, Mag. Zool. & Bot.* ii. p. 502 (pt.) (1838: Java); *Oken, Allg. Naturg.* vii. Abth. ii. p. 989 (pt.) (1838: Java); *Wagner, Schreber's Säug., Suppl.* i. p. 342 (1839: Java); *S. Müller, in Temminck's Nat. Gesch. Nederl. Overz. Bez., Zoogd.* pp. 20, 58 (1839-44: Java); *Owen, Odontogr.* ii. pl. 113 (section of molar) (1840-45); *Lesson, N. Tabl. R. An., Mamm.* p. 12, no. 168 (1842: Java); *Tickell, Calcutta Journ. N. H.* iii. p. 29 (pt.) (1843: Java); *Schinz, Syst. Verz. Säug.* i. p. 120 (pt.) (1844: Java); *E. Desmarest, Dict. Univ. d'Hist. Nat.* xi. p. 247 (pt.) (1848: Java); *Gray, Zool. 'Samarang.'* *Fert.* p. 11 (pt.) (1849: Java); *Horsfield, Cat. Mamm. Mus. E. Ind. Comp.* p. 27 (pt.) (1851: Java; habits); *Wagner, Schreber's Säug., Suppl.* v. p. 594 (pt.) (1853-55: Java); *Gervais, Hist. Nat. Mamm.* i. p. 186 (pt.), fig. (head) (1854: Java); *Giebel, Säug.* p. 994 (1855: Java); *Schlegel, Dierkunde*, i. p. 53 (1857: Java); *Blyth, Cat. Mamm. Mus. As. Soc.* p. 20 (1863: Java); *Kreff, Cat. Mamm. Austral. Mus.* p. 4 (1864: Java); *Peters, MB. Akad. Berlin*, 1867, p. 324 (pt.) (Java); *W. K. Parker, Mon. Shoulder-girdle Vert.* pl. xxviii. figs. 9, 10 (clavicles; sternum) (1868); *Cooke, Journ. Quekett Micr. Cl.* i. pp. 6, 55, pl. i. fig. 1 (1868-69: structure of hairs); *Anonymous, Zool. Garten*, x. p. 350 (1869: habits in confinement); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 398 (pt.) (1870: Java); *Schlegel, Dierentuin Nat. Art. Mag., Mamm.* p. 66 (1872: Java); *Dobson, Cat. Chir. Ind. Mus.* pp. 2-3 (1874: Java); *id., Mon. As. Chir.* pp. 20, 22 (pt.) (1876: Java); *id., Cat. Chir. B. M.* p. 50 (pt.) (1878: Java); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 201 (pt.) (1879: Java); *J. Anderson, Cat. Mamm. Ind. Mus.* pt. i. p. 100 (pt.) (1881: Java); *Mohr, Pflanzen- u. Thierl. Niederl. Malaienl.* p. 398 (1883: Java; habits); *Jentink, Cat. Ost. Mamm.* pp. 258, 259 (pt.) (1887: Java); *id., Cat. Syst. Mamm.* p. 144 (pt.) (1888: Java); *Zander, Anat. Anz.* iv. p. 752 (1889: nerves of hand); *Brehm, Tierleben*, 3 ed. i. p. 341 (pt.) (1890: habits); *Flower & Lydekker, Mamm.* p. 651 (1891: Java); *Selenka, Stud. Entwicklungsgesch. d. Tiere*, H. 5, pt. 2, p. 209, pl. xli. (1892: habits; embryology); *Göhre, ibid.* p. 218, pl. xlii. (1892: vitelline sac; placenta); *Trouessart, Cat. Mamm.* i. p. 80 (pt.) (1897: Java); *Matschie, Megachir.* pl. i. figs. 3, 3 a, 3 b (skull) (1899); *Willink, Nat. Tijd. Nederl. Ind.* lxxv. p. 272 (pt.) (1905: Java); *Haller, Anat. Anz.* xxx. p. 69 (1907: anatomy of brain); *Hirsch, ibid.* p. 544 (1907: pallial commissure).
- Pteropus javanicus*, *Desmarest, Mamm.* i. p. 109, no. 136 (1820: Java); *Horsfield, Zool. Res. Java*, p. —, pl. —, figs. Q-U (skull

- teeth), pl. —. (animal) (1824: Java; habits); *Lesson, Man. Mamm.* p. 108, no. 276 (1827: Java); *Desmarest, Dict. Sci. Nat.* xvi. p. 358 (1827: Java); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 699 (1828: Java); *Lesson, Hist. Nat. Mamm. (Compl. Buffon)* v. p. 52 (1836: Java); *Layard, Cat. S. Afr. Mus.* p. 18 (pt.) (1861: Java).
- Eunycteris phaiops* (pt., *nec* *Pteropus phaiops*, *Temm.*), *Gray, Cat. Monk. &c.* p. 113 (1870: Java).
- Pteropus kelaarti* (pt.), *Gray, Cat. Monk. &c.* p. 104 (skull, not skin) (1870).
- ? *Pteropus funereus* (*nec* *Temm.*), *F. Meyer, Zool. Garten*, xv. p. 238 (1874: breeding in confinement).
- Pteropus pteronotus*, *Dobson, Cat. Chir. B. M.* p. 48 (June, 1878: Java); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 205 (1879: Java); *Jentink, Cat. Syst. Mamm.* p. 144 (1888: Bezuki, Java); *Trouessart, Cat. Mamm.* i. p. 80 (1897: Java).

*Diagnosis*.—Similar to *Pt. v. malaccensis*, but averaging considerably larger. Skull, total length 82–91 mm. Forearm 208–220 mm. *Hab.* Java.

*Colour*.—A series of twenty-two skins, males and females (adult and immature), collected by Mr. Guy C. Shortridge in 1907 and 1908 in various places of Western Java shows no appreciable difference in colour from, and very nearly the same amount of individual variation as, *Pt. v. malaccensis*. In some specimens the back and rump are thinly, in others very heavily, sprinkled with greyish-white hairs; the dark element in the colour of the back is in some specimens blackish or blackish seal-brown, in others conspicuously tinged with, in others again nearly or entirely replaced by, vandyck-brown or dark russet or cinbamon-russet. Head, neck, and underparts varying as in *malaccensis*.

A half-grown young male (same collector; 9.1.5.39) has the head, back, rump, and the whole of the underside from chin to interfemoral deep blackish, with same pale sprinkling on back and rump, and with the colour of the mantle darkened to seal-brown tinged with chocolate. This is the only melanistic specimen I have seen from Java. A series of adult and immature specimens from the same spot (Tjilatjap) are perfectly normal in colour, as is also a young male from Tasikmalaja, Preanger (9.1.5.45), of apparently quite or very nearly the same age as the melanistic one. There can be little doubt, therefore, that in a large series from Java a small percentage (probably less than 5 per cent.) will prove to be melanistic, this being also in accordance with the geographical habitat of this race, bordered as it is to the west (Sumatra) by the bright-mantled *Pt. v. malaccensis*, to the east (Bali, Lombok) by the very dark-coloured *Pt. v. pluton*.

*Measurements*. On pp. 354, 355.

*Specimens examined*. Twenty-seven, in the collections of the Leyden (one) and British Museums, including one cotype of the species and one of *Pt. kelaarti*, and the type of *Pt. pteronotus*.

*Range*. Java.

*Cotype* in collection (the other cotype not in existence).

*Vespertilio vampyrus*, L.; 1758.—Based primarily on Linné's *Vespertilio cauda nulla* in the seventh edition of the 'Systema Naturæ' (1748), and this again solely on Seba's *Canis volans Ternatanus Orientalis*. As pointed out by Mr. Oldfield Thomas (P. Z. S. 1892, p. 315) the original of Seba's pl. lvii. fig. 2, formerly in the possession of Prof. Th. van Lidth de Jeude, is now in the collection of the British Museum. This specimen, technically the type of *V. vampyrus*, L., is well preserved and easily determinable as to species, but much too young to be determined as subspecies, though so much can be said that it belongs to one of the bright-coloured races of *Pt. vampyrus*. The locality given by Seba, viz. Ternate, is undoubtedly wrong, if taken literally and not, as it probably ought to be in this case, as synonymous with the East Indian Archipelago generally; no form of *Pt. vampyrus* occurs in the island of Ternate. In the whole area inhabited by the bright-coloured races of *Pt. vampyrus*, Java would seem to be the most likely place from which Seba's collector acquired this specimen, and that island may therefore be fixed as the type locality of *Pt. vampyrus*.

*Vespertilio caninus*, Blumenbach; 1797.—See p. 220.

*Vespertilio celæno*, Hermann; 1804.—Type locality, Batavia. Undoubtedly based on a specimen of *Pt. vampyrus* (with i' missing on both sides, if Hermann's statement is correct).

*Vespertilio nudus*, Hermann; 1804.—"Patria ignota; Parisiis missus." Generally put down as a synonym of *Pt. vampyrus*, but in fact indeterminable from the description. Perhaps the young, with milk dentition, of some species of *Pteropus*, but the description of the ears ("auriculæ parvæ et simplices") would seem to exclude *Pt. vampyrus*.

*Pteropus javanicus*, Desmarest; 1820.—In a footnote to his description of *Pt. edulis* (Ann. Mus. d'Hist. Nat. xv. p. 91; 1810), E. Geoffroy gives an extract of a manuscript of Leschenault de la Tour on the mammals of Java containing a description of a species of *Pteropus* which Geoffroy identifies with *edulis*. Seeing that Leschenault's description of the colour of the Javan bat differed essentially from that of *Pt. edulis*; as given by Geoffroy, Desmarest separated the former specifically as *Pt. javanicus*. That Desmarest based his *Pt. javanicus* not on actual specimens but solely on the note referred to above, is evident from the fact that his brief description is practically identical with that given by Leschenault.

*Pteropus kelaarti*, Gray; 1870.—See p. 332.

*Eonycteris phaiops*, Gray; 1870.—In Gray's Catalogue of 1870 (l. s. c.) this name covers three species of *Pteropus*, viz. *Pt. melanopogon* (four specimens, Buru, Céram, Goram), *Pt. chrysoproctus* (one, Watubella I.), and *Pt. v. vampyrus* (one, Java). The last specimen was, eight years later, by Dobson made the type of *Pt. pteronotus*.

*Pteropus pteronotus*, Dobson; 1878.—Type locality, Java; type in collection. An immature specimen of *Pt. v. vampyrus*.

<i>a.</i> ♂ juv. al.		Lidth de Jende Coll.	67.4.12.325.
<i>b.</i> Ad. skull.		( <i>Cotype</i> of species.) Capt. J. Stevens [P.]	48.12.22.2.
<i>c.</i> Ad. skull.		( <i>Cotype</i> of <i>Pt. kelaarti</i> , Gray.) Zool. Soc. Coll.	55.12.26.90.
<i>d.</i> ♀ imm. al.; skull.	Java.	J. Bowring, Esq. [P.]	56.11.17.1.
<i>e, f.</i> ♀ ad., ♀ imm. sks.; skulls.	Batavia; 20, 22 July, 1907 ( <i>G. C. Shortridge</i> ).	W. E. Balston, Esq. [P.]	9.1.5.35, 36.
<i>g.</i> ♂ ad. sk.; skull.	Buitenzorg, 855'; 10 Aug. 1907 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.]	9.1.5.37.
<i>h-m.</i> 2 ♂ imm., 1 ♀ ad., 3 ♀ imm. sks.; skulls.	Tjilatjap, sea-level; 18, 19, 30 Nov., 7 Dec. 1907 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.]	9.1.5.38-42, 867.
<i>n q.</i> 4 ♂ imm. sks.; skulls.	Tasikmalaja. Preanger, 1145'; 25 Dec. 1907, 12, 20 Jan. 1908 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.]	9.1.5.43-46.
<i>r v.</i> 4 ♂ ad., 1 ♂ imm. sks.; skulls.	Pangandaran, Dirk de Vries Bay; 15 March, 10, 14, 15 April, 1908 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.]	9.1.5.47-51.

### 68 *c.* *Pteropus vampyrus pluton*, *Temm.*

*Pteropus pluton*, *Temminck*, *Esq. Zool.* p. 56 (1853: Bali; Lombok).

*Pteropus pluto*, *Wagner, Schreber's Säug., Suppl.* v. p. 595 (1853-55: Bali; Lombok); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 406 (1870: Bali; Lombok).

*Pteropus edulis* (pt., *nec E. Geoff.*), *Peters, MB. Akad. Berlin*, 1867, p. 324 (Bali; Lombok); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 201 (1879: Bali; Lombok); *Jentink, Cat. Ost. Mamm.* p. 259 (1887: Bali or Lombok); *id.*, *Cat. Syst. Mamm.* p. 145 (1888: Bali; Lombok); *Willink, Nat. Tijds. Nederl. Ind.* lxx. p. 272 (1905: Bali; Lombok).

*Pteropus celano* (pt., *nec Herm.*), *Trouessart, Cat. Mamm., Suppl.* p. 50 (1904: Bali; Lombok).

*Diagnosis*.—Very large; melanistic. Skull, total length about 86 mm.; forearm 214-217 mm. *Hab.* Bali; Lombok.

*Size*.—As *Pt. v. vampyrus* (Java). See measurements pp. 354, 355.

*Colour*.—"La presque totalité du pelage d'un noir parfait, parsemé en dessus de quelques poils fauves et rares. Sur la nuque une grande tache [the mantle] d'un brun-roussâtre foncé, et qui n'est point encadrée par une bande nuchale; tout le reste des parties supérieures d'un noir parfait et lustré" (*Temminck, l. s. c.*).

Description of *cotype* "*y*," Leyden Museum, ♂ ad., some-

what faded:—Back and the whole of the underparts blackish seal-brown, comparatively slightly sprinkled with silvery greyish or silvery buffy hairs, without materially influencing the general blackish impression of the colour; mantle chestnut (probably faded), palest in centre, gradually darkening to chestnut seal-brown posteriorly, on sides of neck, and crown, and to seal-brown on sides of face.

*Specimens examined.* Three, in the collection of the Leyden Museum.

*Range.* Bali; Lombok.

*Cotypes* in the Leyden Museum.

*Pteropus pluton*, Temminck; 1853.—Based on three mounted specimens (Jentink, Cat. Syst. p. 145, sub *Pt. edulis*,  $\alpha$ ,  $\gamma$ ,  $z$ ;  $z$  is slightly immature), with skull of specimen  $\alpha$  separate (Cat. Ost. p. 259,  $s$ ).

*External measurements of Pteropus vampyrus malaccensis, vampyrus, and pluton.*

	<i>Pt. vampyrus</i>					
	<i>malaccensis</i> , 9 ad. (Incl. type.)		<i>vampyrus</i> , 8 ad.		<i>pluton</i> , 2 ad. Cotypes.	
	Min.	Max.	Min.	Max.	♂ ad.	♀ ad.
	mm.	mm.	mm.	mm.	mm.	mm.
Forearm .....	195	209	208	220	214	217
Pollex, total length, c. u. ....	80.5	86.5	86.5	93		
"  metacarpal .....	17	20.5	19.5	22		
"  1st phalanx .....	41	47.5	43.5	50		
2nd digit, metacarpal .....	97	109	110	110	111	111.5
"  1st phalanx .....	23.5	28.5	27	29	29	25
"  2nd-3rd phalanx, c. u. ....	19	24.5	22.5	23.5	21.5	24
3rd digit, metacarpal .....	128.5	144	143.5	149.5	144	145
"  1st phalanx .....	98	106	106.5	114	112	110
"  2nd phalanx .....	139	147	148	149	151	151
4th digit, metacarpal .....	126	138.5	140.5	143	144	141
"  1st phalanx .....	79	85.5	86	91	95.5	96
"  2nd phalanx .....	77	80	...	...	91.5	91.5
5th digit, metacarpal .....	132.5	145.5	147	148.5	149	147
"  1st phalanx .....	59	65	65	67	74	69
"  2nd phalanx .....	60	65.5	72.5	74	74	74
Ears, length from orifice .....	...	39.5				
"  greatest width, flattened ...	...	22				
Front of eye to tip of muzzle .....	...	32.5				
Interfemoral in centre, depth .....	20*	25.5	...	...	24*	25*
Lower leg .....	95	101.5	99	107	? 111	? 102
Foot, c. u. ....	57	65	60	68		
Calcaneal .....	26	32.5				

\* Estimate (from dried skins).

Measurements of skulls and teeth of *Pteropus vampyrus malaccensis*,  
*vampyrus*, and *pluton*.

	<i>Pt. vampyrus</i>				
	<i>malaccensis</i> .		<i>vampyrus</i> .		<i>pluton</i> .
	Skulls: 13 ad. Teeth: 12 ad., 9 imm. (Incl. type.)		Skulls: 11 ad. Teeth: 10 ad., 15 imm.		Ad. Cotype.
	MIN.	MAX.	MIN.	MAX.	
	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion ...	76.5	86.5	82	91	86
„ palation to incisive foramina ...	37.7	41	40.5	45.5	...
„ front of orbit to tip of nasals ...	26.5	30	28	33	31
„ width of brain-case at zygomata.	26.8	28.5	27	28.5	29.5
„ zygomatic width .....	44.3	50	43.8	50	47.5
„ width across $m^1$ , externally.....	19.8	22.7	21.8	25.2	23.5
„ lachrymal width .....	16.8	19	17	19.7	19.5
„ width across canines, externally	14.2	16.2	14.8	18.8	16.2
„ postorbital constriction .....	8	11.5	7.8	9	8
„ interorbital constriction .....	9	12.8	10.8	12	11
„ width of mesopterygoid fossa ...	8.2	9.2	8.8	9.8	...
„ between $p^1$ - $p^4$ , internally .....	11	12.8	12.2	14.5	...
„ between cingula of canines .....	8	9.7	9	11	...
„ orbital diameter .....	16	16.8	16	17	17.5
Mandible, length .....	61.3	68	65.5	73.8	69
„ coronoid height .....	27.5	33	31.5	34	33
Upper teeth, c- $m^2$ .....	29.2	33.8	31	35.7	33.8
Lower teeth, c- $m_3$ .....	32.2	37	35	39.5	36.3
Upper incisors, combined width .....	6.8	7	6.8	9	...
$p^3$ , length .....	4.8	5.7	4.8	5.9	5.2
„ width .....	3.2	3.8	3.5	4.1	3.7
$p^4$ , length .....	4.7	5.7	5	6	5.7
„ width .....	3.8	4.1	4	4.8	3.8
$m^1$ , length .....	5.6	6.9	6.2	7.2	6.2
„ width .....	3.5	4	3.8	4.2	3.9
$m^2$ , length .....	2.2	3.7	2.7	3.8	4
„ width .....	1.8	2.8	2.2	3	3.2
$p_1$ , length .....	2	2.8	2	2.8	2.7
„ width .....	1.8	2.7	1.8	2.7	2.7
$p_2$ , length .....	4.7	5.5	4.8	6	5.2
„ width .....	3	3.3	3	3.8	3.1
$p_3$ , length .....	4.8	5.8	5	6.2	5.7
„ width .....	3	3.8	3.6	4.1	3.2
$m_1$ , length .....	4.5	6	5.2	6.2	5.2
„ width .....	3	3.8	3.5	4.4	3
$m_2$ , length .....	3.8	5.1	3.8	5.5	4
„ width .....	2.7	3.6	3.2	4.1	3.1
$m_3$ , length .....	1.6	3	2.1	3.8	2.2
„ width .....	1.7	2.6	1.8	3.3	2

68 d. *Pteropus vampyrus edulis*, E. Geoff.

*Pteropus edulis*, E. Geoffroy, *Ann. Mus. d'Hist. Nat.* xv. p. 90 (1810: Timor); Oken, *Lehrb. Naturg.* iii. Abth. ii. p. 936 (pt.) (1816: Timor); Cuvier, *R. Anim.* i. p. 123 (1817); Desmarest, *Mamm.* i. p. 109, no. 137 (1820); Schinz, *Thierr.* i. p. 151 (1821); Desmarest, *Dict. Sci. Nat.* xvi. p. 358 (1827: Timor); Is. Geoffroy, *Dict. Class. d'Hist. Nat.* xiv. p. 699 (1828: Timor); J. B. Fischer, *Syn. Mamm.* p. 81, no. 1 (pt.) (1829: Timor); Lesson, *Hist. Nat. Mamm. (Compl. Buffon)* v. p. 56 (pt.) (1836: Timor); Gray, *Mag. Zool. & Bot.* ii. p. 502 (pt.) (1838: Timor); Oken, *Aily. Naturg.* vii. Abth. ii. p. 989 (pt.) (1838: Timor); Wagner, *Schreber's Säug., Suppl.* i. p. 342 (pt.) (1839: Timor); Lesson, *N. Tabl. R. An., Mamm.* p. 12, no. 168 (pt.) (1842: Timor); E. Desmarest, *Dict. Univ. d'Hist. Nat.* xi. p. 247 (pt.) (1848: Timor); Peters, *MB. Akad. Berlin*, 1867, p. 324 (pt.) (Timor); Fitzinger, *SB. Akad. Wien*. lx. Abth. i. p. 398 (pt.) (1870: Timor); Dobson, *Cat. Chir. B. M.* p. 50 (pt.) (1878: Timor); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 201 (pt.) (1879: Timor); Sventini, *Cat. Ost. Mamm.* p. 259 (pt.) (1887: Timor); id., *Cat. Syst. Mamm.* p. 145 (pt.) (1888: Timor); Seabra, *Jorn. Sci. Math. Lisboa*, (2) v. no. 18, p. 118 (1897: Timor); Trouessart, *Cat. Mamm.* i. p. 80 (pt.) (1897: Timor); Seabra, *Jorn. Sci. Math. Lisboa*, (2) v. no. 19, p. 167, pl. i. fig. 6 (palate-ridges) (1898); Willink, *Nat. Tijds. Nederl. Ind.* lxxv. p. 272 (pt.) (1905: Timor).

*Pteropus funereus*, Temminck, *Mon. Mamm.* ii. p. 63 (pt.), pl. xxxv. fig. 4 (head) (1837: Timor); Wagner, *Schreber's Säug., Suppl.* i. p. 346 (pt.) (1839: Timor); S. Müller, in Temminck's *Nat. Gesch. Nederl. Overz. Bez., Zoogd.* pp. 20, 59 (pt.) (1839-44: Timor); Lesson, *N. Tabl. R. An., Mamm.* p. 12, no. 170 (pt.) (1842: Timor); Schinz, *Syst. Verz. Säug.* i. p. 122 (pt.) (1844: Timor); E. Desmarest, *Dict. Univ. d'Hist. Nat.* xi. p. 247 (pt.) (1848: Timor); Gray, *Zool. Samarang, Vert.* p. 11 (pt.) (1849: Timor); Wagner, *Schreber's Säug., Suppl.* v. p. 596 (pt.) (1853: Timor); Gerreus, *Hist. Nat. Mamm.* i. p. 187 (pt.) (1854: Timor); Giebel, *Saug.* p. 996 (pt.) (1855: Timor); Schlegel, *Dierkunde*, i. p. 53 (pt.) (1857: Timor); Finsch, *Nou-Guinea*, p. 150 (1865: Timor); Fitzinger, *SB. Akad. Wien*, lx. Abth. i. p. 407 (pt.) (1870: Timor); Studer, *Forschungsreise 'Gazelle'* iii. p. 210 (1889: Timor).

*Pteropus celano* (pt., nec Herm.), Matschie, *Megachir.* p. 15 (1899: Timor); Trouessart, *Cat. Mamm., Suppl.* p. 50 (1904: Timor).

*Diagnosis*.—A small, melanistic form of *Pt. vampyrus*. Skull, total length about 76 mm.; forearm 185-187 mm. *Hab.* Timor: Savu.

*Differential characters*.—Size as *Pt. v. natuna* (N. Natunas; Borneo) and *lanensis* (Philippines), averaging much smaller than *Pt. v. malaccensis*, *vampyrus*, and *pluton*. From *Pt. v. natuna* it is easily distinguished by its dark colour. In its essential characters it closely approaches *Pt. v. lanensis*, but colour apparently still darker.

*Colour*.—(1) Melanistic specimens: "Poils d'un brun-noirâtre partout le corps, d'une teinte plus foncée sur la poitrine et plus claire sur le dos." The type specimen thus described by E. Geoffroy (l. s. c.) is now much faded (russet above and beneath, with the fore-neck burnt amber).—Also the colour of the two catypes of



*Pt. funereus* from Timor (Leyden Museum) is much deteriorated by exposure to light; they would seem to have been rather uniform dark above and beneath, perhaps with a slight indication of a maroon-blackish or seal-brown mantle (thus perfectly in accordance with Temminck's description, Mon. Mamm. ii. p. 64, under the heading "A": "D'un noir parfait partout, excepté à la nuque où règne une légère teinte marron très foncé").

(2) Mantle much brighter than back: ♀ juv. skin, Savu I., Aug. (A. Everett); 8.7.26.4: Indistinguishable in colour from specimens of the bright-mantled races.

*Measurements.* On pp. 361, 362.

*Specimens examined.* Four, including the types of *Pt. edulis* and *Pt. funereus*.

*Range.* Timor; Savu Island.

*Type* in the Paris Museum.

*Pteropus edulis*, E. Geoffroy; 1810.—Type, an adult female, obtained in Timor by Péron and Lesueur, mounted, skull *in situ* ("Ancienne Collection," no. 745 *g*; new Catalogue no. 17); see above, under "colour."

*Pteropus funereus*, Temminck; 1837.—In 1837 Temminck divided "*Pt. edulis*" into two species, viz., a small form, *Pt. funereus*, stated to inhabit Timor, Amboina, Borneo, and Sumatra, and a very large form, believed to be of general distribution in the East Indian Archipelago, and for which he retained the name *Pt. edulis*. This view was by no means without foundation in fact; broadly speaking, *Pt. funereus* would correspond to the series of smaller races of *Pt. vampyrus* (*edulis*, *natura*, *luensis*, though Philippine specimens were unknown to Temminck), *Pt. edulis* to the large forms of the species (*malaccensis*, *vampyrus*, *pluton*). But Temminck's statement as to the habitat of *Pt. funereus* must be modified: first, Amboina must be excluded, as lying far beyond the area inhabited by the *Pt. vampyrus* group (it is even doubtful, if Temminck had any specimens from Amboina before him; now at least there are no "*Pt. funereus*" from Amboina in the Leyden Museum; but if he had, they may have been *Pt. chrysoproctus* or *melanoproctus*); second, the specimens from Sumatra referred by Temminck to *Pt. funereus* (and examined by the present writer) are individuals of *Pt. v. malaccensis* which happen to be more or less below the average size of that race. From a modern point of view, Temminck further made the technical mistake of transferring the name *edulis*, which by Geoffroy was based on one of the smaller races (the Timor form), to the large form (Java, &c.), and proposing a new name, *funereus*, for the smaller races. Of the four islands given by Temminck as habitat of his *Pt. funereus*, Timor may be fixed as the type locality, not only because it is the first named, but also because, of those four islands, it is the only one inhabited by a truly melanistic ("*funereus*") race of this species. *Pt. funereus* thus becomes a synonym of *Pt. edulis*, Geoff., and the cotypes of *funereus*, as here restricted, are specimens "*g*" (♀ ad.) and "*h*" (♂ juv.) in Jentink's Cat. Syst. (p. 145), both mounted, skull of "*g*" extracted (Cat. Ost. p. 259. *p*); see above, under colour.

68 *e. Pteropus vampyrus natunæ*, K. And.

- Pteropus funereus*, *Temminck, Mon. Mamm.* ii. p. 63 (pt.) (1837 : Borneo); *Wagner, Schreber's Säug., Suppl.* i. p. 346 (pt.) (1839 : Borneo); *S. Müller, in Temminck's Nat. Gesch. Nederl. Overz. Bez., Zoogd.* pp. 20, 58 (pt.) (1839-44 : Borneo); *Lessou, N. Tabl. R. An., Mamm.* p. 12, no. 170 (pt.) (1842 : Borneo); *E. Desmarest, Dict. Univ. d'Hist. Nat.* xi. p. 247 (pt.) (1848 : Borneo); *Gray, Zool. 'Samarang,' Vert.* p. 11 (pt.) (1849 : Timor); *Wagner, Schreber's Säug., Suppl.* v. p. 596 (pt.) (1853-55 : Borneo); *Gervais, Hist. Nat. Mamm.* i. p. 187 (pt.) (1854 : Borneo); *Giebel, Säug.* p. 996 (pt.) (1855 : Borneo); *Schlegel, Dierkunde*, i. p. 53 (pt.) (1857 : Borneo); *Fitzinger, SB. Akad. Wien*, lx. Abth. i. p. 407 (pt.) (1870 : Borneo); *Mohrnick, Pflanzen- u. Thierl. Niederl. Malaienland*. p. 401 (1883 : Landak, W. Borneo; habits).
- Pteropus edulis* (*nec E. Geoff.*), *Dobson, Cat. Chir. B. M.* p. 50 (1878 : Borneo); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 201 (pt.) (1879 : Borneo); *Jentink, Cat. Ost. Mamm.* p. 259 (pt.) (1887 : Borneo); *id.*, *Cat. Syst. Mamm.* p. 145 (pt.) (1888 : Borneo); *Ererett, P. Z. S.* 1893, p. 494 (Borneo); *Hose, Mamm. Borneo*, p. 38 (1893 : Baram R., Niah R.; habits); *Trouessart, Cat. Mamm.* i. p. 80 (pt.) (1897 : Borneo); *Jentink, Notes Leyden Mus.* xix. p. 49 (1897 : Sibau R., Dutch W. Borneo); *Willink, Nat. Tijds. Nederl. Ind.* lxxv. p. 272 (pt.) (1905 : Natuna Is.; Borneo).
- Pteropus vampyrus* (*nec L.*), *Thomas & Hartert, Nov. Zool.* i. p. 655 (1894 : Bunguran, N. Natunas); *Thomas, op. cit.* ii. p. 489 (1895 : Bunguran; Pulo Panjang); *Miller, Proc. Wash. Acad. Sci.* iii. p. 137 (1901 : Bunguran).
- Pteropus celeno* (pt., *nec Herm.*), *Matschie, Megachir.* p. 15 (1899 : Borneo); *Trouessart, Cat. Mamm., Suppl.* p. 50 (pt.) (1904 : Borneo; Natunas).
- Pteropus vampyrus natunæ*, K. Andersen, *Ann. & Mag. N. H.* (8) ii. p. 369 (1 Oct. 1908 : N. Natunas; N. Borneo).

*Diagnosis*.—Small; bright-coloured mantle strongly contrasting with dark back. Skull, total length about 73-78 mm.; forearm 182.5-196 mm. *Hab.* N. Natuna Is.; Borneo.

*Differential characters*.—Differs from *Pt. v. malaccensis* (Malacca, Sumatra), *vampyrus* (Java), and *pluton* (Bali, Lombok) by its much smaller average size; forearm in the three larger races 195-220 mm., total length of skull 76.5-91. From the two equally small races of *Pt. vampyrus*, viz. *edulis* (Timor) and *lanensis* (Philippines), it may be distinguished by its generally much brighter colour.—In size and most other characters this form approaches *Pt. giganteus* (forearm 163.5-176.5 mm.; skull 71-76), from which it is easily discriminated by its dark-coloured breast and belly. It has a still closer ally in the dark-bellied *Pt. intermedius* (Tenasserim), from which it apparently differs chiefly in the darker foreneck and rather larger size.

*Colour*.—Six specimens (five skins), adult males and females, Bunguran and Pulo Panjang; June, July, Sept.:—Colour on the whole very similar to that of *Pt. v. malaccensis* and *vampyrus*. Back blackish or seal-brown, in some specimens not, in others distinctly but not very heavily, sprinkled with light greyish. Underparts from chin to interfemoral blackish or seal-brown, often

more or less suffused with chocolate; breast and belly in some specimens not, in others thinly, in others again unusually heavily sprinkled with buffy-greyish hairs; foreneck sometimes blackish like chin and breast, but usually more or less suffused with chestnut. Mantle and head as in *Pt. v. maluccensis*.

A seventh specimen (♀ ad. skin, Mt. Kalulong, Sarawak; June; 94.2.1.17) has the back and rump vandyck-brown very thinly sprinkled with light greyish.

*Measurements.* On pp. 361, 362.

*Specimens examined.* Twelve, from the collections of the U.S. National\*, Leyden, and British Museums, including the type of the subspecies.

*Range.* N. Natuna Islands (Bunguran; Pulo Panjang); N. Borneo (Sarawak).

*Type* in collection.

- |                      |   |  |             |
|----------------------|---|--|-------------|
| a. ♂ ad. al.; skull. | Bunguran, N. Natunas.                                       | A. Everett [C.].                               | 94.9.28.24. |
| b. ♂ ad. sk.; skull. | Pulo Panjang, N. Natunas; Sept. 1894<br>( <i>E. Hose</i> ). | Tring Museum.<br>( <i>Type</i> of subspecies.) | 95.11.8.1.  |
| c. ♂ ad. skull.      | Baram, E. Sarawak; 20 Nov. 1889.                            | Dr. Chas. Hose [P.].                           | 92.10.1.4.  |
| d. ♀ ad. sk.; skull. | Mt. Kalulong, E. Sarawak, 1000'; June, 1893.                | Dr. Chas. Hose [C.].                           | 94.2.1.17.  |

### 68 f. *Pteropus vampyrus lanensis*, *Mearns*.

?Cabug *vel* Panicui, *Camel, Phil. Trans.* xxv. p. 2198 (1708: Philippines) (probably either *Pt. v. lanensis* or *Acerodon jubatus*).

*Pteropus edulis* (*nec E. Geoff.*), *Fitzinger, SB. Akad. Wien*, xlii. p. 389 (1860: Manila); *Peters, MB. Akad. Berlin*, 1861, p. 707 (Samar); *id.*, *op. cit.* 1867, p. 324 (pt.) (Samar); *Zeebor, Reise 'Novara,' Zool. i. Säug.* p. 10 (1869: Manila); *Fitzinger, SB. Akad. Wien*, lv. Abth. i. p. 398 (pt.) (1870: Manila); *Dobson, Cat. Chir. B. M.* p. 50 (1878: Samar; Dinagat); *Günther, P. Z. S.* 1879, p. 74 (Dinagat; Rasol I., near Surigao); *Jentink, Cat. Ost. Mamm.* p. 259 (pt.) (1887: Manila); *id.*, *Cat. Syst. Mamm.* p. 145 (pt.) (1888: Manila); *Steere, List Birds & Mamm. Steere Exp. Philipp.* p. 28 (1890: Leyte; Panay; Negros); *Elera, Cat. Sist. Faun. Filip.* p. 5 (pt.) (1895: Samar; Dinagat; Leyte; Cebu); *Elliot, Field Columb. Mus. Publ. ii. Zool. Ser. i.* no. 3, p. 76 (1896: Leyte); *Trouessart, Cat. Mamm. i.* p. 80 (pt.) (1897: Samar); *Sanchez, An. Soc. Españ. Hist. Nat.* xxix. pp. 240, 275, 288 (1900-1901: Luzon; ? Mindanao; Samar).

*Pteropus pluto* (*nec Temm.*), *Peters, MB. Akad. Berlin*, 1861, p. 707 (Samar).

*Pteropus jubatus* (*nec Eschsch.*), *Gerrard, Cat. Bones Mamm. B. M.* p. 56 (1862: Mindanao, skull 55.12.26.89).

*Pteropus funereus* (pt., *nec Temm.*), *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 515 (1872-73: Philippines; structure of hairs).

*Pteropus vampyrus* (*nec L.*, subsp.), *Thomas, Trans. Zool. Soc.* xiv pt. vi. p. 383 (1898: Catanduanes, S. Luzon; Samar).

\* 104723-26 all from the island of Bunguran.

*Pteropus celeno* (pt., nec *Herm.*), *Matschie, Megachir.* p. 15 (1899: Luzon; Samar; Mindanao); *Trouessart, Cat. Mamm., Suppl.* p. 50 (1904: Philippines); *Elliot, Cat. Mamm. Field Col. Mus.* p. 490 (pt.) (1907: Leyte).

*Pteropus lanensis*, *Mearns, Proc. U.S. Nat. Mus.* xxviii. p. 432 (1905: Pantar, Mindanao); *Miller, Fam. & Gen. Bats*, p. 58 (1907).

*Diagnosis*.—Small; generally melanistic. Skull, total length about 73.5–78.5 mm.; forearm 185–201. *Hab.* Philippines.

*Differential characters*.—Most closely allied, and similar in size, to *Pt. v. natunæ*, from which it differs in the generally much darker colour of the mantle; but specimens occur (one, in a series of six examined) which are indistinguishable in colour from *Pt. v. natunæ*.

*Colour*.—(1) Melanistic specimens: ♂ ad. skin, Catanduanes, Sept. (Whitehead coll.); 95.1.3.2:—Back and rump blackish, rather heavily sprinkled with light greyish or buffy-greyish. The whole of the underparts blackish, washed with seal-brown on flanks and anal region, and thinly sprinkled with light greyish. Mantle pale vandyck-brown (approaching russet) rather heavily mixed with blackish; sides of neck blackish like foreneck. Crown and sides of head similar to back; temporal region slightly washed with vandyck-brown.

A specimen from Cebu (♂ ad. al.; 'Challenger' Exp.; 82.7.27.2) is very similar to the foregoing.

In another specimen from Cebu (♂ ad. skin; 'Challenger' Exp.; 80.11.24.2) the back is suffused with pale vandyck-brown (approaching russet), breast and belly slightly tinged with dark vandyck-brown. Mantle blackish (thus much darker than back), sides of neck and foreneck similar. Head blackish, somewhat tinged with vandyck-brown on sides.

A skin from Panay (♀ ad., Steere Exp.; 105439) is very similar to the foregoing.

A skin from Leyte (♀ ad., Steere Exp.; 105461) has the back and rump almost uniform mars-brown; centre of breast blackish, shading to dark chocolate on sides of breast, this again to vandyck-brown on belly. Mantle walnut-brown, shading to dark vandyck-brown on sides of neck, this again to dark chocolate on foreneck and throat. Crown similar to mantle, though of a rather darker tinge.

(2) Mantle much brighter than back: ♂ ad. skin, Catanduanes, Sept. (Whitehead coll.); 97.5.2.3:—Indistinguishable in colour from an average specimen of *Pt. v. natunæ* (or *malaccensis*, or *vampyrus*). Back seal-brown, thinly sprinkled with light greyish. Underparts almost uniform blackish seal-brown from chin to interfemoral, though with a rather faint tinge of dark chocolate on foreneck. Mantle rich orange ochraceous-buff, shading to ochraceous-rufous on sides of neck. Crown vandyck-brown.—In the series examined this is the only specimen from the Philippines with the mantle bright-coloured, strongly contrasting with back.

*Measurements*. On pp. 361, 362.

*Specimens examined*. Seven, from the collections of the U.S. National \* and British Museums.

\* The two specimens referred to above, in the description of the colour.

*Range.* The Philippines generally: Luzon, \*Catanduanes, Samar, \*Leyte, \*Cebu, Negros, \*Panay, \*Dinagat, Mindanao. Specimens have been examined from the islands marked with an asterisk.

*Type* in the U.S. National Museum.

*Pteropus lanensis*, Mearns; 1905.—Type locality, Pantar, near Lake Lanao, altitude 1907', Mindanao. Based on the skin and skull of an adult male (no. 123291). Colour as in the melanistic specimens described above (blackish above and below, mantle and belly faintly washed with seal-brown).

<i>a, b</i> , 2 ♂ ad. sks. ; skulls.	Catanduanes; Sept. 1894.	J. Whitehead [C.].	{ 95.1.3.2. 97.5.2.3.
<i>c</i> , ♂ ad. sk. ; skull.	Cebu (Challenger Exp.).	Lords of the Treasury [P.].	80.11.24.2.
<i>d</i> , ♂ ad. al. ; skull.	Cebu (Challenger Exp.).	Lords of the Treasury [P.].	82.7.27.2.
<i>e</i> , ♂ pull. al.	Dinagat.	A. Everett [C.].	77.10.6.11.
<i>f</i> , Ad. skull.	Mindanao ( <i>H. Cuming</i> ).	Zool. Soc. Coll.	55.12.26.89.

*External measurements of Pteropus vampyrus edulis, natunæ, and lanensis.*

*Pt. vampyrus*

<i>edulis</i> , 2 ad. (Types of <i>Pt.</i> <i>edulis</i> and <i>Pt. funereus</i> .)	<i>natunæ</i> , 7 ad. (Incl. type.)	<i>lanensis</i> , 6 ad.
---	---	----------------------------

	<i>edulis, funereus</i> .		Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.	mm.
Forearm .....	185	187	182.5	196	185	201
Pollex, total length, c. u. ....	...	...	73	81	74.5	83.5
„ metacarpal .....	...	...	17	19	17	19.5
„ 1st phalanx .....	...	...	37	44	40	45.5
2nd digit, metacarpal .....	96.5	91	91	96	92	102.5
„ 1st phalanx .....	22.5	20	23	27	20	28.5
„ 2nd-3rd phalanx, c. u. ....	20.5	19.5	19	23	18	22.5
3rd digit, metacarpal .....	128.5	123	119.5	126.5	124.5	131.5
„ 1st phalanx .....	94	88	91	96	91.5	105.5
„ 2nd phalanx .....	129.5	124.5	121.5	136.5	134	149
4th digit, metacarpal .....	123	121	116	124	121	127
„ 1st phalanx .....	77.5	76	72.5	76.5	74	85
„ 2nd phalanx .....	75	76	73.5	77.5	74	84.5
5th digit, metacarpal .....	...	124	119.5	129	126	137.5
„ 1st phalanx .....	56.5	58	51	59	54	63
„ 2nd phalanx .....	57	60	55	62.5	56	64
Ears, length from orifice .....	...	...	36	...	36.5	...
„ greatest width, flattened ...	...	...	22	...	22	...
Interfemoral .....	...	...	...	25	...	27.5
Lower leg .....	87.5	...	86	90	89	99
Foot, c. u. ....	...	...	54.5	56.5	56	61.5
Calc. ....	...	...	...	31	29	30

*Measurements of skulls and teeth of  
Pteropus vampyrus edulis, natunæ, and lanensis.*

	<i>Pt. vampyrus</i>					
	<i>edulis.</i> Ad. Cotype of <i>Pt. funereus.</i>	<i>natunæ.</i> Skulls and teeth: 8 ad. (Incl. type.)		<i>lanensis.</i> Skulls and teeth: 6 ad.		
		MIN.	MAX.	MIN.	MAX.	
	mm.	mm.	mm.	mm.	mm.	
Skull, total length to gnathion .....	76	72.8	77.8	73.8	78.3	
„ palation to incisive foramina ...	36.7	34.8	37.8	36.5	39	
„ front of orbit to tip of nasals ...	25.8	23.5	26.2	25	27.2	
„ width of brain-case at zygomatica.	26.7	25.5	26.8	25.8	27.5	
„ zygomatic width .....	...	40.8	43	39	45	
„ width across m <sup>1</sup> , externally .....	...	18.7	21.2	20.5	21.5	
„ lachrymal width .....	16	15.2	17.2	16	17.8	
„ width across canines, externally.	14	12.8	15.2	14.7	15.2	
„ postorbital constriction .....	...	7.5	11	7.5	9.5	
„ interorbital constriction .....	...	9.8	11	10	11	
„ width of mesopterygoid fossa ...	...	7.8	9.8	8.2	9.8	
„ between p <sup>4</sup> -p <sup>4</sup> , internally .....	...	10.7	12	11.8	12.2	
„ between cingula of canines .....	...	7.2	9	8	9.8	
„ orbital diameter.....	16	15.2	16.8	15	16.5	
Mandible, length .....	58.7	56.5	61	59.5	62.8	
„ coronoid height .....	28	26	29	27.2	29.7	
Upper teeth, c-m <sup>2</sup> .....	30	28.2	30.2	28.8	30.8	
Lower teeth, c-m <sub>3</sub> .....	33.2	31.8	33.8	32.5	34.2	
Upper incisors, combined width.....	...	6.2	7.2	6.2	7	
p <sup>3</sup> , length .....	...	4.6	5.2	4.8	5.2	
„ width .....	...	3.2	3.9	3.2	3.8	
p <sup>4</sup> , length .....	...	4.8	5.5	4.8	5.6	
„ width .....	...	3.7	4	3.8	4.1	
m <sup>1</sup> , length .....	...	5.7	6.8	5.9	6.2	
„ width .....	...	3.3	4.7	3.7	4	
m <sup>2</sup> , length .....	...	2.2	3.2	3	3.2	
„ width .....	...	2.1	2.8	2.7	2.7	
p <sub>1</sub> , length .....	...	2	2.7	2.1	2.4	
„ width .....	...	2	2.7	2	2.2	
p <sub>2</sub> , length .....	...	4.3	5.1	4.8	5.2	
„ width .....	...	2.8	3.5	3	3.3	
p <sub>4</sub> , length .....	...	4.9	5.6	4.9	5.1	
„ width .....	...	3	3.9	3.5	3.8	
m <sub>1</sub> , length .....	...	4.8	5.7	5.2	5.6	
„ width .....	...	3.2	3.8	3.5	3.8	
m <sub>2</sub> , length .....	...	3.8	4.7	4.2	4.7	
„ width .....	...	3	3.8	3.1	3.5	
m <sub>3</sub> , length .....	...	2.5	2.9	2.1	3	
„ width .....	...	2.1	2.5	1.9	2.2	

M. THE *PTEROPUS ALECTO* GROUP.

*Species*.—*Pt. aterrimus*, *alecto*, *morio*, *gouldi*.

*Range*.—Celebes, Bawean Island (Java Sea), Lesser Sunda Islands, N. and E. Australia.

*General characters*.—Skull unmodified Pteropine. Dentition in typical species weaker than usual, premolars without posterior basal ledges. Ears *hypomelanus* style; interfemoral more developed in centre than usual, but less so than in *Pt. vampyrus*; fur generally short and closely adpressed on back; tibia naked above. Colour remarkably dark: blackish or seal-brown above and beneath, more or less thinly sprinkled with greyish-white hairs; mantle dark-coloured, vandyck-brown, chestnut, chocolate, or seal-brown. Males without glandular neck-tufts, but with fur of mantle rather more rigid and unctuous than in females. Size medium or large (forearm 141–180 mm.).

*Differentiation of species*.—*Pt. aterrimus* is the least specialized form; the size of the teeth is not appreciably reduced, and there is generally some trace of a posterior basal ledge in  $p^3$  and  $p_3$ . In the other three species the dentition is remarkably weak, and the basal ledges of the premolars have disappeared. *Pt. aterrimus* is known only from Bawean Island, *Pt. sumbanus* from Sumba and Savu; the range of *Pt. alecto* extends from Celebes, through Salayer, to Lombok; *Pt. gouldi* is an only slightly modified Australian representative of *Pt. alecto*.

*Affinities of group*.—The *Pt. alecto* replaces the Oriental *Pt. vampyrus* group in Celebes, the Lesser Sunda Islands, and Australia. It accords with *Pt. vampyrus* in all important characters of the teeth, differing chiefly in the smaller and less pointed ears and somewhat shorter interfemoral. The dark colour of the mantle and fur in the *Pt. alecto* group is very closely approached by the eastern, "melanistic" races of *Pt. vampyrus*.

69. *Pteropus aterrimus*, Matschie.

*Pteropus alecto* (pt.), Dobson, Cat. Chir. B. M. p. 56.

*Pteropus aterrimus*, Temminck, *Coup d'œil Ind. Archip.* i. p. 333 (1846: Bawean) (nom. nud.); *id.*, *Esq. Zool.* p. 59 (pt.) (1853: Bawean) (nom. nud.).

*Pteropus nicobaricus b. aterrimus*, Matschie, *Megachir.* p. 17 (1899: Bawean); Trouessart, *Cat. Mamm., Suppl.* p. 50 (1904: Bawean).

*Pteropus nicobaricus aterrimus*, Willink, *Nat. Tijds. Nederl. Ind.* lxx. p. 275 (1905: Bawean).

*Pteropus alecto* (pt.), Temminck, *Esq. Zool.* pp. 58–60 (1853: Bawean).

*Pteropus alecto* (pt., *nec* Temm. 1837), Wagner, *Schreber's Säug., Suppl.* v. p. 509 (1853–55: Bawean); Peters, *MB. Akad. Berlin*, 1867, p. 329 (Bawean); Fitzinger, *SB. Akad. Wien*, lx. Abth. i. p. 432 (1870: Bawean); Dobson, *Cat. Chir. B. M.* p. 56 (1878); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 202 (1879: Bawean); Jentink, *Cat. Ost. Mamm.* p. 260 (1887: Bawean); *id.*, *Cat. Syst. Mamm.* p. 147 (1888: Bawean).

*Pteropus baveanus*, Miller; *Proc. Biol. Soc. Wash.* xix. p. 63 (1 May, 1906; Bawean).

*Diagnosis*.—Skull typical *Pteropine*. Cheek-teeth short and broad: posterior ledges obsolescent in  $p^3$  and  $p_3$ , entirely undeveloped in  $p^4$  and  $p_4$ . Ears moderate, broad, exposed, tip rather broadly rounded off. Tibia naked above. Fur of back short, adpressed. General colour blackish above and beneath, thinly sprinkled with greyish-white or greyish-buffy; back and anal region often washed with vandyck-brown or dark mars-brown; mantle varying from pale hazel to deep chestnut. Forearm 152.5–160 mm. *Hab.* Bawean I.

*Skull*.—Similar to that of *Pt. hypomelanus*, but somewhat larger, with heavier and particularly deeper rostrum, and relatively slightly larger orbits. Coronoid sloping; coronoid height of mandible much less than  $c-m_3$ ; condyle above level of alveolar line.

*Teeth*.—Upper canines strong, slightly recurved or nearly straight; median keel on hinder face sharply projecting; cingulum well defined but narrow.  $p^1$  rudimentary, terete, deciduous. Premolars and molars above and below markedly broader than in *Pt. hypomelanus*. Posterior ledge of  $p^3$  very short or obsolescent; sometimes a faint trace of the postero-external notch is detectable. In  $p^4$  the ledge is entirely undeveloped; posterior margin of tooth generally conspicuously oblique. Owing to large width of cheek-teeth and shortness or absence of posterior ledges, the basal outline of  $p^3$  and  $p^4$  is subsquarish.  $m^1$  simple.  $m^2$  larger than  $m_3$ .— $i_2$  once and a half, sometimes nearly twice the bulk of  $i_1$ . Cingulum of lower canines narrow.  $p_1$  about twice the size of  $i_2$ . Posterior ledge of  $p_3$  very short, generally not distinctly marked off from tooth: ledge of  $p_4$  undeveloped.  $m_1$  and  $m_2$  simple.  $m_3$  usually slightly larger than  $p_1$ .

*Ears* (dried skins).—Apparently not differing essentially in form and relative size from those of *Pt. hypomelanus*. Not abruptly narrowed above, tip rather broadly rounded off.

*Wings*.—Membranes about 18 mm. apart at origin from back.

*Fur*.—Short and closely adpressed on back. Length of fur, back and belly about 10–12, mantle 12–14 mm. Distribution of fur as in *Pt. hypomelanus*.

*Colour*.—Six paratypes of *Pt. baveanus*, male and females, adult and immature, skins, July:—Back and rump seal-brown, with or without a distinct wash of dark vandyck-brown, in some specimens thinly, in others more conspicuously sprinkled with silvery greyish-white hairs. —Breast, belly, and flanks in most specimens blackish seal-brown, sometimes slightly, often more thickly sprinkled with silvery greyish-white or greyish-buffy hairs; anal region in some specimens strongly suffused with vandyck-brown or dark mars-brown; in one specimen this suffusion extends over the belly and breast, everywhere considerably clouded with the general seal-brown colour of the underparts. —Mantle varying from pale hazel or yellowish cinnamon-rufous to deep chestnut with a tinge of maroon; colour darkening on sides of neck, and passing on foreneck into blackish



seal-brown; in one specimen the bright colour of the mantle is continued, though considerably darkened and sprinkled with buffy hairs, as a collar across the foreneck, in another the blackish hairs of the foreneck are tipped with chestnut. Base of fur of mantle and sides of neck generally blackish.—Occiput similar to mantle or darker; crown seal-brown or blackish seal-brown, sometimes sprinkled with buffy hairs; in several specimens the bright colour of the occiput extends forward on crown, though considerably darkened with blackish seal-brown. Sides of head blackish seal-brown with or without chestnut suffusion, sometimes thinly sprinkled with buffy hairs. Throat blackish like rest of underparts.

*Measurements.* On pp. 368, 369.

*Specimens examined.* Twelve, in the collections of the Leyden (five), Berlin (one), and U.S. National Museums (six\*), including type of species and six paratypes of *Pt. baweanus*.

*Range.* Bawean Island, Java Sea.

*Type* in the Berlin Museum.

*Pteropus aterrimus*, Matschie; 1899.—As first published by Temminck, in 1846 (*l. s. c.*), *Pt. aterrimus* is a nomen nudum ("on peut citer [as occurring in the island of Bawean] encore une Roussette, *Pteropus aterrimus*, distincte du *P. edulis* de Java"). Seven years later (Esq. Zool. p. 59, 1853), Temminck again mentions *Pt. aterrimus*, but only to say that he now considers it indistinguishable from *Pt. alecto* ("c'est par erreur que cette espèce [viz. *Pt. alecto*, or *alecton*, as Temminck now writes the name] est nommé[e] *P. aterrimus* dans le Coup-d'œil sur les possessions néerlandaises dans l'Inde archipélagique, vol. i. p. 333"). The Bawean specimens examined by Temminck were collected by Biard; five are now in the Leyden, one in the Berlin Museum. This latter specimen was described by Matschie, *l. s. c.* 1899. under the name "*Pt. nicobaricus* [Abart] b. *aterrimus*." Technically, the name *Pt. aterrimus* must of course date from this, the first published, description of the species.

*Pt. baweanus*, Miller; 1906.—Accidental renaming of species. Type locality, Bawean; type in the U.S. National Museum (skin and skull, 125482). Six paratypes examined.

## 70. *Pteropus alecto*, Temm.

*Pteropus alecto* (pt.), Dobson, Cat. Chir. B. M. p. 56.

*Pteropus alecto*, Temminck, *Mon. Mamm.* ii. p. 75 (1837; Menado); Wagner, *Schreber's Säug.*, Suppl. i. p. 351 (1839; Menado); S. Müller, in Temminck's *Nat. Gesch. Nederl. Overz. Bez., Zoogd.* pp. 20, 59 (1839-44; Celebes); Lesson, *N. Tabl. R. Anim. Mamm.* p. 13, no. 179 (1842; Menado); Schinz, *Syst. Verz. Säug.* i. p. 125 (1844; Celebes); E. Desmarest, *Dict. Univ. d'Hist. Nat.* xi. p. 248 (1848; Menado); Gray, *Zool. Samarang, Vert.* p. 11 (1849; Celebes); Wagner, *Schreber's Säug.*, Suppl. v.

\* Nos. 125485-88, 125492, 125495.

- p. 599 (pt.) (1853: Celebes); *Gervais, Hist. Nat. Mamm. i.* p. 187 (1854: Celebes); *Giebel, Säug. p.* 998 (1855: Celebes); *Finsch, Neu-Guinea*, p. 150 (1865: Celebes); *Peters, M.B. Akad. Berlin*, 1867, p. 329 (pt.) (Celebes); *Fitzinger, S.B. Akad. Wien*, lx. Abth. i. p. 432 (pt.) (1870: Menado); ? *Leche, Lunds Univ. Årsskr.* xii. p. 16 & seq. pl. ii. fig. 8 (milk-teeth) (1878); *Rosenberg, Malay. Arch.* p. 268 (1878: Celebes); *Dobson, Cat. Chir. B. M.* p. 56 (pt.) (1878: Celebes); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 202 (pt.) (1879: Celebes); *Jentink, Cat. Ost. Mamm.* p. 260 (pt.) (1887: Menado); *id.*, *Cat. Syst. Mamm.* p. 147 (pt.) (1888: Celebes; Gorontalo); *id.*, in *Weber's Zool. Ergebn. Niederl. Ost-Ind.* i. p. 96 (1890: Macassar); *Trouessart, Cat. Mamm. i.* p. 82 (pt.) (1897: Celebes); *Matschie, Megachir.* p. 17 (1899: Menado; Minahassa; Gorontalo; Buol; Bontheim; Sokoijo; Macassar); *A. B. Meyer, Abh. Zool. Mus. Dresden*, vii. p. 5 (1899: Minahassa; Buol; Sokoijo; Macassar); *Trouessart, Cat. Mamm., Suppl.* p. 50 (1904: Celebes); *Willink, Nat. Tijd. Nederl. Ind.* lxx. p. 273 (1905: Celebes).
- Pteropus alecton* (pt.), *Temminck, Esq. Zool.* p. 58 (1853: Celebes).  
*Pteropus aterrimus* (pt.), *Temminck, Esq. Zool.* p. 59 (1853).  
 ? *Pteropus nicobaricus* (*nec Zelebor*), *Heude, Mém. Hist. Nat. Emp. Chin.* iii. p. 176 (footnote), pl. v. fig. 5 (teeth) (1896: Macassar).

*Diagnosis*.—Similar to *Pt. aterrimus*, but larger, with relatively larger orbits, weaker dentition, and shorter fur on back. Blackish above and beneath, more or less thinly sprinkled with greyish-white or buffy hairs; mantle dark seal-brown or chocolate, rarely as bright as hazel. Forearm 160–175 mm. *Hab.* Celebes; Salayer; Lombok.

*Skull and teeth*.—Skull similar to that of *Pt. aterrimus*, but averaging conspicuously larger; orbits relatively larger: 14.2–14.8 mm., against 13.7–13.9 in *Pt. aterrimus*.—General characters of teeth as in *aterrimus*, but dentition on the whole considerably weaker, notwithstanding the larger size of the animal: canines much slenderer, antero-posterior basal diameter 3.9–4.1 mm., against 4.5–4.8 in the adult *aterrimus*;  $p^1$ ,  $m^1$ ,  $m_1$ , and  $m_2$ , though of the same width as in *aterrimus*, averaging considerably shorter, owing to a still more pronounced reduction of posterior portion (ledge) of teeth; compare measurements of these teeth, p. 369. In all adult specimens the cheek-teeth are more or less thickly covered with a brownish or blackish coat of tartaric acid.

*Palate-ridges*.—5+5+3. Arrangement as in *Pt. hypomelanus* (p. 101).

*Ears*.—Relative size as in *Pt. aterrimus* (not nearly reaching eye), but upper third of outer margin more distinctly concave, upper third of conch therefore somewhat narrower, and tip more narrowly rounded off.

*Wings*.—Membranes arising close together from sides of back, separated by a space of about 20 mm.

*Interfemoral*.—Distinctly more developed in centre than in *Pt. hypomelanus*, but much less than in the species of the *Pt. vampyrus* group: depth about 13–14 mm.

*Fur*.—Very short and closely adpressed on back. Approximate length of fur of back 7–11 mm., mantle 15 mm., belly 13 mm. Width of furred space across middle of back about 32 mm. On the sides of the back the fur is considerably shorter than in the middle line, in some specimens more or less abraded, making the furred area narrower than indicated above. Distribution of fur as in *Pt. aterrimus*.

*Colour*.—Series of skins (see list below, excluding 7.1.1.238): Similar to that of *Pt. aterrimus*, but mantle darker, not contrasting with back.—Back and rump glossy seal-brown or blackish seal-brown, often thinly sprinkled with silvery whitish hairs.—Underparts from chin to interfemoral, including flanks, blackish seal-brown (a darker and less glossy tinge than that of back), generally thinly, sometimes rather heavily sprinkled with greyish-white or greyish-buffy hairs. Colour as a rule blackest on throat and foreneck. Mantle deep seal-brown, not differing from back except in a more or less distinct maroon tinge, or chocolate clouded with seal-brown, passing through a darker shade on sides of neck, into the blackish of the foreneck.—Head similar to underparts.

One specimen (♀ jun. skin, Macassar, 7.1.1.238) differs in the much brighter colour of the mantle and crown: tawny hazel with blackish bases to the hairs, gradually darkening on sides of neck, and merging on foreneck into general blackish seal-brown of underparts.

*Sexual differentiation*.—Hairs of mantle rigid and unctuous in adult males, soft, spreading, and non-unctuous in adult females. In immature individuals this sexual difference is little, or not at all, developed.

*Measurements*. On pp. 368, 369.

*Specimens examined*. Nine, in the Leyden and British Museums, including supposed type of species.

*Range*. Celebes, from Menado to Macassar; Salayer; Lombok.

*Type* perhaps in the Leyden Museum.

*Pteropus alecto*, Temminck; 1837.—Original description based on one alcoholic specimen from Menado, N. Celebes. The Leyden Museum possesses now no alcoholic specimen of *Pt. alecto*, but the type may, as stated by Jentink, be the mounted skeleton, Cat. Ost. p. 260, "a" (Menado, collected by Forsten), though the evidence is not quite conclusive. Temminck describes the specimen as being "d'une extrême vieillesse"; the teeth of the skeleton are somewhat, not extremely, worn; according to Temminck the forearm measured  $5\frac{1}{2}$  French inches (149 mm.), whereas the forearm of the skeleton is rather more than 6 inches (164 mm.). The skeleton is, however, unquestionably the species here described as *Pt. alecto*, and also Temminck's original description agrees in every respect, except the rather too small measurement of the forearm, with this species, and disagrees with any other form of *Pteropus* known from Celebes.—Temminck's *Pt. alecton*, 1853 (*l. s. c.*), is a mixture of *Pt. alecto* and *Pt. aterrimus*.

*Pteropus alecto* in Dobson's Catalogue.—Specimens *a-c* (p. 57), from Ternate and Batchian, are *Pt. chrysauchen*, Pet.; specimen *f*,

from Mysol, is the type of *Pt. mysolensis*, Gray, a synonym of *Pt. chrysauchen*; specimen *g*, from Ceram, is the type of *Pt. ceramensis*, Gray, which is *Pt. ocularis*, Pet. Dobson's description and measurements of *Pt. alecto* were taken from specimens of *Pt. chrysauchen*. The British Museum possessed at that time no specimen of *Pt. alecto*, Temm.

<i>a.</i> ♂ ad. sk.; skull.	Menado, N. Celebes ( <i>Dr. A. R. Wallace</i> ).	Tomes Coll.	7.1.1.236.
<i>b.</i> ♀ juv. sk.	Sokoijo *, Matanna Lake, C. Celebes; 6 Mar. 1896.	Drs. Sarasin [C. & E.].	99.10.1.1.
<i>c, d.</i> ♂ juv., ♀ juv. sks.; skulls.	Macassar, S. Celebes ( <i>Dr. A. R. Wallace</i> ).	Tomes Coll.	7.1.1.237, 238.
<i>e.</i> ♂ ad. al.; skull.	Macassar.	Prof. Max Weber [C. & P.].	94.7.4.1.
<i>f.</i> ♂ ad. sk.; skull.	Salayer, S. of Celebes; Nov. 1895.	A. Everett [C.].	97.1.3.1.
<i>g, h.</i> 1 ♂ ad., 1 ad. sks.; skulls.	Lombok ( <i>Dr. A. R. Wallace</i> ).	Tomes Coll.	7.1.1.234, 235.

*External measurements of Pteropus aterrimus and alecto.*

	<i>Pt. aterrimus</i> , 3 ad. (Paratypes of <i>Pt. baveanus</i> .)		<i>Pt. alecto</i> , 5 ad. (Brit. Mus. series.)	
	MIN.	MAX.	MIN.	MAX.
	mm.	mm.	mm.	mm.
Forearm.....	152.5	160	160	175
Polex, total length, c. u.....	65	69.5	67	72.5
„ metacarpal .....	15	16	15	18
„ 1st phalanx .....	34	37	34	42.5
2nd digit, metacarpal .....	79	83	79	88
„ 1st phalanx .....	18	19.5	18	24
„ 2nd-3rd phalanx, c. u..	18	18.5	17	20.5
3rd digit, metacarpal .....	102	112.5	111	118
„ 1st phalanx .....	74.5	80	77.5	88.5
„ 2nd phalanx .....	102.5	112	115	119
4th digit, metacarpal .....	99	107	110.5	114.5
„ 1st phalanx .....	60	63.5	63	73.5
„ 2nd phalanx.....	58.5	62.5	63	68.5
5th digit, metacarpal .....	105	114.5	112	118.5
„ 1st phalanx .....	44	47.5	44.5	55.5
„ 2nd phalanx .....	41.5	46	45.5	53
Ears, length from orifice.....	(25†)	(27†)		29.5†
„ greatest width, flattened ...	(16.5†)	(17.5†)		19†
Front of eye to tip of muzzle .....	...	...		29.5†
Interfemoral .....	...	...		13.5†
Lower leg .....	73	75.5	72	78
Foot, c. u. ....	...	...	52	53
Calcar.....	...	...		21.5†

\* See P. & F. Sarasin, *Reisen in Celebes*, i. map 6 (1905).

† Estimate from dried skins.

‡ Measurements from one alcoholic specimen (94.7.4.1).

Measurements of skulls and teeth of *Pteropus aterrimus* and *alecto*.

	<i>Pt. aterrimus</i> . Skulls: 3 ad. Teeth: 3 ad., 3 imm. (Paratypes of <i>Pt. baveanus</i> .)		<i>Pt. alecto</i> . Skulls: 6 ad. Teeth: 6 ad., 2 imm. (Incl. type.)	
	MIN.	MAX.	MIN.	MAX.
Skull, total length to gnathion .....	69	71.7	70.5	73.8
„ palation to incisive foramina .....	34.5	34.8	35.3	37
„ front of orbit to tip of nasals .....	24	25	24.2	27.2
„ width of brain-case at zygomata .....	23.8	25	25	25.8
„ zygomatic width.....	35.2	39	38	39
„ width across $m^1$ , externally.....	18.8	19.8	19	21.2
„ lachrymal width .....	14.8	15.8	14.8	16.8
„ width across canines, externally .....	13.7	14.8	14.2	15
„ postorbital constriction .....	7.3	7.7	7.8	9.2
„ interorbital constriction .....	8.7	10	9	10
„ width of mesopterygoid fossa .....	8	8	8.7	9
„ between $p^1$ - $p^4$ , internally.....	10.2	11	10.3	11.7
„ between cingula of canines .....	7.8	8.7	8	8.8
„ orbital diameter .....	13.7	13.9	14.2	14.8
Mandible, length .....	54.7	56.5	55.5	59.8
„ coronoid height .....	24.7	25.7	26.5	28.2
Upper teeth, $c$ - $m^2$ .....	26.8	27	26.7	29.7
Lower teeth, $c$ - $m_3$ .....	29.8	30.2	30.2	33.8
Upper incisors, combined width.....	6	7.2	6.2	6.6
$p^3$ , length .....	4.3	4.7	4.2	5
„ width .....	3.2	3.8	3.2	3.8
$p^4$ , length .....	4.6	5.1	4.2	4.8
„ width .....	3.7	4.1	3.7	4.2
$m^1$ , length .....	5.5	6	4.8	5.7
„ width .....	3.2	3.8	3.2	3.9
$m^2$ , length .....	2.9	3.1	2.2	3
„ width .....	2.3	2.8	2	2.8
$p_1$ , length .....	2	2.2	1.8	2.2
„ width .....	1.7	2	1.7	2
$p_3$ , length .....	4.8	5	4.2	5.1
„ width .....	3	3.5	2.8	3.5
$p_1$ , length .....	4.8	5.1	4.5	5
„ width .....	3.3	3.8	3.2	4
$m_1$ , length .....	5	5.7	4.6	5.2
„ width .....	3.1	3.8	3.2	4
$m_2$ , length .....	3.8	4	3.2	3.8
„ width .....	3.1	3.6	3	3.7
$m_3$ , length .....	2.1	2.7	1.8	2.2
„ width .....	2	2.2	2	2.1

71. *Pteropus morio*, K. And.

*Pteropus gouldi* (?) (*nec* *Pet.*), Thomas, Nov. Zool. iv. p. 263 (1897: Savu).

*Pteropus morio*, K. Andersen, Ann. & Mag. N. H. (8) ii. p. 369 (1 Oct. 1908: Sumba; Savu).

*Diagnosis*.—Similar to *Pt. alecto* but much smaller, and with conspicuously longer fur. Forearm 141.5 mm. *Hab.* Sumba and Savu Is.

*Fur*.—Much longer than in *Pt. alecto*, about 16–17 mm. on back, mantle, and belly. Least width of furred area of back about 32 mm. Distribution of fur as in the allied species.

*Colour*.—Not differing essentially from that of *Pt. alecto*, except in the rather paler tinge of the back. Back seal-brown slightly lightened by dark vandyck-brown tips to most of the hairs, and sprinkled with a few whitish hairs. Rump conspicuously washed with pale vandyck-brown, owing to the brownish tips to the hairs being longer and paler than on back.—Underparts as in *Pt. alecto*, but with a slight tinge of vandyck-brown on sides of anal region, and with concealed bases of hairs more nearly seal-brown instead of blackish.—Mantle deep chocolate with blackish bases to the hairs. Sides of neck, foreneck, and head as in *Pt. alecto*.

*Sexual differentiation*.—Presumably as in *Pt. alecto*. The type of *Pt. morio*, an aged female (teeth excessively worn), has the hair of the mantle soft and spreading as in females of *Pt. alecto* and *gouldi*; adult males not seen.

*Measurements*. On pp. 373, 374.

*Specimens examined*. Four, as registered below.

*Range*. Sumba Island; Savu Island.

*Type* in collection.

*Breeding-time*.—A female, from Sumba Island, killed in October, had "one full-grown young" (collector's label, British Museum, 98.11.3.15). Three specimens collected in the Savu Islands in August are not full-grown (forearm about 120 mm.).

a. ♀ ad. sk.; skull.	Waingapo, Sumba; Oct. 1896.	A. Everett [C.]	98.11.3.15. (Type of species.)
b-d. ♂ juv., 2 ♀ juv. sks.; skulls.	Savu; Aug. 1896.	A. Everett [C.]	8.7.26.1-3.

72. *Pteropus gouldi*, *Pet.*

*Pteropus gouldi*, Dobson, Cat. Chir. B. M. p. 60.

*Pteropus finereus* (*nec* Temm.), Gray, List Mamm. B. M. p. 37 (1843: Pt. Essington); *id.*, List Ost. Specim. p. 10 (1847: Australia); Gerrard, Cat. Bones Mamm. B. M. p. 55 (1862: Australia); Gould, Mamm. Austr. iii. p. 30, pl. xxx. (animal) (1863: N. Australia); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 407 (pt.) (1870: Pt. Essington); Gray, Cat. Monk. &c. p. 104 (1870: Pt. Essington; N.E. Australia; Hewitt's group; Celebes, errore); Ramsay, Proc. Linn. Soc. N. S. Wales, ii. p. 8 (1878: Cape York; Bet I.); P. L. Selater, P. Z. S. 1896, p. 608.  
*Pteropus gouldi*, Peters. MB. Akad. Berl n. 1867, p. 703 (Rock-

hampton); *Dobson, Cat. Chir. B. M.* p. 60 (1878: Quail I.; Howick's group; Gould I.; Percy I.); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 292 (1879: Cape York; Quail I.; Howick's Is.; Gould I.; Percy I.); *Collett, Zool. Jahrb.* ii. p. 843 (1887: Mackay); *Jentink, Cat. Syst. Mamm.* p. 149 (1888: C. York); *Ogilby, Cat. Austr. Mamm.* p. 79 (1892: N.E. Australia); *Collett, P. Z. S.* 1897, p. 319 (N. Australia: Daly R., Pt. Darwin); *Lucas, Proc. R. Soc. Queensland*, xii. p. 51 (1897); *Dahl, Zoologist*, (4) i. p. 190 (1897: N. Australia; habits); *Trouessart, Cat. Mamm.* i. p. 82 (1897: N. Australia); *Seabra, Journ. Sci. Math. Lisboa*, (2) v. no. 19, p. 168, pl. i. fig. 7 (palate-ridges) (1898); *Matschie, Megachir.* p. 18, pl. vii. figs. 2, 2a, 2b (skull: Rockhampton) (1899: Thursday I.; Rockhampton); *Trouessart, Cat. Mamm., Suppl.* p. 51 (1904: Queensland; Torres Str. Is.); *Miller, Fam. & Gen. Bats*, p. 58 (1907).

† *Pteropus edulis* (pt., *nec Geoff.*), *J. Anderson, Cat. Mamm. Ind. Mus.* pt. i. p. 100 (1881: S. Australia).

*Diagnosis*.—Similar to *Pt. alecto*, but with narrower palate and rostrum, weaker dentition, somewhat longer ears, and longer fur. Blackish above and beneath, thinly sprinkled with whitish or buffy; mantle chocolate. Forearm 153–180 mm. *Hab.* N. and N.E. Australia.

*Skull and teeth*.—Skull much like that of *Pt. alecto*, but (probably owing to reduced size of teeth) palate narrower and rostrum more compressed laterally: maxillary width externally across  $m^1$ – $m^1$  17.3–19 mm., against 19–21.2 mm. in *Pt. alecto* with similar size of skull.—General characters of teeth the same as in *Pt. alecto*, but dentition averaging markedly weaker, the reduction in the size of the teeth being especially noticeable in  $p^3$ ,  $p^4$ ,  $m^2$ ,  $p_3$ ,  $p_4$ ,  $m_1$ ,  $m_2$ , and rather more in the width than the length of the teeth (compare measurements, pp. 369 and 374).

*Ears*.—Relatively somewhat larger than in *Pt. alecto*, but not differing in shape. Outer margin flatly concave in upper third, tip rather narrowly rounded off.

*Fur*.—Longer than in *Pt. alecto*. Approximate length, back 11–14, mantle 14–18, belly 13–15 mm. Distribution of fur as in the allied species.

*Colour*.—Mantle chocolate or chestnut-chocolate, in shoulder region often lightened with yellowish ochraceous; hairs uniform to base or with extreme base blackish. Head, back, rump, and entire underside blackish, glossy on back and rump, dull on underparts, thinly sprinkled on back and rump with greyish-white, on underparts with greyish-buffy hairs. Base of hairs of crown in some specimens vandyck-brown or chocolate, in others blackish like tips of hairs. Region round eyes washed with dark vandyck-brown or chocolate.

*Sexual differentiation*.—As in *Pt. alecto*.

*Measurements*. On pp. 373, 374.

*Specimens examined*. Twenty-eight, in the collections of the Berlin and British Museums, including the cotypes of the species.

*Range*. Queensland, south at least to Rockhampton, and including Torres Straits islands and islands off eastern coast of Queensland:

Northern Territory (Pt. Essington, Alligator R., Pt. Darwin, Daly R.).

*Cotypes* in the Berlin Museum.

*Habits*.—In North Australia this Flying Fox spends the day in the mangroves or in the bamboo jungles along the water-courses, assembled in flocks numbering several thousands. A camp is never perfectly quiet, even in the middle of the day numbers are flitting about in and around the trees, uttering their hoarse shrieks. The buzzing noise issuing from one of these camping grounds when heard at a distance may be compared to that of a gigantic beehive, and the clamour of the colony when disturbed is deafening. Although by no means numerous, at least one of these camps may be found on any large river in N. Australia, and its numbers comprise probably nearly all the individuals of a considerable district. At sundown the bats commence travelling, sometimes great distances, to reach a patch of the forest where the Eucalypts are in blossom, the flowers of these trees forming their principal food. A constant string of animals is then for hours issuing from the camp, and the observer who posts himself on their roving route may to a certain extent form an idea of their numbers. By this means the number of individuals issuing from a large camping ground on the bank of the Victoria River, N. Australia, was estimated at about 32,000, an average of 300 passing every minute for nearly two hours. On another occasion this species was observed in countless numbers, towards dusk, flying from the mainland (Cape York) to islands in the Straits, and returning in the early part of the morning on their way to the scrubs. Young are born in N. Australia in March and April, and in August many of the females have young of considerable size attached to the breasts (compare *Pt. morio*). The fat flesh of this species is considered a great delicacy by the aborigines, notwithstanding its strong smell of *Eucalyptus*. Being of a pugnacious and irritable temper, a wounded *Pt. gouldi* will sometimes attack the legs of the hunter, and disturbed in their feeding-ground or in the camp the bats exude their stinking excrements on the intruder. (Knut Dahl, 1897; Pierson Ramsay, 1878; *U. s. c.*).

*Pteropus gouldi*, Peters: 1867.—Type locality, Rockhampton, Queensland. Two cotypes, viz., an adult female, mounted, skull separate (Berlin Museum, no. 3408), and a young specimen of the same sex, skin in alcohol, skull loose in skin (3409), both from the Godeffroy Museum. The skull of cotype 3408 is the original of pl. vii. fig. 2 in 'Megachiroptera des Berliner Museums.'

a. Jun. skull.	Gould Coll.	46.4.4.83.
b. Jun. sk.; skull.	Gould Coll.	53.10.22.1.
c. Ad. skull.	Dr. F. M. Rayner [P.].	62.2.8.11.
d, e. Ad. skull; ♀ ad. sk., skull.	Howick group (H.M.S. 'Rattlesnake'; J. MacGillivray).	Capt. Stanley [P.]. 59.7.20.57. 50.7.20.131.
f. Jun. sk.; skull.	Gould I. (H.M.S. 'Fly').	Dr. J. B. Jukes [P.]. 44.7.19.33.



<i>g.</i> ♂ ad. sk.; skull.	Percy I.; Sept. 1859 (H.M.S. 'Herald').	Capt. Denham [C.]	74.3.16.1.
<i>h.</i> Yg. ad. skull, skeleton.	Percy I.; May, 1881 (H.M.S. 'Alert').	Dr. Coppinger [C.]	81.10.28. 1 bis.
<i>i-m.</i> ♂ ad., ♂ juv. ♀ ad., 2 ♀ juv. sks.; skulls.	Inkerman, N. Queensland; Apr., 9, 13 Oct. 1907 ( <i>H. Stalker</i> ).	Sir W. Ingram & Hon. J. Forrest [P.]	7.8.9.1-3. 8.8.8.11, 12.
<i>n.</i> ♂ ad. sk.; skull.	Mt. Elliot, Townsville, N. Queensland, 100'; Dec. 1907 ( <i>W. Stalker</i> ).	Sir W. Ingram & Hon. J. Forrest [P.]	8.8.8.13.
<i>o-t.</i> ♂ pull., 5 ♀ pull. al.	(N. Australia Expedition.)	Dr. J. R. Elsey [P.]	57.10.24.5-9.
<i>u, v.</i> ♂ ad., 1 juv. sks.; skulls.	Quail I., N. Territory (N. Australia Exp.).	Dr. J. R. Elsey [P.]	57.10.24.2, 4.
<i>w.</i> ♂ ad. sk.; skull.	Pt. Essington, N. Territory.		128, <i>a.</i>
<i>x.</i> [♀] ad. sk.; skull.	Pt. Essington.	Capt. W. Chambers [P.]	42.1.13.122.
<i>y, z.</i> ♂ ad., ♀ ad. sks.; skulls.	Alligator R., N. Territory; 6 Oct. 1903 ( <i>J. T. Tunney</i> ).	Hon. W. Rothschild [P.]	4.4.4.1, 2.

*External measurements of Pteropus morio and gouldi.*

	<i>Pt. morio.</i> ♀ ad. Type.	<i>Pt. gouldi.</i> 10 ad.	
	mm.	mm.	mm.
Forearm .....	141.5	153	180
Pollex, total length, c. u. ....	60.5	62	74
" metacarpal .....	14	15	17
" 1st phalanx .....	32.5	32	39.5
2nd digit, metacarpal .....	74	72	90
" 1st phalanx .....	17.5	18	22
" 2nd-3rd phalanx, c. u. ....	15.5	16	20
3rd digit, metacarpal .....	101.5	101	119
" 1st phalanx .....	75.5	75	89
" 2nd phalanx .....	112.5	103	129
4th digit, metacarpal .....	98.5	98	115
" 1st phalanx .....	61	60.5	74
" 2nd phalanx .....	...	65	75
5th digit, metacarpal .....	102	105	124.5
" 1st phalanx .....	45.5	46.5	56
" 2nd phalanx .....	42.5	47	59.5
Ears, length from orifice .....	(27*)	(30*)	(32*)
" greatest width, flattened .....	(17*)	(20*)	(21.5*)
Lower leg .....	? 68	73	80
Foot, c. u. ....	48.5	49	57
Calcaneal .....	? 14.5	21	24.5

\* Estimate from dried skins.

*Measurements of skulls and teeth of Pteropus morio and gouldi.*

	<i>Pt. morio.</i> ♀ ad. Type.*	<i>Pt. gouldi.</i> Skulls: 11 ad. Teeth: 10 ad., 7 imm. (Brit. Mus. series.)	
		Min.	Max.
Skull, total length to gnathion .....	mm. 65.5	mm. 68	75.5
.. palation to incisive foramina .....	32	33.2	36
.. front of orbit to tip of nasals .....	21.8	24	28
.. width of brain-case at zygomata .....	23.7	24.5	26.5
.. zygomatic width .....	36.2	37	42.5
.. width across m <sup>1</sup> , externally .....	17.3	17.3	19
.. lachrymal width .....	14	14.7	16.8
.. width across canines, externally .....	13.7	12.8	15.7
.. postorbital constriction .....	7.8	7	9.7
.. interorbital constriction .....	9	9	10.8
.. width of mesopterygoid fossa .....	7.2	7.8	8.8
.. between p <sup>1</sup> -p <sup>1</sup> , internally .....	...	10.2	12.2
.. between cingula of canines .....	8	7	8.2
.. orbital diameter .....	13.2	14.2	14.7
Mandible, length .....	51.7	52.5	59.5
.. coronoid height .....	24.2	22.2	30
Upper teeth, c-m <sup>2</sup> .....	23.8	25	27.8
Lower teeth, c-m <sub>3</sub> .....	26.2	28.5	31.5
Upper incisors, combined width .....	6.5	5.9	6.8
p <sup>3</sup> , length .....	4.5	3.8	4.7
.. width .....	3.2	2.8	3.5
p <sup>1</sup> , length .....	...	4.1	4.8
.. width .....	...	3	3.8
m <sup>1</sup> , length .....	...	4.8	5.8
.. width .....	...	2.8	3.8
m <sup>2</sup> , length .....	...	1.8	2.8
.. width .....	...	1.6	2.2
p <sub>1</sub> , length .....	2.2	1.7	2.5
.. width .....	1.8	1.2	1.8
p <sub>3</sub> , length .....	4.5	4	4.8
.. width .....	2.8	2.6	3.1
p <sub>4</sub> , length .....	...	4	4.8
.. width .....	...	2.8	3.5
m <sub>1</sub> , length .....	...	4.3	5.1
.. width .....	...	2.8	3.5
m <sub>2</sub> , length .....	...	3.2	3.9
.. width .....	...	2.6	3.2
m <sub>3</sub> , length .....	...	1.7	2.7
.. width .....	...	1.7	2.1

\* Teeth much worn.

N. THE *PTEROPUS CONSPICILLATUS* GROUP.

*Species*.—*Pt. chrysauchen*, *conspicillatus*, *ocularis*.

*Range*.—Moluccas, New Guinea, N. Australia.

*General characters*.—Skull as in the *Pt. alecto* group, but heavier, and with unusually strong crests. Teeth relatively larger, but not differing in structure. Ears slightly larger, tip narrowly rounded off; interfemoral short or obsolescent in centre; length and distribution of fur as in *Pt. alecto*. Colour blackish above and beneath, with strongly contrasting light yellowish mantle and occiput; often pale spectacles. Sexual differentiation as in *Pt. alecto*. Size medium or large (forearm 135–181 mm.).

*Differentiation of species*.—*Pt. chrysauchen* (Gilolo group, N.W. New Guinea) and *Pt. conspicillatus* (S.E. New Guinea, N. Australia) are geminate species; the latter differs from the former in the slightly weaker dentition and pronounced pale spectacles, but traces of spectacles are sometimes easily detectable in *Pt. chrysauchen*. In relatively strong contrast to these two very closely related forms stands the much smaller Ceram species, *Pt. ocularis*.

*Affinities of group*.—The *Pt. conspicillatus* replaces the *Pt. alecto* group in the Moluccas and New Guinea. The only differential characters, as compared with the *alecto* group, are the rather larger and more narrowly pointed ears, shorter interfemoral, and much paler mantle.

73. *Pteropus chrysauchen*, *Pet.*

*Pteropus alecto* (pt.), Dobson, *Cat. Chir. B. M.* p. 56.

*Pteropus chrysauchen*, *Peters, MB. Akad. Berlin*, 1862 (14 Aug.), p. 576, footnote (Batchian); *Matschie, Megachir.* p. 18 (1899: Morotai; Ternate; Batchian; Ghebi; Pinon I.; Dorei, N.W. New Guinea; Hum I., N.W. New Guinea); *id.*, *Krieger's Neu-Guinea*, p. 77 (1899: N. New Guinea); *Trouessart, Cat. Mamm., Suppl.* p. 50 (1904: Morotai; Ternate; Batchian; Gilolo; Mysol; N.W. New Guinea); *Willink, Nat. Tijds. Nederl. Ind.* lxx, p. 273 (pt.) (1905: Morotai; Ternate; Batchian; Gilolo; Salawati; Mysol); *Jentink, Notes Leyden Mus.* xxviii, pp. 163, 209 (1906: Gilolo group; Pinon I.; Dorei); *id.*, *Nora Guinea*, v. (Zool.) p. 361 (1907: Schouten Is.).

*Pteropus alecto* (*nec Temm.*), *Peters, MB. Akad. Berlin*, 1867, p. 329 (pt.) (Morotai; Ternate; Batchian; Ghebi); *id.*, *MB. Akad. Berlin*, 1876, p. 318 (Pinon I.); *Dobson, Cat. Chir. B. M.* p. 56 (pt.) (1878: Ternate; Batchian; Mysol); *Trouessart, Rev. & Mag. Zool.* (3) vi, p. 202 (pt.) (1879: Morotai; Ternate; Batchian; Ghebi; Mysol; Pinon I.); *Peters & Doria, Ann. Mus. Civ. Genova*, xvi, p. 689 (pt.) (1881: Salawati); *Jentink, Cat. Ost. Manum*, p. 260 (pt.) (1887: Morotai; Gilolo; Obi; Ghebi; Mysol); *id.*, *Cat. Syst. Mamm.* p. 147 (pt.) (1888: Morotai; Gilolo; Obi; Ghebi; Mysol; Dorei); *Trouessart, Cat. Mamm.* i, p. 82 (pt.) (1897: Morotai; Ternate; Batchian; Ghebi; Pinon I.); *Heller, Abh. Mus. Dresden*, vi, no. 8, p. 4 (pt.) (1897: Mysol; Dorei; MacCluer Bay); *Matschie, Megachir.* pl. vi, figs. 1, 1 a, 1 b (skull) (1899: Ternate).

*Pteropus mysolensis*, Gray, *Cat. Monk. &c.* p. 105 (1870: Mysol; Ternate).

*Diagnosis*.—Allied to *Pt. alecto*, but skull larger, with relatively heavier rostrum, stronger crests, greater zygomatic width, and larger orbits; cheek-teeth much larger, canines unusually long. Distribution and length of fur as in *Pt. alecto*. Head (as far back as ears), back, rump, and underparts blackish; occiput, mantle, and sides of neck strongly contrasting yellowish buff; circum-ocular region and sides of rostrum sometimes washed with paler colour. Forearm about 175–180 mm. *Hab.* Gilolo group; N.W. New Guinea.

*Skull*.—General characters as in *Pt. alecto*, but larger and more heavily built: total length 74–79 mm., against 70·5–74 in *Pt. alecto*, mandible 60–66, against 55·5–60, orbit 16–16·5, against 14·2–14·8. Rostrum considerably broader, less compressed laterally; lachrymal width of skull (across anterior orbital margins, at base of lachrymal foramina) 17·2–18·2 mm., against 14·8–16·8 in *Pt. alecto*; width across external surfaces of upper canines 16–17, against 14–15. Sagittal crest well developed even in immature individuals, in aged specimens unusually deep; postorbital processes often reaching to within short distance of corresponding small processes on zygoma; base of postorbital processes very strong, raised considerably above level of median frontal region, making this latter deeply concave; zygomatic arches much flaring posteriorly. Heavy rostrum, strong development of crests, and great zygomatic width, as compared with *Pt. alecto*, probably due to much heavier dentition. Coronoid moderate, somewhat sloping; coronoid height of mandible less than  $e-m_3$ ; condyle considerably above level of alveolar line of mandible.

*Teeth*.—Upper canines unusually long (from alveolar border to tip 11·8–13 mm., against 9–10 in *Pt. alecto*), heavy at base, crown nearly straight; cingulum moderate, forming a well defined but narrow rim at inner and posterior base of crown; median longitudinal ridge on lingual face of crown sharply projecting; vertical groove on front face deep and broad. Lower canines very long, slightly recurved; cingulum narrow; vertical groove on outer face of crown deeper and more sharply defined than in *Pt. alecto*. Cheek-teeth much longer than in *Pt. alecto*; length (longitudinal axis of crown) of  $p^1$  4·9–5·7, against 4·2–4·8, of  $m^1$  5·7–6·7, against 4·8–5·7, of  $p_4$  5·5–5·8, against 4·5–5, of  $m_1$  5·5–5·8, against 4·6–5·2, of  $m_2$  3·8–4·8, against 3·2–3·8; width of cheek-teeth very nearly as in *Pt. alecto*. Structure of premolars, above and below, as in *alecto*; posterior ledge extremely small or undeveloped in  $p^3$  and  $p_3$ , absent in  $p^4$ ,  $m^1$ ,  $p_4$ ,  $m_1$ , and  $m_2$ .

*Palate-ridges*.—5+5+3; arrangement as in *Pt. hypomelanus* (p. 101) and *Pt. alecto*. Occasionally a trace of an additional ridge between the normal 9th and 10th ridges.

*Ears*.—Relatively slightly longer than in *Pt. alecto*, nearly reaching back of eye. Outer margin flatly concave above, tip of ear narrowly rounded off.

*Wings*.—Membranes about 25 mm. apart at origin from back.

*Interfemoral*.—Short or undeveloped in centre.

*Fur*.—Very short and closely adpressed on back. Length of fur, back 7-9, mantle and belly 10-12 mm. Width of furred area at middle of back 30-38 mm. Distribution of fur as in *Pt. alecto*; forearm and tibia naked above and beneath.

*Colour*.—British Museum series (see list below):—Back and rump glossy blackish, with or without a tinge of blackish seal-brown, in most specimens thinly and rather inconspicuously sprinkled with silvery-white hairs.—Chin, throat, foreneck along middle line, breast, belly, and flanks blackish seal-brown, thinly or rather thickly mixed with coarse, more or less crinkled, yellowish or greyish hairs.—Mantle and occiput buff (palest extreme) or ochraceous-buff or orange-buff or golden ochraceous; the colour of the mantle extending, in the same or a slightly darker tinge, to sides of neck and sides of foreneck, being interrupted in the median line of the foreneck by a broader or narrower longitudinal tract of dark fur connecting dark throat and dark breast; buffy colour of sides of neck more or less mixed with blackish hairs. Colour of mantle sharply cut off from black of crown and back.—Forehead, crown (as far back as front of ears), and sides of head blackish like back, in some specimens thinly, in others more or less thickly mixed with buffy hairs. Sides of rostrum generally similar to crown, but in some specimens distinctly paler (compare *Pt. conspicillatus*), owing to a slight predominance of the yellowish over the blackish hairs.

Individual variation in colour small, chiefly dependent on the paler or deeper tinge of the mantle, and the thinner or thicker sprinkling of the blackish fur with pale hairs.

*Sexual differentiation*.—Fur of mantle in males rigid and unctuous, in females softer, more spreading. Hairs of mantle in males yellowish from tip to base, in females with rather long, concealed, blackish or seal-brown bases.

*Measurements*. On pp. 382, 383.

*Specimens examined*. Nine, in the collections of the Berlin and British Museums, including the type of the species and of *Pt. mysolensis*.

*Range*. Gilolo group (Morotai, Ternate, Batchian, Obi); islands between Gilolo and New Guinea (Ghebi, Salawati, Mysol); N.W. New Guinea (Dorei, Pinon I., Schouten Is.).

*Type* in the Berlin Museum.

*Pteropus chrysauchen*, Peters; 1862.—Type locality, Batchian; type a mounted adult female, skull *in situ*, purchased of Frank, Reg. no. 2270. The skull figured in 'Megachiroptera des Berliner Museums' (pl. vi. fig. 1, *Pt. alecto* on plate) is that of a mounted young female in the Berlin Museum, from Ternate, collected by Bernstein, and acquired from the Leyden Museum, Reg. no. 4776.—Only a few years later (1867), Peters considered *Pt. chrysauchen* inseparable from *Pt. alecto*; the same view was taken by Dobsen (1878). The species was restored by Matschie. It is, in fact, much more closely related to *Pt. conspicillatus* than to *Pt. alecto*.

*Pteropus mysolensis*, Gray; 1870.—Based on two specimens collected by A. R. Wallace, the one in Mysol (♀ jun., 61.12.11.1), the other in Ternate (♀ jun., 60.8.26.11). Gray was evidently unacquainted with Peters's description of *Pt. chrysauchen*; there is no reference to this latter name in Gray's 'Catalogue' of 1870, and *Pt. mysolensis* is in reality a new name of *Pt. chrysauchen*. The Mysol specimen may be fixed as the type. It is apparently inseparable from Ternate and Batchian individuals; the mantle is deeper in colour (golden ochraceous) than in any specimen I have seen from Ternate and Batchian, but this probably only because these latter do not show the extremes of individual variation in this respect; in the closely allied *Pt. conspicillatus* the mantle varies from cream-buff to deep golden ochraceous.—Gray's "*Pt. mysolensis* var. *ceramensis*" (Cat. Monk. &c. p. 105, 1870) is a distinct species, *Pt. ocularis* (infra, p. 381).

a. ♀ jun. sk.; skull.	Ternate.	Dr. A. R. Wallace	60.8.26.11. [C].
b. ♂ jun. sk.; skull.	Batchian.	Dr. A. R. Wallace	60.1.10.3. [C].
c, d. ♂ ad., [♂] jun. sks.; skulls.	Batchian (Dr. A. R. Wallace).	Tomes Coll.	7.1.1.241, 242.
e-g. ♂ ad., ♀ ad., [♀] imm. sks.; skulls.	Batchian.	Dr. A. B. Meyer	76.1.4.1-3. [C].
h. ♀ jun. sk.; skull.	Mysol.	Dr. A. R. Wallace	61.12.11.1. [C]. (Type of <i>Pt. mysolensis</i> , Gray.)

#### 74. *Pteropus conspicillatus*, Gould.

*Pteropus conspicillatus*, Dobson, Cat. Chir. B. M. p. 61.

*Pteropus conspicillatus*, Gould, P. Z. S. 1849, p. 109 (1850: Fitzroy I.; habits); Temminck, Esq. Zool. p. 57 (1853: Fitzroy I.); Wagner, Schreber's Säug., Suppl. v. p. 597 (1853-55: Fitzroy I.); Gervais, Hist. Nat. Mamm. i. p. 188 (1854); Giebel, Säug. p. 996, footnote (1855: Fitzroy I.); Gerrard, Cat. Bones Mamm. B. M. p. 56 (1862: Australia); Gould, Mamm. Austr. iii. p. 29, pl. xxix. (col. fig.) (1863: Fitzroy I.; habits); Krefft, Cat. Mamm. Austral. Mus. p. 5 (1864: Pt. Essington); Peters, MB. Akad. Berlin, 1867, p. 324 (Fitzroy I.); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 424 (1870: Fitzroy I.); Gray, Cat. Monk. &c. p. 103 (1870: Fitzroy I.); Ramsay, Proc. Linn. Soc. N. S. Wales, ii. p. 7 (1878: Rockingham Bay; Yule I.); Dobson, Cat. Chir. B. M. p. 61 (1878: Fitzroy I.; Rockingham Bay; Yule I.); Trouessart, Rev. & Mag. Zool. (3) vi. p. 202 (1879: N.E. Australia; Yule I.); Ramsay, Proc. Linn. Soc. N. S. Wales, iii. p. 242 (1879: South Cape, Brit. New Guinea; Constance I.; food); id., op. cit. iv. p. 85 (1879: Pt. Moresby); Flower & Lydekker, Mamm. p. 651 (1891); Ogilby, Cat. Austr. Mamm. p. 80 (1892: N.E. Australia; Yule I.); Thomas, Nov. Zool. iii. p. 526 (1896: Kiriwina I.); id., Ann. Mus. Civ. Genova, (2) xviii. p. 608 (1897: Grange I., S.E. New Guinea; Woodlark I.); Trouessart, Cat. Mamm. i. p. 82 (1897: N.E. Australia; Yule I.; New Guinea); Lucas, Proc. R. Soc. Queensl. xii. p. 51 (1897); Heller, Abh. Mus. Dresden, vi. no. 8, p. 4 (1897: Yule I.; Trobriand Is.); Matschie, Megachir. p. 18, pl. ix. figs. 4, 4a,

4*b* (skull) (1899: Bongu, Astrolabe Bay; Madang, German New Guinea; Yule I.; Woodlark I.; Fitzroy I.); *id.*, *Krieger's Neu-Guinea*, p. 77 (1899: S. New Guinea); *id.*, *Semon, Zool. Forsch. Austr. Malay. Arch.* p. 774 (1903: Cooktown); *Trouessart, Cat. Mamm., Suppl.* p. 50 (1904: S.E. & E. New Guinea: Kiriwina I.; Woodlark I.; Fitzroy I.); *Jentink, Notes Leyden Mus.* xxviii. pp. 163, 209 (1906: Bongu; Madang); *Miller, Fam. & Gen. Bats*, p. 58 (1907).

*Pteropus alecto* (pt., *nec Temm.*), *Peters & Doria, Ann. Mus. Civ. Genova*, xvi. p. 689 (1881: Yule I.); *Heller, Abh. Mus. Dresden*, vi. no. 8, p. 4 (1897: Yule I.).

Flughunde, *Semon, Im austr. Busch*, p. 285 (1896: camp near Cooktown).

*Diagnosis*.—Closely allied to *Pt. chrysauchen*, but dentition rather weaker, and circumocular space and sides of muzzle considerably paler in colour, forming distinct "spectacles." Forearm 157–181 mm. *Hab.* S.E. New Guinea with adjacent islands; N. and N.E. Australia.

*Skull and teeth*.—Skull scarcely differing from that of *Pt. chrysauchen*, except perhaps in a slightly smaller average size of the orbits (15–16 mm., against 16–16.5). Largest cheek-teeth averaging rather weaker than in *Pt. chrysauchen*: length of  $m^1$  5.6–6.2 mm., against 5.7–6.7, of  $p_4$  4.8–5.5, against 5–5.8, of  $m$ , 4.5–5.5, against 5–5.8.

*Colour*.—As in *Pt. chrysauchen*, but sides of muzzle and hairs round eyes ochraceous-buff, forming conspicuous spectacles, sometimes slightly sprinkled with brownish or blackish hairs; crown and sides of head blackish thinly mixed with greyish or buffy hairs; blackish colour of crown extending forward in an acutely triangular patch between pale superciliaries to base of rostrum. Mantle and occiput varying from cream-buff washed with buffy in the centre (palest extreme), through ochraceous-buff or rich orange-buff, to golden ochraceous.

*External dimensions*.—As *Pt. chrysauchen*, but with metacarpals and phalanges averaging somewhat shorter. The variation in size, among individuals obtained within the same zoogeographical area, is considerable: the type of the species ( $\sigma$  ad.), from Fitzroy Island, N.E. Queensland, is the smallest individual in the series examined (forearm 157 mm.); a specimen ( $\sigma$  ad.) from Cooktown, N.E. Queensland, closely approaches the maximum of size (forearm 176 mm.). The variation in the size of the teeth does not go parallel to the variations in external dimensions; large-sized individuals may have small teeth, and *vice versa*.

*Sexual differentiation*.—As in *Pt. chrysauchen*.

*Measurements*. On pp. 382, 383.

*Specimens examined*. Eight, as registered below.

*Range*. German and British New Guinea (Bongu, Madang, Yule I., Pt. Moresby, Grange I., South Cape); islands off S.E. New Guinea (Kiriwina, Woodlark, Alcester Is.); Torres Straits Islands (Nepean I.); N. Queensland (Cooktown, Rockingham Bay, Fitzroy I.); Arnhemland (Pt. Essington).

*Type* in collection.

*Habits*.—In 1848, John MacGillivray found this species in “prodigious numbers” on the wooded slope of a hill on Fitzroy Island, N.E. Queensland; many of the branches were bending under the load of bats, some in a state of inactivity suspended by their hind claws, others scrambling along among the boughs and taking to wing when disturbed, looking while flying like a large flock of rooks; on close approach a strong musky odour became apparent, and a loud incessant chattering was heard. When wounded, these large bats are handled with difficulty, as they bite severely, and on such occasions their cry reminds one of the squalling of a child. In S.E. New Guinea this species has been observed feeding on the fruits of fig-trees. Apart from man, its chief enemy in Australia is *Uroaëtus aedua*. (J. MacGillivray, *ap.* Gould, *l. s. c.* 1850; Ramsay, *l. s. c.* 1879; Semon, *l. s. c.* 1896.)

*Remarks*.—*Pt. conspicillatus* is undoubtedly an eastern representative of *Pt. chrysauchen*. Of both species the available series are small, and, so far as they go, there is in fact no difficulty in referring the individuals to the one or the other form. But it should be remembered that the differences in skull (size of orbits), dentition (size of teeth), and length of metacarpals and phalanges, even if they prove good on examination of larger material, which in all probability they will, are only trivial average differences, and that the most conspicuous character of *Pt. conspicillatus*, the pale spectacles, is sometimes more or less distinctly indicated in *Pt. chrysauchen*; further, that *Pt. chrysauchen* extends south-east to N.W. New Guinea, *Pt. conspicillatus* north-west to S.E. New Guinea, and that the geographical line between these forms in New Guinea is as yet unknown. It appears highly probable that *Pt. chrysauchen* and *conspicillatus* merge into one another in some intermediate region of New Guinea. The facts that *Pt. conspicillatus* in the Australian continent is confined to N. Queensland and Arnhemland, that it occurs also in S.E. New Guinea and adjoining islands, and that it has its closest relative in N.W. New Guinea and the Gilolo group, would seem to be evidence that it is a comparatively recent immigrant into the Australian continent.

- |  |   |                                 |  |
|--|---|---------------------------------|--|
| a. ♂ ad. al.;<br>skull.                  | Grange I., Table Bay,<br>Brit. New Guinea;<br>March 1890 ( <i>Dr. L.</i><br><i>Loria</i> ). | Genoa Museum [P.].              | 97.8.7.1.  |
| b. c. ♂ ad., [♀]<br>ad. sks.;<br>skulls. | Kiriwina I., Trobriand<br>Group; 12 March,<br>1895.   | A. S. Meek [C.].                | 96.11.5.2, 3.  |
| d. ♂ jun. al.                            | Woodlark I.; March,<br>1890 ( <i>Dr. L. Loria</i> ).  | Genoa Museum [P.].              | 97.8.7.2.  |
| e. ♂ ad. al.;<br>skull.                  | Alcester Is.; 14 Aug.,<br>1904 ( <i>Dr. C. G.</i><br><i>Seligmann</i> ).                    | Major W. Cooke<br>Daniels [P.]. | 5.6.5.1.   |
| f. Juv. skull.                           | Nepean I., Torres<br>Straits.   | H. Cuning.                      | 62.5.6.3.  |
| g. ♂ ad. sk.;<br>skull.                  | Australia.  | Gould Coll.                     | 53.10.22.30.<br>(Figured in Gould, <i>Mamm. Austr.</i> , <i>l. s. c.</i> ) |



- h. ♂ ad. sk.: Cooktown, N.E. Queens- H. C. Robinson, Esq. 0.5.30.1.  
 skull. land; 8 July, 1899. [P].  
 i. ♂ ad. sk.: Fitzroy I., N.E. Queens- Voy. H.M.S. 'Rattle- { 50.7.20.56.  
 skull. land; June, 1848. snake? { 50.9.6.16.  
 (Type of species.)

### 75. *Pteropus ocularis*, Pet.

*Pteropus alecto* (pt.), Dobson, Cat. Chir. B. M. p. 56.

*Pteropus ocularis*, id., op. cit. p. 62.

*Pteropus ocularis*, Peters, MB. Akad. Berlin, 1867 (27 May), p. 326 (Ceram); Dobson, Cat. Chir. B. M. p. 62 (1878: Ceram); Trouessart, Rev. & Mag. Zool. (3) vi. p. 203 (1879: Ceram); Thomas, P. Z. S. 1888, p. 471, footnote (remarks on type); Trouessart, Cat. Mamm. i. p. 82 (1897: Ceram); Matschie, Megachir. pl. iv. figs. 5, 6 (skull) (1899: Ceram).

*Pteropus* (Spectrum) hypomelanus d. *ocularis*, Matschie, Megachir. p. 24 (1899: Ceram). c. *ocularis*, Trouessart, Cat. Mamm., Suppl. p. 52 (1904: Ceram).

*Pteropus mysolensis* var. *ceramensis*, Gray, Cat. Monk. &c. p. 105 (1870: Ceram).

*Pteropus alecto* (pt., nec Temm.), Dobson, Cat. Chir. B. M. p. 57, specimen g (1878: Ceram); Trouessart, Rev. & Mag. Zool. (3) vi. p. 202 (1879: Ceram); id., Cat. Mamm. i. p. 82 (1897: Ceram).

*Pteropus chrysauchen* (pt., nec Pet.), Willink, Nat. Tijds. Nederl. Ind. lxx. p. 273 (1905: Ceram).

**Diagnosis.**—Similar to *Pt. conspicillatus*, but much smaller, and with relatively somewhat smaller ears. General colour blackish above and beneath, with ochraceous-buff mantle and sides of neck, and broad cinnamon or cinnamon-rufous spectacles. Forearm 135 mm. *Hab.* Ceram.

**Skull and teeth.**—Similar in general shape to those of *Pt. conspicillatus*, but much smaller. See measurements, p. 383.

**Ears.**—Comparatively smaller than in the allied species, *Pt. chrysauchen* and *conspicillatus*, and tip more rounded off.

**Fur.**—Length, back about 13, mantle 13, belly 11 mm. Closely adpressed on back. Distribution of fur as in the allied species; forearm and tibia naked; a narrow line of hairs on upper side of interfemoral along proximal half of tibia.

**Colour** (type, adult male).—Back and rump uniform seal-brown. Chin, throat, foreneck, breast, belly, and flanks blackish seal-brown (darker than back), slightly and rather inconspicuously sprinkled with glossy silvery white or buffy hairs.—Mantle rich ochraceous-buff, approaching orange-buff, passing into buff on sides of neck, shoulder region, and occiput, where it is mixed with cinnamon.—A broad ring of cinnamon round eyes. Vertex blackish seal-brown, forming a transverse band in front of ears, continued forward in a narrow median line to muzzle, and downward over temporal region to throat, where it merges into the general seal-brown colour of underparts.

An immature male in the British Museum (type of *Pt. mysolensis*

var. *ceramensis*, Gray) is similar in colour to the type of the species, but the spectacles darker, more approaching cinnamon-rufous, and less sharply defined.

*Measurements.* Below and on p. 333.

*Specimens examined.* Two, in the collections of the Berlin and British Museums, including the type of the species.

*Range.* Ceram.

*Type* in the Berlin Museum.

*Pteropus ocularis*, Pet., 1867; and *Pt. mysolensis* var. *ceramensis*, Gray, 1870.—Two examples of the species described above were collected by Dr. A. R. Wallace in Ceram, probably in 1860, and together with other objects of natural history from the same collector sold by auction in London (Stevens's rooms) in 1861. The one went, direct or through some intermediary, to the Berlin Museum and was by Peters, in 1867 (*l. s. c.*), made the type of his *Pt. ocularis*. It is an adult male, mounted skin, skull extracted, Reg. no. 2958; skull figured in 'Megachiroptera des Berliner Museums' (*l. s. c.*). The other specimen, skin and skull of

*External measurements of Pteropus chrysauchen, conspicillatus, and ocularis.*

	<i>Pt. chrysauchen</i> ♂ ad. (Incl. type.)		<i>Pt. conspicillatus</i> 7 ad. (Incl. type.)		<i>Pt. ocularis</i> ♂ ad. Type.
	MIN.	MAX.	MIN.	MAX.	
	mm.	mm.	mm.	mm.	mm.
Forearm .....	175	179.5	157	181	135
Pollex, total length, c. u. ....	75	77.5	59	74	58
„ metacarpal .....	17	18	13	18	12
„ 1st phalanx .....	37	42.5	33	39.5	30
2nd digit, metacarpal .....	90	99.5	75.5	90.5	71
„ 1st phalanx .....	18	22	15.5	21	15
„ 2nd-3rd phalanx, c. u. ....	18	19	15.5	19	16
3rd digit, metacarpal .....	115.5	129	102.5	120.5	92.5
„ 1st phalanx .....	83	92	78	87	69.5
„ 2nd phalanx .....	120	140	103	129.5	...
4th digit, metacarpal .....	112	123.5	100	116.5	91
„ 1st phalanx .....	69	77	64	74.5	56.5
„ 2nd phalanx .....	...	...	59	76.5	...
5th digit, metacarpal .....	117	129	104	120.5	94
„ 1st phalanx .....	50	58	47	55.5	39.5
„ 2nd phalanx .....	51.5	56.5	49	57.5	36
Ears, length from orifice .....	...	...	33	36	...
„ greatest width, flattened ...	...	...	19	19	...
Front of eye to tip of muzzle ...	...	...	31	31.5	...
Interfemoral .....	...	2*	0	0	...
Lower leg .....	780	...	80.5	82.5	58.5
Foot, c. u. ....	53.5	58	51	59	...
Calcar .....	18*	21*	19*	23.5	...

\* Estimate, from skin.

*Measurements of skulls and teeth of Pteropus chrysauchen, conspicillatus, and ocellaris.*

	<i>Pt. chrysauchen.</i>		<i>Pt. conspicillatus.</i>		<i>Pt. ocellaris.</i>	
	Skulls: 3 ad.		Skulls: 7 ad.		Skull: type	
	Teeth: 3 ad,		Teeth: 7 ad.,		Teeth: type and	
	5 imm.		1 imm.		B. M. 61.12.	
			(Incl. type.)		11.2.	
	MIN.	MAX.	MIN.	MAX.	Type.	♂ imm.
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	74*	78.5	72	80	62*	...
" palation to incisive foramina .....	38.5	41.5	...	39.3	...	...
" front of orbit to tip of nasals .....	27.7	28	23.7	27.2	22	...
" width of brain-case at zygomatica....	27	27.8	25.8	29.5	23.5	...
" zygomatic width .....	46.8	46.8	40	47	35.8	...
" width across m <sup>1</sup> , externally.....	20.5	22.8	20.7	22	17	...
" lachrymal width .....	17.2	18.2	16.2	18.8	14	...
" width across canines, externally ....	16	17	14	16.3	12.7	...
" postorbital constriction .....	7.7	8.1	7.7	9.5	7.7	...
" interorbital constriction .....	10.2	11	8.8	12	7	...
" width of mesopterygoid fossa .....	8.7	9	8.2	9.3	...	...
" between p <sup>1</sup> -p <sup>1</sup> , internally .....	12	13.2	11	13	...	...
" between cirgula of canines .....	8.7	9.2	7.8	9.8	7.2	...
" orbital diameter.....	16	16.5	15	16	13.3	...
Mandible, length .....	60.2	65.8	56.5	63.3	50.3	...
" coronoid height .....	30	30.8	26.8	30	24.2	...
Upper teeth, c-m <sup>2</sup> .....	28.8	31.2	27.5	31	24.8	...
Lower teeth, c-m <sub>3</sub> .....	32.7	35.7	30.7	34.8	27.5	...
Upper incisors, combined width .....	7.2	7.5	6	7	6	...
p <sup>3</sup> , length .....	4.7	5.4	4.8	5.2	4	3.7
" width .....	3.3	3.9	3.2	3.8	3.2	2.8
p <sup>1</sup> , length .....	4.9	5.7	4.7	5.5	4	3.8
" width .....	3.7	4.2	3.7	4.3	3.7	3.5
m <sup>1</sup> , length .....	5.7	6.7	5	6.2	4.8	4.8
" width .....	3.3	3.9	3.1	4.1	3.5	3.2
m <sup>2</sup> , length .....	2.3	3.2	2.8	3	2.8	3
" width .....	2	2.9	2.2	2.8	2.2	2.7
p <sub>1</sub> , length .....	1.8	2.6	2	2.4	1.8	1.8
" width .....	1.8	2.5	1.7	2	1.7	1.7
p <sub>3</sub> , length .....	4.4	5.7	4.8	5.2	3.8	3.6
" width .....	2.9	3.6	3	3.8	2.8	2.5
p <sub>1</sub> , length .....	5	5.8	4.8	5.5	3.9	3.8
" width .....	3.3	3.8	3.2	4.1	3.2	3
m <sub>1</sub> , length .....	5	5.8	4.5	5.5	4	4.3
" width .....	3.2	3.8	2.9	3.9	3.2	3
m <sub>2</sub> , length .....	3.8	4.8	3.7	4.2	3.8	3.8
" width .....	3	3.7	2.8	3.7	3.2	3
m <sub>3</sub> , length .....	1.8	2.7	1.8	2.3	2.7	2.7
" width .....	1.8	2.4	1.7	2.4	2.2	2.2

\* Estimate.

an immature male, was acquired by the British Museum and described by Gray, in 1870 (*l. s. c.*), as *Pt. mysolensis* var. *ceramensis*. Dobson (Cat. Chir. B. M. 1878) recognized *Pt. ocularis* as a distinct species allied to *Pt. conspicillatus*; but Gray's type of *Pt. mysolensis* var. *ceramensis*, although in reality indistinguishable from, and even a topotype of, *Pt. ocularis*, he referred to *Pt. alecto* (specimen g). By Matschie (*l. s. c.* 1899) *Pt. ocularis* was put down as doubtfully distinct from *Pt. hypomelanus* (subgenus *Spectrum*, whereas *Pt. chrysauchen* and *Pt. conspicillatus* were placed in the subgenus *Pteropus*), a conclusion that apparently was based rather more on geographical considerations than on the actual characters of the species, the true affinities of which, as proved by skull, dentition, and all external characters, are with *Pt. chrysauchen* and *conspicillatus*, not with *Pt. hypomelanus*.

a. ♂ imm. sk.; skull. Ceram. Dr. A. R. Wallace [C.]. 61.12.11.2.  
(Type of *Pt. mysolensis* var. *ceramensis*, Gray.)

#### O. THE *PTEROPUS NEOHIBERNICUS* GROUP.

*Species*.—*Pt. papuanus*, *neohibernicus*.

*Range*.—New Guinea, Bismarck Archipelago.

*General characters*.—Skull typical Pteropine. Cheek-teeth without posterior basal ledges. Palate-ridges 5+8+3. Ears short, somewhat attenuated above; interfemoral scarcely developed in centre; fur of back very short, adpressed, in adult individuals restricted to a narrow spinal tract. Colour varying. Males without glandular neck-tufts. Size very large (forearm about 189–200 mm.).

*Specific differentiation*.—The two species, the one inhabiting New Guinea (*Pt. papuanus*), the other the Bismarck Archipelago (*Pt. neohibernicus*), are very closely related, differing apparently only in the darker or paler colour of the back.

*Affinities of group*.—The group differs from all other groups of the genus by the combination of these two characters: cheek-teeth without posterior basal ledges, furred area of back confined to spinal tract. The only other species showing this latter character is *Pt. melanopogon*, which however differs widely in dentition.

There can be little doubt that the *Pt. vampyrus*, *alecto*, *chrysauchen*, and *neohibernicus* groups represent four branches of one type of the genus, viz., an Indo-Malayan (*vampyrus*), a Celebean (*alecto*) extending also to the Lesser Sunda Islands and Australia, a Moluccan (*chrysauchen*) extending to New Guinea and Australia, and a New Guinean branch (*neohibernicus*) extending to the Bismarck Archipelago. The four groups are remarkably alike in skull and dentition; in all the fur is very short and closely adpressed on back. The ears are nearly of the *hypomelanus* style in the *alecto*, *chrysauchen*, and *neohibernicus* groups, long and pointed only in the *vampyrus* group. The interfemoral is short in the centre in the *chrysauchen* and *neohibernicus*, conspicuously deeper in the

*alecto*, deepest in the *vampyrus* group. In the colour of the fur the western Oriental species (*giganteus*, *ariel*) are nearest to the ordinary style of the genus (light mantle and underparts); in the Indo-Malayan species of the *vampyrus* type and in the *chrys-auchen* group the underparts are dark-coloured, in the *alecto* group and the eastern "melanistic" races of *Pt. vampyrus* also the light colour of the mantle has been more or less completely suppressed, and in the Papuan *neohibernicus* type the prevailing colour of the upperside is some shade of russet, with the underparts similar or paler. Taken together, these four groups cover almost the whole of the Oriental region, Austro-Malaya, and N. and E. Australia.

## 76. *Pteropus papuanus*. Pet. & Doria.

*Pteropus argentatus* (pt., *nec* Gray), *Finsch, Neu-Guinea*, p. 150 (1865: New Guinea).

*Pteropus* sp., *Ramsay, Proc. Linn. Soc. N. S. Wales*, iv. p. 85 (1879: New Guinea).

*Pteropus melanopogon* var. *papua*, *Peters & Doria, Ann. Mus. Civ. Genova*, xvi. p. 690 (March, 1881: Mansinam, N.W. New Guinea); *Trouessart, Cat. Mamm.* i. p. 80 (1897: New Guinea).

*Pteropus melanopogon papuanus*, *Heller, Abh. Mus. Dresden*, vi. no. 8, p. 4 (1897: Mansinam).

*Pteropus* (*Eunycteris*) *melanopogon b. papuanus*, *Matschie, Megachir.* p. 12 (1899: Ghebi; Andei; Loloki; Constantin Harbour). *a. papuanus*, *Trouessart, Cat. Mamm., Suppl.* p. 49 (1904: Ghebi; Andei).

*Eunycteris papua*, *Matschie, in Krieger's Neu-Guinea*, p. 77 (1899: New Guinea); *Jentink, Notes Leyden Mus.* xxviii. pp. 163, 203 (1906: Pt. Moresby).

*Pteropus melanopogon*, *Jentink, Cat. Ost. Mamm.* p. 255 (pt.) (1887: Mysol); *id.*, *Cat. Syst. Mamm.* p. 142 (pt.) (1888: Mysol; Pt. Moresby); *Thomas, Ann. Mus. Civ. Genova*, (2) xviii. p. 608 (1897: Grange I.); *Willink, Nat. Tijds. Nederl. Ind.* lxx. p. 272 (pt.) (1905: Mysol; New Guinea).

*Diagnosis*.—Cheek-teeth short and without posterior basal ledges. Fur of back extremely short, in adults restricted to a narrow spinal stripe. Back vandyck-brown, underparts dark ochraceous-buffy, mantle buff-yellow. Forearm about 190 mm. *Hab.* New Guinea.

*Skull*.—As in *Pt. vampyrus*. Rostrum not appreciably shortened; front of orbit vertically above front of  $m^1$ .

*Teeth* (compare figs. 9C, C', p. 68, and figs. 10D, D', p. 69, dentition of *Pt. neohibernicus*).—Upper canines long, slender, profile of front margin flatly convex or nearly straight; cingulum very narrow. Cingulum of lower canines extremely narrow, rather ill-defined.  $p^1$  spiculiiform, early deciduous. Large premolars and molars ( $p^3$ ,  $p^4$ , and  $m^1$ ,  $p_3$ ,  $p_4$ ,  $m_1$ , and  $m_2$ ) peculiarly short and broad, with rounded edges; posterior basal ledges practically obliterated.  $m^2$  and  $m_3$  larger than usual.

*Palate-ridges*.—Chief character, the increased number of middle, divided ridges (eight, instead of five or six). Formula  $5+8+3$ . First ridge terminating laterally at front of canine; second at back of

canine; third at front of  $p^3$ ; fourth at back of  $p^3$ ; fifth at front of  $p^4$ ; sixth at front of  $m^1$ ; seventh at middle of  $m^1$ ; eighth at  $m^2$ ; ninth to eleventh, the extremities of which are united, behind  $m^2$ ; twelfth and thirteenth (extremities separated *inter se* and from foregoing) further behind; fourteenth to sixteenth situated at palation border. It will be noticed that the arrangement of the eight anterior ridges is quite or very nearly the same as in *Pt. rufus* (p. 202), *giganteus* (p. 326), and *vampyrus*; these ridges therefore evidently correspond to the eight anterior ridges in these species. The ninth, tenth, and eleventh ridges (extremities united laterally) seem to be homologous with (formed by an incomplete subdivision into three of) the ninth ridge of typical species, while the twelfth and thirteenth ridges are probably homologous with the tenth ridge of typical species; the three ridges situated nearest the hinder border of the palate (fourteenth to sixteenth) no doubt correspond to the similarly situated ridges (eleventh to thirteenth) in typical species.

*Ears*.—Short, somewhat attenuated in upper third and narrowly pointed at tip.

*Wings*.—Arising close together (about 13 mm. apart) from sides of spine (as in *Pt. melanopogon*).

*Fur*.—Length and distribution nearly as in *Pt. melanopogon*; fur of back extremely short, and furred area restricted to the narrow spinal tract between the lines of insertion of the lateral membranes. Approximate length, back 5, mantle and belly 12 mm. Least width of furred area of back about 15 mm.

*Colour*.—♂ imm. (al.), Grange I., S.E. New Guinea, 97.8.7.4: Back dark vandyck-brown; hairs of rump and thighs similar, but broadly tipped with buffy, producing the general effect of dark brown varied with buffy.—Breast, belly, anal region, and flanks nearly uniform dark ochraceous-buffy; base of hairs seal-brown, except at centre of breast, where most of the hairs are uniform pale to base. Underside of humerus mixed seal-brown and buffy. Woolly hairs on underside of membranes dark brownish tipped with buffy.—Mantle shiny buff-yellow, strongly contrasting with dark back, lightening to yellowish buffy on occiput and shoulders, and tinged with orange-buff at centre of mantle, this latter tinge becoming deeper on sides of neck, and gradually passing into deep tawny on foreneck. Extreme base of fur of mantle dark brown.—Crown and interocular triangle light yellowish buffy (similar to occiput); sides of head similar, but slightly washed with ochraceous; throat mixed seal-brown and tawny.

*Measurements*. On p. 391.

*Specimen examined*. One, as catalogued below.

*Range*. New Guinea generally, as yet recorded from Mansinam, Andei, and Loloki in the north-west, and Constantin Harbour, Grange Island, and Port Moresby in the south-east. Probably extending north-west to the islands of Ghebi and Mysol (see references to literature above).

Type in the Genoa Museum.

*Pteropus melanopogon* var. *papuanus*, Peters & Doria; 1881.—Type locality, Mansinam, N.W. New Guinea. Type, ♀ ad., collected by Dr. O. Beccari; forearm 190 mm., ear 25, tibia 85 (Peters & Doria, *l. s. c.*).

a. ♂ imm. al.; Grange I., Baxter Bay, Museo Civico, Genoa 97.8.7.4.  
skull. S.E. New Guinea; [P].  
March, 1890 (*Dr. L. Loria*).

## 77. *Pteropus neohibernicus*, Pet.

*Pteropus melanopogon* (pt.), Dobson, Cat. Chir. B. M. p. 44.

*Pteropus melanopogon* var. *neohibernicus*, Peters, *MB. Akad. Berlin*, 1873 (18 May), p. 317 (New Ireland); Dobson, *P. Z. S.* 1878, p. 315 (Duke of York I.); Trouessart, *Cat. Mamm. i.* p. 80 (1897: New Ireland; Duke of York I.).

*Pteropus neohibernicus*, Peters & Doria, *Ann. Mus. Civ. Genova*, xvi. p. 690 (1881: New Ireland).

*Pteropus* (*Eunycteris*) *melanopogon d. neohibernicus*, Matschie, *Megachir.* p. 12 (1899: New Ireland; Duke of York I.; New Britain). *e. neohibernicus*, Trouessart, *Cat. Mamm., Suppl.* p. 49 (1904: New Ireland).

*Pteropus degener*, Peters, *MB. Akad. Berlin*, 1876 (18 May), p. 318, footnote (Aru Is., errore); Peters & Doria, *Ann. Mus. Civ. Genova*, xvi. p. 690 (1881: Aru Is., errore).

*Pteropus melanopogon* var. *degener*, Trouessart, *Cat. Mamm. i.* p. 80 (1897: Aru Is., errore).

*Pteropus* (*Eunycteris*) *melanopogon c. degener*, Matschie, *Megachir.* p. 12 (1899: Aru Is., errore). *b. degener*, Trouessart, *Cat. Mamm., Suppl.* p. 49 (1904: Aru Is., errore).

*Pteropus melanopogon* (*nec* Pet.), Dobson, *P. Z. S.* 1877, p. 115 (Duke of York I.); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 205 (pt.) (1879: New Ireland; Duke of York I.); Sclater, *Cat. Syst. Mamm.* p. 142 (pt.) (1888: New Britain); Elliot, *Cat. Mamm. Field Col. Mus.* p. 492 (1907: ? Duke of York I.).

*Pteropus melanopogon* var. *a*, Dobson, *Cat. Chir. B. M.* p. 45 (1878: Aru Is., errore). *Var. γ, id., op. cit.* p. 46 (1878: Duke of York I.).

*Pteropus coronatus*, Thomas, *P. Z. S.* 1888, p. 481, footnote, pl. xx. fig. 2 (head), pl. xxi. figs. 2, 3 (teeth) (1889: Mioko I., nr. Duke of York I.); Trouessart, *Cat. Mamm. i.* p. 82 (1897: Duke of York I.); Matschie, *Megachir.* p. 14 (1899: Mioko); Trouessart, *Cat. Mamm., Suppl.* p. 49 (1904: Bismarck Arch.); Miller, *Fam. S. Gen. Bats*, p. 58 (1907).

*Pteropus rufus* (*nec* E. Geoff., *nec* Tiedem.), Ramsay, *Rec. Austral. Mus. i.* no. 6, p. 105 (March, 1891: New Britain).

*Diagnosis*.—Similar to *Pt. papuanus*, but colour of back paler. Forearm 189–199 mm. *Hub.* Bismarck Archipelago.

*Fur*.—Length and distribution essentially as in *Pt. papuanus*. Approximate length of fur, back 5–10, mantle and belly 11–15 mm.

Least width of furred area of back in fully adult specimens about 15-25, in immature individuals not infrequently 35-45 mm.

*Colour*.—♂ ad., cotype, New Ireland, 4994 (Berlin Museum): Back and rump uniform deep russet. Foreneck, breast, belly, and flanks russet, rather paler than upperside, everywhere sparsely sprinkled with shiny buffy or silvery greyish hairs; foreneck and sides of neck slightly washed with chestnut. Mantle and occiput tawny-ochraceous. Crown, sides of head, and throat dark chestnut.

Individual variation rather considerable, chiefly depending on the darker or paler tinge of the colour, and on the greater or less admixture (rarely complete predominance) of buffy hairs on the back:—General colour of back varying in most specimens from pale russet, through russet, to deep mars-brown, nearly always more or less conspicuously sprinkled with buffy. The colour is sometimes uniformly and thinly sprinkled with buffy, but generally darkest (less mixed with buffy) along sides of back and rump and on upper side of thighs, palest (more thickly sprinkled with buffy) along middle of back and rump. The palest specimen examined is practically uniform yellowish buffy on back and rump, these portions of the fur being as pale as the mantle; the opposite extreme is represented by specimens with deep mars-brown back and rump strongly contrasting with brighter mantle, and by one specimen with sides of back and rump and upper side of thighs dark vandyck-brown contrasting with yellowish-buffy median spinal tract.—Breast, belly, and flanks varying from nearly uniform pale ochraceous, through tawny, to russet or even mars-brown; flanks, sides of breast and belly, and anal region occasionally somewhat darker than centre of breast. Hairs on underside of membranes dark russet or mars-brown.—Occiput and mantle rarely as light as yellowish buffy or yellowish cream-buff, generally some tinge of ochraceous-buff or rich ochraceous, sometimes washed with tawny. Sides of neck and foreneck generally quite or nearly similar to breast and belly. Top of head generally darker than occiput, more washed with tawny or russet or even mars-brown. In many specimens this darker shade extends nearly uniformly over the crown, interocular space, and sides of head, often sprinkled with buffy or silvery hairs; in others it more or less approaches the shape of an ill-defined **T**, the vertical bar extending forward between eyes, the cross bar occupying the crown in front of the ears; and in a few specimens (among these the type of *Pt. coronatus*) the dark **T**-mark is unusually conspicuous and well-defined. In this latter case the markings of the upper side of the head strangely suggest the style of markings in *Pt. capistratus*.

*Sexual differentiation*.—Canines generally conspicuously larger in males than in females.

*Measurements*. On pp. 390, 391.

*Specimens examined*. Thirty-seven, in the collections of the Berlin and British Museums, including the cotypes of the species and the types of *Pt. degener* and *Pt. coronatus*.



*Range.* Bismarek Archipelago: New Ireland, Duke of York I., Mioko, New Britain.

*Cotypes* in the Berlin Museum.

*Pteropus melanopogon* var. *neohibernicus*, Peters; 1876.—Type locality, New Ireland. Cotypes, ♂ ad. and ♀ ad., collected by Dr. Hüsker ('Gazelle' Expedition); Reg. nos. 4994 and 4995: skull of 4994 (♂) separate, of 4995 *in situ*. The male represents a dark, the female a light extreme of the colour of the fur.

*Pteropus degener*, Peters; 1876.—Type locality, Aru Islands. "nach der Angabe des Naturalienhändlers Gerrard." Type, ♂ ad., mounted skin, skull separate, collected by James Cockerell: Berlin Museum, Reg. no. 4996.—The type of *Pt. degener* is a light-coloured individual of *Pt. neohibernicus*: colour somewhat faded (the specimen has evidently originally been preserved in alcohol); it is matched by one of the cotypes of *Pt. neohibernicus* (♀ ad., 4995), described by Peters in the same paper and page. Dobson's statement, that the type of *Pt. degener* agrees "so closely with *Pteropus melanopogon* in size, in the general colour of the fur, and in the nakedness of the back that I really doubt whether it should be considered a variety, even, on account of the comparative shortness of the ears" (Cat. Chir. B. M. p. 45), is very misleading; in the colour of the fur the type of *Pt. degener* is entirely different from *Pt. melanopogon*; the nakedness of the back is undoubtedly due to bad preservation of the specimen (mounted from alcohol); the ears have the shortness characteristic of *Pt. neohibernicus* and *papuanus*, in contradistinction to *Pt. melanopogon*, *keyensis*, and *aruensis*; the characters of the teeth are very different from those of the three latter species, but quite in accordance with those of the two former. There can be no doubt, therefore, that *Pt. degener* is a *Pt. neohibernicus* with wrong locality; this conclusion is supported also by the fact that J. Cockerell, in the middle of the seventies, accompanied the Rev. George Brown on a missionary voyage to the Bismarek Archipelago, whereas he is not known to have collected in the Aru Islands.

*Pteropus coronatus*, Thomas; 1889.—Type locality, Mioko Island, near Duke of York Island; type in collection. An immature *Pt. neohibernicus* with unusually pronounced and well-defined dark T-shaped mark on the head (see description of colour-variations above).

*Pteropus rufus*, Ramsay; 1891.—Type locality, "the New Britain group of islands." Cotypes ("several specimens") in the Australian Museum, Sydney. From the description and measurements undoubtedly *Pt. neohibernicus*. Ramsay compared *Pt. rufus* with descriptions of *Pt. vampyrus* and *grandis*, apparently not with *Pt. neohibernicus*. The name *rufus* is antedated by *Pt. rufus*, E. Geoffroy (1804), and *Pt. rufus*, Tiedemann (1808), which latter is *Pt. niger*, Kerr.

*Remarks.*—This species differs from *Pt. papuanus* apparently only in the paler colour of the fur of the back. Of thirty-seven

specimens of *Pt. neohibernicus*, none is precisely as dark-backed as, but several closely approach, the single specimen examined of *Pt. papuanus*. It is not improbable that a completer material of this latter form will prove it to be only subspecifically distinguishable from *Pt. neohibernicus*.

- a.* ♂ imm. sk.; skull. New Ireland. Rev. G. Brown [C.]. 77.7.18.1.  
*b-d.* [♂] jun., [♀] yg. Duke of York I. Rev. G. Brown [C.]. 78.2.5.1-3.  
 ad., ♀ ad. sks.; skulls.  
*c.* ♂ jun. al.; skull. Mioko I., nr. Duke Dr. O. Finsch [C.]. 86.7.9.1.  
 of York I.; (Type of *Pt. coronatus*, Thos.)  
 13 Mar. 1885.  
*f.* [♀] ad. sk.; skull. New Britain; Berlin Museum [E.]. 93.1.1.2.  
 6 Nov. 1880  
 (Dr. O. Finsch).

*External measurements of Pteropus neohibernicus.*

		<i>Pt. neohibernicus.</i> 3 ad.*	
		Min.	Max.
		mm.	mm.
Forearm .....		189	199
Pollex, total length, c. u. ....		79	81
„ metacarpal .....		17.5	20
„ 1st phalanx .....		39.5	42
2nd digit, metacarpal .....		103.5	111.5
„ 1st phalanx .....		22	29.5
„ 2nd-3rd phalanx, c. u. ....		19.5	23
3rd digit, metacarpal .....		133.5	144
„ 1st phalanx .....		100	104
„ 2nd phalanx .....		144	150
4th digit, metacarpal .....		128	141
„ 1st phalanx .....		84	84.5
„ 2nd phalanx .....		81	...
5th digit, metacarpal .....		139	146.5
„ 1st phalanx .....		62.5	65.5
„ 2nd phalanx .....		58	64.5
Ears, length from orifice.....		(24 †)	
„ greatest width, flattened .....		(17.5 †)	
Lower leg .....		88.5	91
Foot, c. u. ....		65.5	68.5
Calcar .....		25	26

\* Type of *Pt. degener*, and B.M. 78.2.5.2, 93.1.1.2.

† Measurements of ear from a slightly immature specimēn (type of *Pt. coronatus*).

*Measurements of skulls and teeth of Pteropus papuanus  
and neohibernicus.*

	<i>Pt. papuanus.</i> ♂ imm. (Brit. Mus.)	<i>Pt. neohibernicus.</i> Skulls: 3 ad. Teeth: 3 ad., 4 imm.*	
		MIN.	MAX.
	mm.	mm.	mm.
Skull, total length to gnathion .....	...	85	91.5
„ palation to incisive foramina ...	...	44	...
„ front of orbit to tip of nasals ...	...	29.5	33
„ width of brain-case at zygomata ...	...	28.5	29.8
„ zygomatic width .....	...	45.2	47.8
„ width across m <sup>1</sup> , externally .....	...	23.2	24.8
„ lachrymal width .....	...	19	19.3
„ width across canines, externally ...	...	16	17.8
„ postorbital constriction .....	...	7.5	8
„ interorbital constriction .....	...	10.8	12
„ width of mesopterygoid fossa ...	...	9.2	...
„ between p <sup>4</sup> -p <sup>4</sup> , internally .....	...	12	12.8
„ between cingula of canines .....	...	9.8	10.8
„ orbital diameter .....	...	16.2	17.5
Mandible, length .....	...	69	73.5
„ coronoid height .....	...	34	35.2
Upper teeth, c-m <sup>2</sup> .....	...	34	35.8
Lower teeth, c-m <sub>3</sub> .....	...	38.2	41.5
p <sup>3</sup> , length .....	5.1	4.7	5.3
„ width .....	4.1	4	4.6
p <sup>4</sup> , length .....	5.6	5.1	5.8
„ width .....	4.7	4.8	5.5
m <sup>1</sup> , length .....	6.1	6	7.1
„ width .....	4.5	4.2	5
m <sup>2</sup> , length .....	3.8	3.7	4
„ width .....	3.2	3.2	3.7
p <sub>1</sub> , length .....	2.2	1.8	2.2
„ width .....	2.2	1.8	2.2
p <sub>3</sub> , length .....	5.2	4.7	5.5
„ width .....	3.8	3.6	4
p <sub>4</sub> , length .....	5.7	5	6
„ width .....	4.3	4	5
m <sub>1</sub> , length .....	5.9	5.7	6.7
„ width .....	4.5	4.2	5
m <sub>2</sub> , length .....	5	4.6	5.3
„ width .....	3.8	3.8	4.5
m <sub>3</sub> , length .....	2.9	3	3.2
„ width .....	2.8	2.8	3

\* 3 ad., viz. type of *Pt. degener*, and B.M. 78.2.5.2, 93.1.1.2; 4 imm., viz. B.M. 77.7.18.1, 78.2.5.1, 78.2.5.3, 86.7.9.1 (type of *Pt. coronatus*).

P. THE *PTEROPUS MACROTIS* GROUP.

*Species*.—*Pt. epularius*, *macrotis*, *poliocephalus*.

*Range*.—Aru Islands, New Guinea, Australia.

*General characters* (compare fig. 17, p. 394, skull and dentition of *Pt. epularius*).—Brain-case more deflected than usual, rostrum of normal length, eyes unusually large, sagittal crest low or undeveloped, coronoid weak, low, and sloping. Dentition weak, cingulum of canines narrow, cheek-teeth peculiarly short, posterior basal ledges practically wanting. Ears long and pointed; inter-femoral scarcely developed in centre. Length, distribution, and colour of fur and secondary sexual characters varying (see below). Size moderate or rather large (forearm 121–162 mm.).

*Differentiation of species*.—The three species are representatives of two, very closely related types, the one ranging over New Guinea and the Aru Islands, the other confined to Australia (where it is apparently the commonest and most widely distributed species of the genus).—In *Pt. epularius* (Aru Islands) and *macrotis* (New Guinea) the fur is short, closely adpressed on back, tibia naked above, colour blackish above and beneath with strongly contrasting buffy mantle (nearly exactly the same generalized style of colour as seen in the *Pt. mariannus* and *conspicillatus* groups); males with glandular neck-tufts. The two species differ from each other only in size.—In *Pt. poliocephalus* (Australia) the fur is much longer, less closely adpressed, and extending thickly on upperside of tibia to ankle; all those portions of the pelage which in *Pt. epularius* and *macrotis* are blackish, are in the Australian species so heavily mixed or suffused with a peculiar tinge of olive-buff as to make the total impression of the colour, in average specimens, olive-buff more or less distinctly darkened with blackish or brownish; mantle darker, approximately tawny; males without glandular neck-tufts; size rather larger than *epularius*. *Pt. poliocephalus* has hitherto been widely separated from *Pt. macrotis* and *epularius*, owing, no doubt, to its different external appearance; in all important characters of the skull and dentition it is, however, so completely similar to the two other species included in this group as to leave no doubt of its true relationships.

*Affinities of group*.—The *macrotis* is probably rather closely allied to the *scapulatus* group.

78. *Pteropus epularius*, Ramsay.

*Pteropus macrotis* (pt.), Dobson, Cat. Chir. B. M. p. 43.

*Pteropus* (Epomops?) *epularius*, Ramsay, Proc. Linn. Soc. N. S. Wales, ii. p. 8 (1878: Katow).

*Pteropus* (Spectrum) *epularius*, Matschie, Megachir. p. 23 (1899: Katow; Yule I.); Trouessart, Cat. Mamm., Suppl. p. 52 (Katow; Yule I.).

Spectrum *epularium*, Matschie, Krieger's Neu-Guinea, p. 77 (1899: S. New Guinea); Jentink, Notes Leyd. Mus. xxviii. pp. 164, 209 (1906).

*Pteropus macrotis* (pt., nec *Pet.*), *Dobson, Cat. Chir. B. M.* p. 43, pl. iii. fig. 5 (ear) (1878: Yule I.); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 205 (1879: Katow; Yule I.); *Peters & Doria, Ann. Mus. Civ. Genova*, xvi. p. 690 (1881: Yule I.); *Trouessart, Cat. Mamm. i.* p. 79 (1897: New Guinea; Yule I.); *Heller, Abh. Mus. Dresden*, vi. no. 8, p. 4 (1897: Katow; Yule I.); *Willink, Nat. Tijds. Nederl. Ind.* lxx. p. 274 (1905: Katow).

*Diagnosis*.—Brain-case slightly more deflected than usual; orbits large; sagittal crest low or undeveloped; coronoid process low and sloping. Cingulum of canines narrow; cheek-teeth shorter, but scarcely narrower than usual; upper premolars subsquarish; posterior ledges of premolars obsolete, except postero-internally in  $p^1$ . Ears long and pointed; tibia naked above. Blackish above and beneath, with strongly contrasting buffy mantle; glandular neck-tufts in males. Forearm 136–141 mm. *Hab.* British New Guinea.

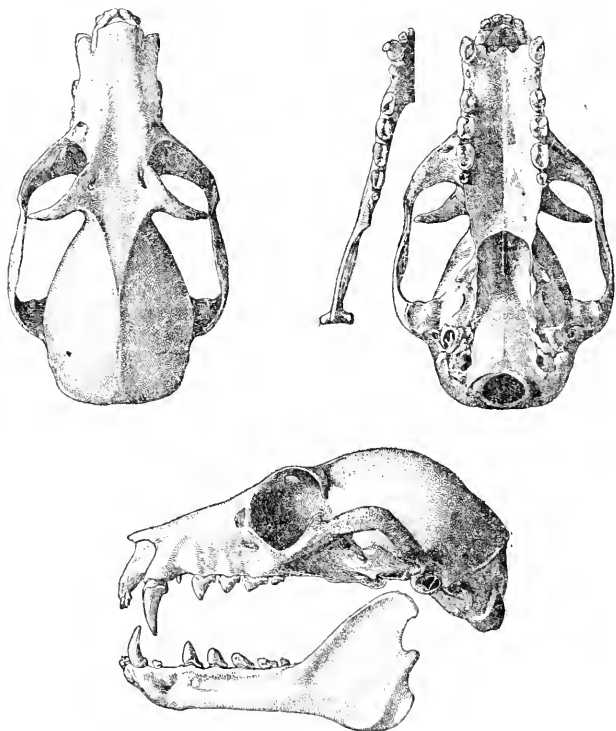
*Skull* (fig. 17).—Deflection of brain-case greater than usual, alveolar line if projected backward passing through supraoccipital above upper margin of occipital foramen. Rostrum low, somewhat compressed laterally; width of rostrum across alveolar borders of  $p^1$ – $p^1$  subequal to depth at middle of  $p^1$ . Orbits large, diameter (14–14.2 mm.) much more than width of rostrum at  $p^1$  (11–12 mm.); front of orbit above front of  $m^1$ . Postorbital processes long, reaching within short distance of corresponding processes of zygoma; distance from tip of postorbital process to gnathion much more than from former point to lambda; frontal region between postorbital processes flatly concave. Temporal ridges in adult individuals closely approximated or united into a very low sagittal crest. Coronoid process low, narrow antero-posteriorly, and sloping; coronoid height of mandible subequal to length of upper tooth-row,  $c$ – $m^2$ , much less than  $c$ – $m_3$ ; condyle somewhat above alveolar line, which projected backward passes a little below, or nearly touches, lower margin of condyle.

*Teeth* (fig. 17).—Upper incisors typical Pteropine, slightly spaced.  $i_2$  once and a half to twice the bulk of  $i_1$ . Cingulum of canines narrow; profile of front margin of upper canines slightly convex or nearly straight, of lower canines more convex; vertical groove on front face of upper canines deep, terminating above tip of tooth.  $p^1$  spiculiform.  $p_1$  slightly larger than  $i_2$  and  $m_3$ , smaller than  $m^2$ .  $p^3$  and  $p^4$  shorter than usual, basal outline subsquarish with rounded corners; posterior basal ledge obsolete in  $p^3$ , in  $p^4$  developed only at postero-internal corner of tooth, forming a distinct rounded tubercle behind inner main cusp of tooth; antero-internal base (cingulum) of  $p^4$  rather more developed than usual, forming a low, projecting, but incompletely differentiated ledge in front of inner main cusp; some trace of a similar antero-internal ledge detectable also in  $m^1$ .  $m^2$  slightly larger than  $p_1$ . Posterior basal ledges undeveloped in lower cheek-teeth.

*Palate-ridges*.—5+4+2. First ridge terminating laterally at front of canine; second at back of canine; third at front of  $p^3$ ;

fourth at front of  $p^4$ ; fifth at back of  $p^1$ ; sixth at front or middle of  $m^1$ ; seventh at back of  $m^1$  or front of  $m^2$ ; eighth at back of, or closely behind,  $m^2$ ; ninth behind  $m^2$ ; tenth and eleventh situated near palation border.

*Ears*.—Long, reaching, or extending slightly beyond, hinder corner of eye. Inner margin convex from base to tip, outer margin convex in lower, concave in upper half; upper half of conch, therefore, considerably attenuated; tip subacutely pointed.



TERZ.

Fig. 17.—*Pteropus epularius*, ♂. Yule Island. No. 76.10.28.1. †.

*Wings*.—Membranes arising within about 20 mm. of each other from sides of back.

*Interfemoral*.—Scarcely developed in centre.

*Fur*.—Short and rather closely adpressed on back. Approximate length, back 10, mantle 12, belly 12 mm. Least width of furred area of back about 35–40 mm.

Above, fur extending in a narrow line of short, closely adpressed hairs along upperside of humerus, crossing membrane in front of elbow, and continued on proximal fourth or fifth of forearm, leaving region of elbow quite naked. Knee and tibia naked, except for a few scattered hairs. Lateral interfemoral densely haired along inner side of femur and proximal half or third of tibia, naked distally and along inner margin.—Below, forearm and tibia naked. Hairing on underside of membranes as usual.

*Colour*.—♂ ad. al., teeth slightly worn, Bioto River, 5.6.5.2: General colour of back and rump approximately vandyek-brown; individual hairs seal-brown at base, with short tips dull buffy or clay.—Underside from chin to interfemoral, including flanks, glossy seal-brown, darkest (nearly blackish) on chin, throat, and foreneck. Woolly hairs on underside of membranes Prout's brown or buffy Prout's brown.—Mantle orange ochraceous-buff, strongly contrasting with brownish back, lightening to nearly cream-buff on shoulders, and darkening to ochraceous on sides of neck; base of fur of mantle and sides of neck not darker. Glandular neck-tufts (males only) deep ochraceous.—Occiput and region round ears similar to mantle. Vertex dark golden buffy with long seal-brown bases to the hairs. Circumocular region and sides of head seal-brown, slightly mixed with buffy hairs.

A second specimen (♂ ad., teeth unworn, Yule I., 76.10.28.1) differs from foregoing only in having the mantle, sides of neck, occiput, and region round base of ears paler in colour, nearly cream-buff, tinged with buff in centre of mantle; cream-buff colour continued forward from occiput in a narrow line between dark superciliaries to base of muzzle.

*Sexual differentiation*.—Males with a brush-like tuft of rigid glandular hairs on each side of neck; hair of mantle between neck-tufts harsh. Females without tufts, and with hair of mantle between tufts soft and spreading (*teste* Ramsay, *l. s. c.*).

*Measurements*. On pp. 400, 401.

*Specimens examined*. Two males, as registered below.

*Range*. As yet only recorded from British New Guinea (Katow, Yule I., Bioto R.).

*Cotypes* in the Australian Museum, Sydney.

*History in literature*.—Original description based on four specimens collected by Mr. Masters at Katow, British New Guinea, where this species was found in large numbers clustering on the leaves of a Nipa palm (*Nipa fruticans*) overhanging the water; their discovery was due to the fetid odour which pervaded the place (Ramsay, *l. s. c.*). By Dobson (1878, *l. s. c.*) *Pt. epularius* was believed identical with *Pt. macrotis*. The species was justly kept separate from *Pt. macrotis* by Matschie (1899, *l. s. c.*) on account of its smaller size.

*Remarks*.—The chief characters of this species are the peculiarly short cheek-teeth with nearly obsolete posterior basal ledges, the large eyes, long and pointed ears, and light buffy mantle contrasting with dark brownish or blackish back and underparts. In shape

and relative length the ears recall those of *Pt. giganteus*, *vampyrus*, and their allies; the general style of the colour of the fur is similar to that of *Pt. mariannus* (and its Polynesian allies), *Pt. chrysauchen*, and *Pt. conspicillatus*.

- a. ♂ ad. al.; skull. Yule I., British New Guinea Purchased (Higgins). 76.10.28.1.  
 b. ♂ ad. al.; skull. Bioto R., British New Guinea; June, 1904 Major W. Cooke Daniels [P.]. 5.6.5.2.  
 (Dr. C. G. Seligmann).

### 79. *Pteropus macrotis*, Pet.

*Pteropus macrotis* (pt.), Dobson, Cat. Chir. B. M. p. 43.

- Pteropus macrotis*, Peters, MB. Akad. Berlin, 1867 (27 May), p. 327 (Buru, errore); Dobson, Cat. Chir. B. M. p. 43 (pt.) (1878: Aru Is.); Trouessart, Rev. S. Mag. Zool. (3) vi. p. 205 (pt.) (1879: Aru); Peters & Doria, Ann. Mus. Civ. Genova, xvi. p. 690 (pt.) (1881: Aru); Jentink, Cat. Ost. Mamm. p. 254 (1887: Wokam); id., Cat. Syst. Mamm. p. 141 (1888: Wokam); Trouessart, Cat. Mamm. i. p. 79 (pt.) (1897: Aru); Heller, Abh. Mus. Dresden, vi. no. 8, p. 4 (pt.) (1897: Aru); Willink, Nat. Tijds. Nederl. Ind. lxx. p. 274 (pt.) (1905: Buru, errore; Wokam).  
*Pteropus* (Spectrum) *macrotis*, Matschie, Megachir. p. 23, pl. vi. figs. 2, 2a, 2b (skull) (1899: Aru); Trouessart, Cat. Mamm., Suppl. p. 52 (1904: Aru).  
*Pteropus insignis*, Rosenberg, Reis. Zuidoostereil. p. 31 (1867: Wokam); id., Malay. Arch. p. 360 (1878: Wokam).

*Diagnosis*.—Similar to *Pt. epularius*, but in every respect smaller. Forearm 121 mm. *Hab.* Aru Is.

*Size* (type).—Forearm 121 mm., against 136–141 in *Pt. epularius*; upper tooth-row, c–m<sup>2</sup>, 19.8 mm., against 21.7–22. For details see pp. 400 and 401.

*Colour* (type).—Considerably faded. The colour was described by Peters (1867, l. s. c.), when the type had been mounted for not more than two years, as follows:—Back and underparts blackish brown; occiput and mantle fine yellow, centre of mantle tinged with orange. Crown dark brown, with a narrow pale stripe above the eyes and two pale spots on forehead.

*Measurements*. On pp. 400, 401.

*Specimen examined*. One, the type of the species and of *Pt. insignis*.

*Range*. Aru Islands (Wokam).

*Type* in the Leyden Museum.

*Pt. macrotis*, Peters, 1867; and *Pt. insignis*, Rosenberg, 1867.—Type of *Pt. macrotis*, a mounted adult female, skull separate (posterior portion incomplete), obtained in Wokam, 7 April, 1865, by Rosenberg. Type locality erroneously stated by Peters to be Buru. Peters's measurement of the forearm, viz. 112 mm., must be a slip or misprint; the actual length is 121. Skull of type figured in 'Megachiroptera des Berliner Museums' (l. s. c.).—The same



specimen is the type of Rosenberg's *Pt. insignis*. Peters's description of *Pt. macrotis* appeared in the May issue, 1867, of the 'Monatsberichte' of the Berlin Academy; Rosenberg's 'Reis naar de Zuidoostereilanden,' dated 1867, was apparently published late in 1867 or early in 1868.

## 80. *Pteropus poliocephalus*, Temm.

*Pteropus poliocephalus*, Dobson, Cat. Chir. B. M. p. 31.

*Pteropus poliocephalus*, Temminck, Mon. Mamm. i. p. 179 (1825: Australia); Lesson, Man. Mamm. p. 111, no. 286 (1827: Australia); Desmarest, Dict. Sci. Nat. xlv. p. 360 (1827: Australia); Is. Geoffroy, Dict. Class. d'Hist. Nat. xiv. p. 700 (1828: Australia); J. B. Fischer, Syn. Mamm. p. 82, no. 5 (1829: Australia); Lesson, Hist. Nat. Mamm. (Compl. Buffon) v. p. 60 (1836: Australia); Temminck, Mon. Mamm. ii. p. 66 (1837: Australia; Tasmania); Waterhouse, Cat. Mamm. Mus. Zool. Soc. p. 13, no. 101 (1838: Australia); Gray, Mag. Zool. & Bot. ii. p. 502 (1838: Australia); Oken, Allg. Naturg. vii. Abth. ii. p. 990 (1838); Wagner, Schreber's Säug., Suppl. i. p. 347 (1839: Australia; Tasmania); Gray, in Grey's Journ. Exp. Australia, ii. App. C, p. 400 (1841: Moreton Bay, Queensland; Clarence R., N. S. Wales); Lesson, N. Tabl. R. An., Mamm. p. 13, no. 172 (1842: N. S. Wales; Tasmania); Gray, List Mamm. B. M. p. 36 (1843: Clarence R.); Schinz, Syst. Verz. Säug. i. p. 123 (1844: Australia); Horsfield, Cat. Mamm. Mus. E. Ind. Comp. p. 29 (1851: Australia); Wagner, Schreber's Säug., Suppl. v. p. 597 (1853-55: Australia; Tasmania); Gervais, Hist. Nat. Mamm. i. p. 188\* (1854: Tasmania); Giebel, Säug. p. 996 (1855: Australia; Tasmania); Schlegel, Dierkunde, i. p. 53 (1857: Australia); Fitzinger, SB. Akad. Wien, xlii. p. 389 (1860: Australia); Blyth, Cat. Mamm. Mus. Asiat. Soc. p. 20 (1863: Australia); Gould, Mamm. Austr. iii. p. 28, pl. xxviii. (animal) (1863: N. S. Wales; not Tasmania; habits); Krefft, Cat. Mamm. Austral. Mus. p. 4 (1864: coast districts of N. S. Wales; in very dry seasons as far as Melbourne); Giebel, Zeitschr. ges. Naturw. xxviii. p. 251 (1866: skull); Peters, MB. Akad. Berlin, 1867, p. 323 (Australia); Krefft, Cat. N. S. Wales (Paris Exhib.), App. p. 94 (1867: N. S. Wales, north to Brisbane; habits); Cooke, Journ. Quekett Micr. Club, i. pp. 6, 55, pl. i. fig. 3 (1868-69: structure of hairs); Selater, P. Z. S. 1868, p. 526 (1869: N. S. Wales); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 422 (1870: Australia; Tasmania); Gray, Cat. Monk. &c. p. 104 (1870: Clarence R.; Cape Upstart, Queensland); Krefft, Mamm. Austr. pl. i. (animal), with text (unpaged) (1871: N. S. Wales, coast districts; habits); Marchi, Atti Soc. Ital. Sci. Nat. xv. p. 515 (1872-73: structure of hairs); Dobson, Cat. Chir. Ind. Mus. p. 2 (1874: Australia); Gulliver, P. Z. S. 1875, p. 493 (size of red blood-corpuscles); Giebel, Brown's Thier. vi. Abth. 5, Lief. 13-14, pl. liii. figs. 6a, b, c, d (teeth) (1877); Dobson, Cat. Chir. B. M. p. 31 (1878: Clarence R. & Pt. Stephens, N. S. Wales; Cape Upstart, Queensland); Leche,

\* Misspelt *Pt. polycephalus*.

- Lunds Univ. Arsskr.* xii. p. 16 & seq. (1878: milk-teeth); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 204 (1879: E. Australia); *Moseley, Notes Naturalist 'Challenger,'* p. 268 (1879: N. S. Wales; habits); *J. Anderson, Cat. Mamm. Ind. Mus.* pt. i. p. 99 (1881: Australia); *Leche, Bromé's Thier.* vi. Abth. 5, Lief. 28, pl. xciv. fig. 3 (femur) (1885); *Collett, Zool. Jahrb.* ii. p. 842 (1887: Mackay, Queensland); *Jentink, Cat. Ostéol. Mamm.* p. 253 (1887: N. S. Wales); *id. Cat. Syst. Mamm.* p. 139 (1888: Cape York; N. S. Wales; Tasmania); *Röse, Morph. Jahrb.* xvi. p. 30 & seq. (1890: anatomy of heart); *Ogilby, Cat. Austr. Mamm.* p. 78 (1892: Australia); *Lydekker, R. Nat. Hist.* i. p. 256 (1893-94: habits); *Broom, Proc. Linn. Soc. N. S. Wales* (2) x. p. 481 (1895: premaxillæ); *P. L. Selater, List An. Zool. Soc. Gard.* 9 ed. p. 102 (1896); *Trouessart, Cat. Mamm.* i. p. 78 (1897: E. & S. Australia; Tasmania); *Lucas, Proc. R. Soc. Queensl.* xii. p. 51 (1897: Queensland); *Matschie, Megachir.* pl. vii. figs. 1, 1 a, 1 b (skull) (1899: Sidney); *Beddard, Mamm.* p. 525, fig. 257 (animal) (1902); *Miller, Fam. & Gen. Bats*, pp. 56 (footnote), 58 (1907); *Elliot, Cat. Mamm. Field Col. Mus.* p. 491 (1907: Australia).
- Pteropus* (Spectrum) *poliocephalus*, *Matschie, Megachir.* p. 21 (1899: Victoria; N. S. Wales; Trobriand Is.); *Trouessart, Cat. Mamm., Suppl.* p. 51 (1904: S.E. Australia; Tasmania; Queensland; Trobriand Is.).
- Pteropus edwardsi* (*nec E. Geoff.*), *Powell, Zoologist*, (2) v. p. 2135 (1870: sudden appearance in large numbers at Sidney, 1858; habits).

*Diagnosis.*—Similar to *Pt. epularius* in skull and dentition, but larger, with much longer and richer fur, and upperside of tibia thickly clothed to ankle. Colour peculiar: head, back, and underparts olive-buff more or less darkened with brownish, collar tawny. Size above medium: forearm about 160 mm. *Hab.* Eastern Australian coast-regions.

*Skull.*—On the whole similar to that of *Pt. epularius*, but conspicuously larger. Orbits as large as in *Pt. epularius*, front of orbit above back of  $p^1$ . Zygomatic arches unusually slender; sagitta crest low or undeveloped. Coronoid weak, slightly less sloping than in *Pt. epularius*; coronoid height of mandible much less than  $c-m_3$ , even distinctly less than  $c-m^2$ ; position of condyles as in *epularius*.

*Teeth.*—General shape of cheek-teeth as in *Pt. epularius*, but  $m^1$  relatively longer. Canines slender, crown in profile nearly straight, cingulum narrow. Posterior basal ledges of premolars obsolescent in  $p^3$  and  $p_3$  (in the young teeth sometimes faintly indicated), entirely absent in  $p^4$  and  $p_4$ .

*Wings.*—Membranes about 25 mm. apart at origin from sides of back.

*Interfemoral.*—Extremely short or undeveloped in centre.

*Fur.*—Long, dense; approximate length of hairs at middle of back 31 mm. (this measurement taken on the long blackish hairs; shorter, olive buffy fur about 16 mm.), middle of mantle 30, middle of belly 25 mm. Straight and directed backward, but not closely adpressed on back, slightly frizzly on rump. Fur of back

extending on membrane for a space of about 22 mm.; least width of furred area of back 70 mm.

Upperside of humerus and proximal half or two-thirds of forearm covered with rather densely set, adpressed hairs. Tibia thickly clothed above to ankle with unusually long hairs.—Beneath, basal third or half of forearm covered with rather long adpressed hairs. Underside of antebrachial membrane, lateral membrane along outer side of forearm to carpal joint, and between humerus and basal half of forearm in front and femur behind, densely covered with long, woolly, frizzled hairs. Tibia densely haired below to a short distance from ankle.

*Colour*.—Series of skins, adult and slightly immature:—General colour of back, rump, thighs, and tibiæ olive-buff more or less darkened with brownish. Chiefly two kinds of individual hairs; the one (generally conspicuously longer) uniform blackish or dark brown from base to tip; the other (generally shorter) a darker or paler shade of olive-buff; thinly spread among these some shiny silvery whitish-grey hairs; the mixture of these colours produces the general effect of an olive-buff more or less shaded with brown; in some individuals the dark brownish are largely in excess of the olive-buffy hairs (general effect dark brown washed with olive-buff); in others, and more frequently, the olive-buff are in excess of the brownish hairs (olive-buff more or less darkened with brown).—Breast, belly, and flanks similar to back, or slightly darker, sometimes distinctly tinged with pale russet.—Mantle, sides of neck, and foreneck tawny, forming a complete collar; tawny colour confined to tips of hairs, middle portion much paler, ochraceous-buff, basal portion blackish seal-brown.—The tawny colour of the mantle extends in some individuals forward on occiput or hinder part of crown; in most specimens, however, the whole of the head (above, on sides, and beneath) is similar in colour to the back.

*Measurements*. On pp. 400, 401.

*Specimens examined*. Twenty, in the collections of the Leyden and British Museums.

*Range*. Eastern Australian coast districts, from Cape Howe in the south to Cape York in the north; occasionally as far south as Melbourne.—Temminck's statement that this species occurs also in Tasmania (two mounted specimens in the Leyden Museum, ticketed Tasmania, are indistinguishable from continental specimens) is contradicted by Gould, and remains unsupported by any recent evidence. Recorded by Matschie (*l.s.c.*) from the Trobriand Islands.

*Cotypes* probably not in existence.

*Habits*.—Gould met with this species in the dense and luxuriant brushes that fringe the south-eastern portion of Australia, such as those of Illamara, in the neighbourhood of the Hunter, the Manning, and the Clarence. It is strictly nocturnal, remaining during the day suspended from the branches of the larger trees clothing the gullies and mountain sides. The enormous numbers that might be seen pendent from the trees in the more secluded parts of the

forest, looking like great black fruits, were (about the middle of the 19th century) beyond conception, and no native animal was more troublesome to the settlers than this large bat, which, resorting to the fruit grounds by night, sometimes committed the most fearful havoc. The growers organized parties to shoot them, but the bats have the cunning (Moseley says) to choose a set of trees where the undergrowth is exceedingly dense, and where it is therefore difficult to get at them. Their favourite food seems, however, to be the small wild fig; a specimen now in the British Museum was shot while feeding on the blossom of Eucalyptus. When undisturbed they utter a curious cackling cry.

*Pteropus poliocephalus*, Temminck; 1825.—In 1825 (*l. s. c.*), when first describing this species, Temminck had examined four specimens, all from “la Nouvelle Hollande,” viz., a mounted example in the Leyden Museum, a second individual “entièrement rongé par les dermestes” in the same Museum, and a third and fourth respectively in the Paris Museum and in London. None of

*External measurements of Pteropus epularius, macrotis, and poliocephalus.*

	<i>Pt. epularius</i> 2 ad.		<i>Pt. macrotis</i> Type. ♀ ad.	<i>Pt. poliocephalus</i> 3 ad.	
	Min.	Max.		Min.	Max.
	mm.	mm.	mm.	mm.	mm.
Forearm .....	136	141	121	161	162
Pollex, total length, e. u. ....	58	59	...	...	69
" metacarpal .....	12.5	13.5	...	13.7	...
" 1st phalanx .....	27.5	28	...	34.7	...
2nd digit, metacarpal .....	61	61	57.5	79	82.5
" 1st phalanx .....	16	17	17	19.5	23
" 2nd-3rd phalanx, e. u. .	15.5	16	13	16	18.8
3rd digit, metacarpal .....	87	88.5	82	106	112.5
" 1st phalanx .....	66.5	68	60.5	79	84
" 2nd phalanx .....	89.5	91.5	...	106	111
4th digit, metacarpal .....	86.5	87	79.5	104.5	111
" 1st phalanx .....	53.5	54	48	66	66.5
" 2nd phalanx .....	53	54	47	66.5	67.5
5th digit, metacarpal .....	91.5	93	82.5	110	116
" 1st phalanx .....	43	46	41	47	49.5
" 2nd phalanx .....	41	41.5	38	47	49
Ears, length from orifice.....	33.5	35.5	...	? 33*	...
" greatest width, flattened ...	19	19	...	? 17*	...
Front of eye to tip of muzzle .....	22	22	...	...	...
Interfemoral .....	0	0	...	...	...
Lower leg .....	58	62	? 56	72	72.5
Foot, e. u. ....	43	45	...	...	56
Calcar .....	14	17	...	...	...

\* Estimate, from dried skin.

*Measurements of skulls and teeth of Pteropus epularius  
macrootis, and poliocephalus.*

	<i>Pt. epularius.</i> 2 ad.		<i>Pt.</i> <i>macrootis.</i> Type. ♀ ad.	<i>Pt. poliocephalus.</i> Skulls: 3 ad. Teeth: 3 ad., 5 imm.	
	Mix.	Max.		Mix.	Max.
	mm.	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	55.8	...	...	65.8	...
„ palation to incisive foramina ...	25.3	27	...	32.2	34.5
„ front of orbit to tip of nasals ...	17	18.8	17	22.8	24.7
„ width of brain-case at zygomata ...	22.5	22.7	...	25.2	...
„ zygomatic width .....	32.8	32.8	...	36.8	39.8
„ width across m <sup>1</sup> , externally .....	14.2	15.8	14	18.7	19.5
„ lacrymal width .....	13	13.2	...	14	16
„ width across canines, externally ..	12.6	13	11.7	14.2	15
„ postorbital constriction .....	10	10.5	10	9	9.2
„ interorbital constriction .....	8.6	9	8.7	10.2	10.8
„ width of mesopterygoid fossa ...	7.8	7.8	...	8.3	8.5
„ between p <sup>1</sup> -p <sup>4</sup> , internally .....	8.3	9.8	...	11.8	12.5
„ between cingula of canines .....	7.2	7.7	...	9	9.2
„ orbital diameter .....	14	14.2	14	14.2	14.8
Mandible, length .....	45	46.8	44	51	54.5
„ coronoid height .....	21.7	21.8	19.2	22	24
Upper teeth, c-m <sup>2</sup> .....	21.7	22	19.8	24.8	26.8
Lower teeth, c-m <sub>3</sub> .....	24	24.7	22.2	27.8	29.5
Upper incisors, combined width .....	5.8	6.7	...	...	7
p <sup>3</sup> , length .....	3.5	3.8	3.2	4	4.7
„ width .....	2.8	2.9	...	2.9	3.2
p <sup>4</sup> , length .....	3.6	3.8	3.1	3.9	4.5
„ width .....	3	3	...	3	3.4
m <sup>1</sup> , length .....	4.1	4.1	3.7	4.8	5.7
„ width .....	2.8	2.8	...	2.8	3.2
m <sup>2</sup> , length .....	2	2.1	2	2.3	2.9
„ width .....	1.8	2	...	2	2.2
p <sub>1</sub> , length .....	1.8	2	1.8	2	2.3
„ width .....	1.5	1.7	...	1.2	2
p <sub>3</sub> , length .....	3.2	3.5	3.7	4.2	5
„ width .....	2.2	2.3	...	2.2	2.7
p <sub>4</sub> , length .....	3.3	3.6	3.2	4.2	4.8
„ width .....	2.4	2.5	...	2.7	3
m <sub>1</sub> , length .....	3.6	3.8	3.2	4.2	4.8
„ width .....	2.3	2.5	...	2.7	3.2
m <sub>2</sub> , length .....	2.8	2.8	2.7	3.2	3.8
„ width .....	2.1	2.1	...	2.1	2.8
m <sub>3</sub> , length .....	1.5	1.8	1.5	1.7	2.1
„ width .....	1.2	1.5	...	1.5	1.9

the specimens now in the Leyden Museum can be pointed out as types; the Leyden specimen which, as said by Temminck, already in 1825 was in very poor condition may, most likely, have been destroyed; the other Leyden type may, or may not, be one of the specimens in the Leyden Museum the history of which has been lost (*c, d, h, i*, in Jentink's Cat. Syst. p. 139). No specimens now in the British or Paris Museums can be identified with those referred to by Temminck as seen by him in London and Paris.—Temminck's description (compared with the specimens in the Leyden Museum labelled *Pt. poliocephalus* and probably dating back to his time) leaves no doubt as to the identification of the species.

<i>a.</i>	Imm. sk.; skull.	Australia.	Purchased (Warwick).	38.10.11.53.
<i>b.</i>	Imm. sk.; skull.	Australia.	Dr. Merriman.	125. <i>b.</i>
<i>c-d.</i>	♂ ad., ♂ imm. ska.; skulls.	Australia.	Dr. Merriman.	42.4.29.28-29.
<i>e.</i>	Imm. sk.; skull.	Australia; May 8, 1846.		47.8.14.1.
<i>f.</i>	Ad. sk.; skull.	N. Australia (N. Australia Expedition).	Dr. J. R. Elsey [C. & P.].	57.10.24.3.
<i>g.</i>	Ad. sk.; skull.	Cape Upstart, Queensland; April, 1843 (H.M.S. 'Fly').	Dr. J. B. Jukes [P.].	44.7.19.34.
<i>h.</i>	Imm. sk.; skull.	Clarence R., N. S. Wales.	Gould Coll.	41.1503.
<i>i, j.</i>	♀ juv. al., skull; pull. skull.	Port Stephens, N. S. Wales.	Dr. G. Bennett [P.].	72.11.8.10, 11.

#### Q. THE *PTEROPUS SCAPULATUS* GROUP.

*Species*.—*P. scapulatus*, *woodfordi*.

*Range*. Australia; Solomon Islands.

*General characters*.—Brain-case strongly deflected, rostrum of normal length, ascending rami of premaxillæ unusually heavy, orbits moderate, sagittal crest undeveloped or low, coronoid very weak, low, and much sloping, condyle of mandible level of alveolar line. Dentition degenerated: all teeth reduced, cheek-teeth excessively narrow, cingulum of canines narrow; aberration from tooth-formula (disappearance of  $m_3$  and  $m_2$ ; supernumerary premolars) more frequent than in any other group. Ears *macrotis* style in one, small in the other species; interfemoral scarcely developed in centre; fur short, more or less closely adpressed on back. Colour brownish above and beneath (with or without a conspicuous sprinkling with pale hairs): mantle buffy, cinnamon, or russet. Males with glandular neck-tufts. Size moderate or small (forearm 131-143 in one, 92-99 in the other species).

*Differentiation of species*.—*Pt. woodfordi* (Solomon Islands) is perfectly similar to *Pt. scapulatus* (Australia) in skull and dentition, differing chiefly in the much smaller size and very short ears.

*Affinities of group*.—Probably rather closely connected with the *Pt. macrotis* group, from which it differs particularly in the strong degeneration of the dentition.

# Sl. *Pteropus scapulatus*, *Pet.*

*Pteropus scapulatus*, Dobson, Cat. Chir. B. M. p. 41.

*Pteropus scapulatus*, *Peters, M.B. Akad. Berlin*, 1862 (14 Aug.), p. 574 (C. York); *Gould, Mamm. Austr.* i. p. xxxvii (1863: C. York); *Peters, M.B. Akad. Berlin*, 1867, p. 329 (C. York); *Dobson, Cat. Chir. B. M.* p. 41, pl. iv. fig. 3 (teeth) (1878: Claremont Is.); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 205 (1879: Claremont Is. and R.); *Collett, Zool. Jahrb.* ii. p. 843 (1887: Mackay); *Jentink, Cat. Ost. Mamm.* p. 254 (1887: Australia); *id., Cat. Syst. Mamm.* p. 141 (1888: Clarence R.); *Flower & Lydekker, Mamm.* p. 651 (1891); *Leche, Morph. Jahrb.* xix. Heft 3, p. 543 (1892: reduction of teeth); *Ogilby, Cat. Austr. Mamm.* p. 80 (1892: N.E. Australia); *P. L. Sclater, List Anim. Zool. Soc. Gard.* 9 ed. p. 102 (1896: Thursday I.); *Dahl, Zoologist*, (4) i. p. 191 (1897: Daly R.; habits); *Collett, P. Z. S.* 1897, p. 318 (Daly R.); *Lucas, Proc. R. Soc. Queensl.* xii. p. 51 (1897: Queensland); *Trouessart, Cat. Mamm.* i. p. 79 (1897: N.E. Australia); *Thomas, Nor. Zool.* xi. p. 222 (1904: S. Alligator R.); *Miller, Fam. & Gen. Bats*, p. 58 (1907); *Thomas, Ann. & Mag. N. H.* (8) i. p. 347 (1908: supernumerary lower premolar).

*Pteropus* (Spectrum) *scapulatus*, *Matschie, Megachir.* p. 22, pl. vii. figs. 4, 4a, 4b (skull of type) (1899: C. York; Rockhampton); *Trouessart, Cat. Mamm., Suppl.* p. 51 (1904: N. and N.E. Australia).

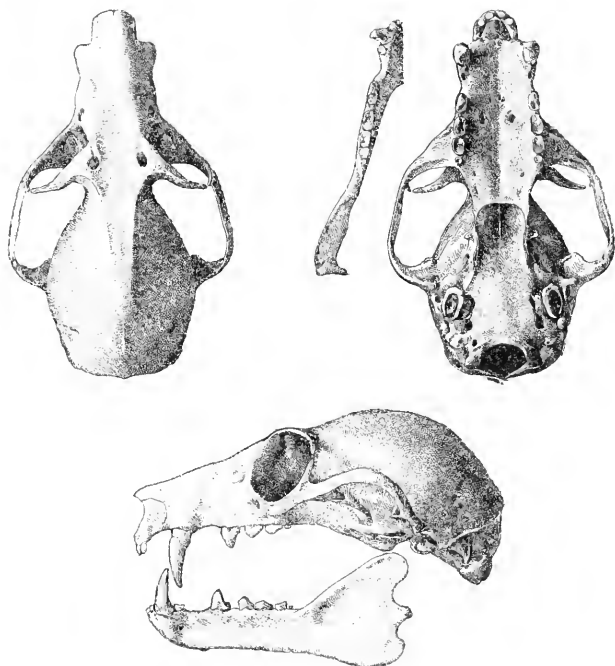
*Pteropus elseyi*, *Gray, P. Z. S.* 1866, p. 67 (Claremont Is.); *id., Cat. Monk. &c.* p. 108 (1870: Claremont Is.: N. Australia).

*Diagnosis*.—Brain-case strongly deflected, sagittal crest low or undeveloped, condyle of mandible level with alveolar line. Canines long and thin, other teeth reduced, cheek-teeth excessively narrow. Ears long and pointed; tibia naked above. Fur of body dark brown above and beneath, head grizzled hair-brown, collar cinnamon or russet, hair on underside of membranes pale straw-yellow. Males with glandular neck-tufts. Forearm 131–143 mm. *Hab.* N. and N.E. Australia.

*Skull* (fig. 18).—Very similar to that of *Pt. epularius*, from which it differs chiefly as follows:—Brain-case more strongly deflected, alveolar line projected backward passing through supraoccipital near its upper margin; premaxillæ unusually broad in antero-posterior direction (see profile of skull, fig. 18); orbits moderate, somewhat smaller than in *Pt. epularius*; front of orbit vertically above posterior half of p<sup>1</sup>; lower postorbital processes (from zygoma) unusually long in aged specimens; coronoid process (in accordance with degeneration of cheek-teeth) still lower than in *Pt. epularius*, much sloping condyle level with alveolar line of mandible.—Temporal crests generally separated in fully adult specimens, occasionally in aged specimens fused to form a sagittal crest which, however, remains low, only slightly raised above the smooth surface of the brain-case. Symphysis menti not longer than usual (*cf.* Dobson, Cat. Chir. B. M. p. 42).

*Teeth* (fig. 18).—Upper and lower incisors reduced in size, distinctly

spaced,  $i^1-i^1$  and  $i_1$  and  $i_1$  generally more broadly separated than  $i^1-i^2$  and  $i_1-i_2$ ; posterior lodges of upper incisors quite or very nearly obsolete; lower incisors subterete,  $i_2$  once and a half to twice the bulk of  $i_1$ . Upper canines unusually long and slender, tips quite or nearly reaching lower margin of mandible, when the jaws are closed; profile of crown slightly recurved or nearly straight;



11121 -

Fig. 18.—*Pteropus scapulatus*, ♂. Australia. No. 62.64.2. 1.

cingulum very narrow; vertical groove on front face extremely broad and deep, terminating a little above tip of tooth. Lower canines long and slender, tips level with base of upper third of premaxillae; crown distinctly recurved in profile, much more strongly so (hook-like) in front view, this latter to a greater degree than in any other species of the genus; cingulum very narrow. Cheek-teeth above and below small and excessively narrow, premolars more spaced than usual.  $p^1$  spiculiform, deciduous.  $p_1$  twice to three times the bulk of  $i_2$ , subequal to  $m_2$ , generally situated close to lower canine and separated by wide diastema from  $p_3$ .



$p^3-m^2$  and  $p_3-m_3$  recalling in general structure corresponding teeth of *Pt. epularius* and *macrotis*, but shorter, lower, and very much narrower.  $m^2$  and  $m_3$  rudimentary, the former subequal to an upper incisor, the latter equal to or smaller than  $i_2^*$ .

*Palate-ridges*.— $5+4+2$  (or 3).—First ridge terminating laterally at front of canines; second at back of canines; third at front of  $p^1$ ; fourth at back of  $p^3$ ; fifth at middle of  $p^1$ ; sixth at front or middle of  $m^1$ ; seventh at back of  $m^2$ ; eighth and ninth behind  $m^2$ ; tenth and eleventh situated at palation border. Often a more or less rudimentary twelfth (the usual third posterior) ridge.

*Ears*.—Shape and relative size as in *Pt. epularius*.

*Wings*.—Membranes broadly separated at origin from back, interspace 35–45 mm.

*Interfemoral*.—Scarcely developed in centre.

*Fur*.—Short, silky, closely adpressed on back. Approximate length, back 9–12, mantle 13–15, belly 11–14 mm. Furred area of back broad, 40–50 mm. at middle of back.

Above, fur extending in a narrow line of very short closely adpressed hairs along humerus and proximal third or half of forearm, generally leaving region round elbow naked. Tibia naked. Lateral interfemoral furred along inner side of thigh and proximal half of tibia, naked distally and along inner margin.

Below, tibia naked, except immediately below knee. Hairing on underside of antebrachial membrane, and on lateral membrane along outer side of forearm and between humerus and femur, unusually long and dense.

*Colour* (whole series examined).—Back and rump glossy dark brown, sometimes nearly pure Prout's brown, more often approaching brownish bistre; the whole of the surface, particularly in the darkest-coloured specimens, distinctly grizzled, owing to the extreme tips of the hairs being paler-coloured, broccoli-brown or hair-brown; the arranged fur shows in certain lights distinct purplish reflections.—Breast, belly, and anal region generally dark and dull Prout's brown or vandyek-brown, rarely approaching mars-brown (lightest extreme), sometimes of a tinge between vandyek-

\* Probably owing to the degeneration of the teeth abnormalities in the tooth formula, so rare in other species of the genus, are by no means uncommon in *Pt. scapulatus*. Of twenty-one skulls examined, no less than five present deviations from the normal condition of the dentition. The most frequent aberration is, as might indeed be expected, the complete suppression of the rudimentary  $m_3$  and its alveolus on both sides; this is the case in four skulls (B. M. 57.10.24.1, ♀ ad.; 62.5.2.3, ♀ imm.; 8.8.8.4, ♂ ad.; 8.8.8.6, ♀ imm.), and in one of these also the left  $m^2$  and its alveolus has disappeared (8.8.8.4, ♂ ad., teeth only moderately worn). In one specimen a supernumerary premolar is present on the left side situated in the broad diastema between  $p_1$  and  $p_3$ , in shape and size a copy of  $p_1$ , in position corresponding to the premolar ( $p_2$ ) which is permanently missing in Chiroptera; no trace of a corresponding tooth on right side (86.11.1.1, ad.). In one specimen a supernumerary premolar is present on both sides between  $p^3$  and  $p^4$ , which, to give room for the additional tooth, in this specimen are more broadly separated than usual; structure of supernumerary premolar typical Pterepine, size nearly half that of  $p^4$  (8.8.8.3, ♂ ad.).

brown and seal-brown (darkest extreme): concealed base of fur generally paler, wood-brown or mars-brown. Flanks usually similar to breast and belly, sometimes slightly more washed with mars-brown. Hair on underside of membranes pale straw-yellow, strongly contrasting with dark underside of body.—Mantle varying from rich cinnamon, through rich russet, to nearly burnt-umber, these tinges confined to short tips of hairs; base of fur much paler, buffy, ochraceous-buffy or buffy clay, generally more or less incompletely concealed by darker hair-tips. Narrow spinal tract of mantle in some specimens distinctly darker (darker-tipped) than lateral portions of mantle, producing an ill-defined spinal stripe, dividing mantle into a right and left half ("shoulder-patch," Peters; hence probably the name *scapulatus*). Sides of neck, foreneck, and throat essentially like mantle, but generally of a rather darker tinge. Glandular neck-tufts (in males only) varying from yellowish buffy to deep tawny.—Colour of mantle extending forward to, or surrounding base of, ears. Rest of head and face, above and on sides, similar to back, but generally more conspicuously grizzled or powdered with hair-brown.

*Sexual differentiation*.—A thick tuft of rigid glandular hairs on each side of neck in males, wanting in females; hairs of mantle in a broad transverse belt between right and left neck-tufts more rigid and inelastic in males, softer and more spreading in females. Canines heavier in males than in females.

*Measurements*. On pp. 410, 411.

*Specimens examined*. Nineteen, in the collections of the Berlin (one) and British Museums, including the type of the species and of *Pt. elseyi*, Gray.

*Range*. N. Queensland, from Thursday Island, southward at least to Rockhampton; Arnhemland; Kimberley Division.

*Type* in the Berlin Museum.

*Pteropus scapulatus*, Peters: 1862.—Type, ♀ ad., mounted skin, skull separate, Cape York, bought of Frank; Berlin Museum no. 2616. Skull of type figured in 'Megachiroptera des Berliner Museums' (l. s. c.).

*Pteropus elseyi*, Gray; 1866.—Type locality, Claremont Islands, N.E. Queensland; type in collection. Peters's description of *Pt. scapulatus* was not unknown to Gray, who, however, considered that species allied to, if not identical with, *Pt. poliocephalus* (Cat. Monk. &c. p. 105; 1870).

*Remarks*.—*Pt. scapulatus* is readily distinguished from any other known species of the genus by the combination of these two characters: cheek-teeth excessively narrow, ears long and pointed. It is the only medium-sized (forearm 131–143 mm.) species with degenerated cheek-teeth, the three other species of this genus with similarly reduced teeth, viz. *Pt. subniger*, *personatus*, and *woodfordi*, being very small (forearm 86–99 mm.). In the Solomon Islands it is represented by a closely allied, but short-eared species, *Pt. woodfordi*.

a. Ad. al.; skull.	Thursday I. (Zool. Soc. Gard.).	R. Army Medical College [P.].	9.1.4.5.
b. ♂ ad. sk.; skull.	Australia	Purchased (Bower- bank).	62.6.4.2.
c, d. ♀ ad., ♀ juv. sks.; skulls.	Claremont Is., N.E. Queensland; 29 Aug. 1860.	J. MacGillivray [C.]. (62.5.2.2., ♀ ad., type of <i>Pt. elseyi</i> , Gray.)	62.5.2.2., 3.
e. Ad. skull.	Claremont Is.	J. MacGillivray [C.].	62.5.6.4.
f. ♀ ad. sk.; skull.	Inkerman, E. Queensland (W. Stalker).	Sir W. Ingram [P.].	7.8.9.4.
g-m. 4 ♂ ad., 1 ♀ ad., 2 ♀ imm. sks.; skulls of h-m.	Inkerman, 100'; 8, 12, 13 Oct., 13 Nov. 1907 (W. Stalker).	Sir W. Ingram & Hon. J. Forrest [P.].	8.8.8.1-7.
n-p. ♂ yg. ad., 2 ♂ ad. sks.; skulls.	Burdekin R., E. Queensland; 21 Nov. 1907 (W. Stalker).	Sir W. Ingram & Hon. J. Forrest [P.].	8.8.8.8-10.
q. Ad. skull.	Mackay, E. Queens- land; July, 1882 (Dr. Lumboltz).	Prof. R. Collett [P.].	86.11.1.1.
r. ♀ ad. sk.; skull.	(N. Australia Ex- pedition); April, 1856.	Dr. J. R. Elsey [C.].	57.10.24.1.
s. ♂ imm. sk.; skull.	S. Alligator R., Arnhemland; 7 Oct. 1902 (J. T. Tunney).	Hon. W. Rothschild [P.].	4.1.3.1.
t. ♀ ad. sk.	Fitzroy R., Kim- berley Division (J. T. Tunney).	Hon. W. Rothschild [P.].	4.4.4.14.

82. *Pteropus woodfordi*, Thos.

*Pteropus woodfordi*, Thomas, *Ann. & Mag. N. H.* (6) i. p. 153 (1 Feb. 1888: Aola); *id.*, *P. Z. S.* 1888, p. 472, pl. xx. fig. 1 (head), pl. xxi. fig. 1 (skull) (1889: Aola); *Truessart, Cat. Mamm.* i. p. 78 (1897: Aola); *Miller, Fam. & Gen. Bats.* p. 58 (1907); *Elliot, Cat. Mamm. Field Col. Mus.* p. 491 (1907: Solomon Is.).

*Pteropus* (Sericonycteris) *woodfordi*, Matschie, *Megachir.* p. 33 (1899: Aola); *Truessart, Cat. Mamm., Suppl.* p. 55 (Aola).

*Diagnosis*.—Similar to *Pt. scapulatus* in skull and dentition, but much smaller; ears small, nearly concealed in fur. Colour some shade of mars-brown above and beneath, lightened with paler tips to the hairs, and more or less thickly sprinkled with buffy or greyish-white hairs; mantle slightly paler than back; face generally darker. Forearm 92.5-99 mm. *Hub.* Solomon Is.

*Skull and teeth* (fig. 19).—Similar in general characters and nearly all details to skull and teeth of *Pt. scapulatus*, but size much smaller, and lower canines decidedly less recurved.

*Palate-ridges*.—5+4+2. Arrangement as in *Pt. scapulatus*.

*Ears*.—Short, nearly concealed in the fur, not reaching half the distance to back of eye. Subtriangular, with slight, but distinct emargination of outer margin below tip of conch, which is rather

broadly rounded off. Outer and inner face of conch with rather long, thinly spread hairs from base to tip.

*Wings*.—Membranes less broadly separated than in *Pt. scapulatus*, arising within about 11–14 mm. of each other from sides of back. Second phalanx of fourth digit distinctly longer than first phalanx (compare measurements with those of *Pt. scapulatus*, p. 410).

*Interfemoral*.—Undeveloped in centre.

*Fur*.—Rather short; directed posteriorly on back, but not closely adpressed. Approximate length on back, mantle, and belly 11–14 mm. Width of furred area of back 32 mm.

Above, distal two-thirds of humerus, forearm, knee, and tibia

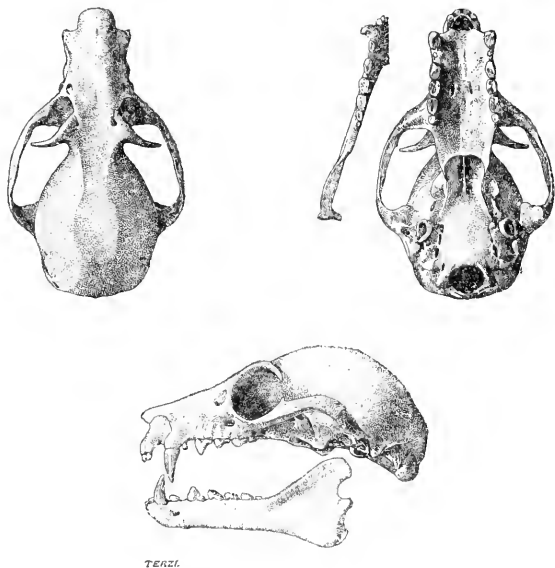


Fig. 19.—*Pteropus woodfordi*, ♂. Guadalcanar. No. 88.1.5.6.  $\frac{1}{2}$ .

naked. Interfemoral hairy along inner side of femur and proximal third or fourth of tibia, naked along inner margin. Beneath, distal half of humerus, forearm, and tibia naked. Hairing on underside of membranes not longer and denser than usual.

*Colour*.—Adult male (al., Guadalcanar; teeth unworn; 88.1.5.6): Back dark mars-brown, most of the hairs with short buffy or ochraceous-buffy tips, too short to conceal brown base of fur. Buffy hair-tips gradually increasing in length posteriorly, making general aspect of rump buffy slightly varied with mars-brown. Back and rump everywhere thinly and inconspicuously sprinkled

with silvery-white hairs.—Breast, belly, and flanks dark mars-brown, thickly mixed with longer, coarse, and somewhat crinkled buffy-white or silvery-white hairs.—Mantle and sides of neck buffy clay (a shade of buffy paler than but not contrasting with buffy element of colour of back); short base of hairs vandyck-brown. Glandular tuft on side of neck orange tawny.—Occiput and crown mixed buffy clay and dark brown, producing a general aspect darker than but not contrasting with that of mantle. Region above, behind, and below eyes, chin, and throat dark vandyck-brown more finely mixed with pale buffy, producing a dark brown facial “mask” rather strongly contrasting with pale head.

Individual variation in colour.—The buffy element in the colour of the head, back, rump, and underparts is in some individuals completely replaced by silvery whitish-grey (this is the case in the type of the species); although not differing essentially in any other colour character, such individuals strongly contrast in general aspect with the male described above. Also the *amount* of pale sprinkling of the fur is individually variable, but as a rule greater on the underparts than on the back, which sometimes is only very slightly mixed with paler hairs or hair-tips. In very pale-coloured individuals the light colour of the mantle and sides of neck is continued across the foreneck, forming a complete collar, though even in this case the lighter hair-tips on the foreneck are shorter than on the sides of the neck. The dark facial “mask” is generally conspicuous, though in the palest-coloured individuals much lightened by pale tips to the hairs.

*Sexual differentiation.*—Males with, females without, a tuft of rigid glandular hairs on each side of neck.

*Measurements.* On pp. 410, 411.

*Specimens examined.* Those registered below.

*Range.* C. and E. Solomon Islands: New Georgia, Guadalcanar.

*Type* in collection.

*Remarks.*—*Pt. woodfordi* may be readily distinguished from any other species of the genus by the combination of these four characters: cheek-teeth excessively narrow, ears small and nearly hidden in the fur, tibia naked above, head not striped. It is undoubtedly closely related to *Pt. scapulatus*, with which it accords in all characters of the skull and dentition (apart from the less recurved lower canines), as well as in the number and arrangement of the palate-ridges; it differs chiefly from that species by the much smaller ears, the less broadly separated wings, the practically complete suppression of the hairs on the distal portion of the humerus and the whole of the forearm, the unmodified (*i. e.* not peculiarly long and thick) hairing on the underside of the membranes, and much smaller size. In the colour of the fur it does not differ essentially from *Pt. scapulatus*, but the general aspect of the coloration is to some extent changed by the rather thick and coarse sprinkling, on back and particularly on underparts, with buffy or silvery hairs.

a. ♂ ad. al.; skull.	New Georgia, Solomon Is. (H.M.S. 'Penguin').	Lords of the Admiralty [P.].	95.10.16.1.
b. ♂ ad. al.	Aola, Guadalcanar, Solomon Is.	C. M. Woodford, Esq. [C.].	88.1.5.5.
(Type of species.)			
c-c. ♂ ad., 2 ♀ ad. al.; skulls of c, d.	Aola.	C. M. Woodford, Esq. [C.].	88.1.5.6-8.
f. ♀ yg. ad. sk.; skull.	Guadalcanar.	C. M. Woodford, Esq. [C.].	89.4.3.4.

*External measurements of Pteropus scapulatus and woodfordi.*

	<i>Pt. scapulatus.</i> 15 ad. (Incl. type of species and of <i>Pt. elseyi</i> .)		<i>Pt. woodfordi.</i> 6 ad. (Incl. type.)	
	Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.
Forearm .....	131	143	92.5	99
Pollex, total length, c. u. ....	56	60	37.5	40.5
„ metacarpal .....	13	14.5	9	10
„ 1st phalanx .....	28	31	19	20.5
2nd digit, metacarpal .....	69	73	41	46.5
„ 1st phalanx .....	12.5	17	11	12.5
„ 2nd-3rd phalanx, c. u. ....	14	18	11.5	13
3rd digit, metacarpal .....	91	98.5	62	67
„ 1st phalanx .....	64.5	73	42	48
„ 2nd phalanx .....	99	110	67.5	75.5
4th digit, metacarpal .....	90	96.5	61	66
„ 1st phalanx .....	55.5	62	37.5	41
„ 2nd phalanx .....	54	62	40	45.5
5th digit, metacarpal .....	93	103	63.5	70.5
„ 1st phalanx .....	41	48	28	32
„ 2nd phalanx .....	40	46	26	28
Ears, length from orifice .....		31*	15	16
„ greatest width, flattened .....		21.5*	9.5	10
Front of eye to tip of muzzle .....		23*	16	17
Lower leg .....	61	66	40	44
Foot, c. u. ....	44	48	30	33
Calcar .....	(15†)	(19†)	8	10.5

\* From one alcoholic specimen.

† Estimate from skins.

*Measurements of skulls and teeth of Pteropus scapulatus  
and woodfordi.*

	<i>Pt. scapulatus.</i> Skulls: 14 ad. Teeth: 14 ad., 5 imm. (Incl. type of species and of <i>Pt. elseyi.</i> )		<i>Pt. woodfordi.</i> Skulls and teeth: 4 ad.	
	Min.	Max.	Min.	Max.
Skull, total length to gnathion .....	mm.	mm.	mm.	mm.
„ palation to incisive foramina .....	51	59.5	42	44.5
„ front of orbit to tip of nasals .....	25	27.3	17.8	19
„ width of brain-case at zygomatic .....	17.3	19.5	12.8	14
„ zygomatic width .....	21.5	23	17.5	18
„ width across $m^1$ , externally .....	33	35.8	24.8	26.7
„ lachrymal width .....	13.7	14.8	10.3	11.3
„ width across canines, externally .....	12.8	14.2	9.8	10.2
„ postorbital constriction .....	11.8	14.7	9	10
„ interorbital constriction .....	9	12.5	8.7	9.8
„ width of mesopterygoid fossa .....	8.2	10.5	6.5	7
„ between $p^1$ - $p^1$ , internally .....	6.8	7.8	5.8	6.3
„ between cingula of canines .....	9.2	10	6.8	7.6
„ orbital diameter .....	7.5	8.8	5.7	6.3
Mandible, length .....	12.2	13	9.6	9.7
„ coronoid height .....	30	43	31	32.2
Upper teeth, $c$ - $m^2$ .....	17.2	20	13.7	13.8
Lower teeth, $c$ - $m^3$ .....	17	19.5	13.8	14.8
Upper incisors, combined width .....	19	22	15.2	16.8
$p^1$ , length .....	5.2	6.8	4.4	4.7
„ width .....	2.8	3.2	2.4	2.7
$p^2$ , length .....	1.6	2	1.6	1.8
„ width .....	2.8	3.1	2.1	2.2
$p^3$ , length .....	1.8	2.1	1.7	1.8
„ width .....	2.7	3.2	2.6	2.8
$m^1$ , length .....	1.8	2.1	1.7	1.7
„ width .....	0.5	1.4	1.2	1.5
$m^2$ , length .....	0.5	1.1	0.9	1.1
„ width .....	1.6	2	1.7	1.8
$p_1$ , length .....	1	1.7	1.1	1.2
„ width .....	3	3.2	2.7	2.8
$p_2$ , length .....	1.3	1.8	1.2	1.3
„ width .....	2.2	3	2.2	2.6
$p_3$ , length .....	1.7	2	1.2	1.4
„ width .....	2.2	3	2.2	2.5
$m_1$ , length .....	1.7	2	1.2	1.5
„ width .....	1.8	2	1.7	1.8
$m_2$ , length .....	1.2	1.6	1.2	1.3
„ width .....	0.3	0.6	0.7	0.9
$m_3$ , length .....	0.3	0.5	0.5	0.8
„ width .....				

## 5. ACERODON, Jourdan.

*Pteropus* (pt.), Dobson, Cat. Chir. B. M. p. 15.

Type.

1837. *Acerodon*, Jourdan, *L'Echo du Monde Savant*, iv.no. 275, p. 156 (14 Oct. 1837)..... *A. jubatus*.

*Pteropus* (pt.), Temminck, *Mon. Mamm.* ii. pp. 59, 69 (1837);  
 Wagner, *Schreber's Säug., Suppl.* i. p. 344, footnote (1839);  
*Acerodon* "höchstens eine Unterart von *Pteropus*"; Lesson,  
*N. Tabl. R. An., Mamm.* p. 13, no. 174 (1842); Gray, *Zool.*  
*'Samarang,' Vert.* p. 11 (1849); Wagner, *Schreber's Säug.,*  
*Suppl.* v. pp. 595, 597 (1853-55); Peters, *MB. Akad. Berlin,*  
 1867, p. 332; Gray, *Cat. Monk. Sc.* pp. 105, 110 (1870);  
 Dobson, *l. s. c.* (1878).

*Acerodon*, F. Cuvier, *C. R. Ac. Sci. Paris*, vi. no. 1, p. 3 (Jan. 1838:  
 critical remarks on characters given by Jourdan); *id.*, *Ann. Sci.*  
*Nat.* (2) *Zool.* viii. p. 369 (published later than 5 Feb. 1838:  
 essentially a reprint of foregoing).

*Acerodon*, Lesson, *N. Tabl. R. An., Mamm.* p. 14 (pt.) (1842: two  
 species, "*A. vanikorensis*" [= *Pteropus vanikorensis* + *Pt. tuberculatus*];  
 and *A. jubatus*; *A. mackloti* placed in the genus *Pteropus*);  
 Heude, *Mém. Hist. Nat. Emp. Chin.* iii. p. 177, pl. v. figs. 10-12  
 (teeth) (1896: dental characters); Matschie, *Megachir.* p. 9  
 (pt.) (1899: subgenus of *Pteropus*; five forms, one of which,  
 "*A. batchianus*," is however a *Pteropus* [*cauciceps*]); Miller,  
*Fam. & Gen. Bats*, p. 59 (1907: characters); K. Andersen,  
*Ann. & Mag. N. II.* (8) iii. p. 20 (Jan. 1909: characters; date of  
 technical name; revision of species).

*Diagnosis*.—Similar to *Pteropus*, but  $p^1$  and  $m^1$ , in certain species  
 also  $p^3$  and  $p_3$ , with a well differentiated antero-internal tubercle,  
 and  $p_1$ ,  $m_1$ , and  $m_2$  with a sharply defined inner basal ledge. Fore-  
 arm 130-205 mm.

*Skull* (fig. 20).—Typical Pteropine. Occiput distinctly tubular.  
 Length of rostrum (front of orbit to tip of nasals) much more than  
 lachrymal breadth; front margin of orbit vertically above back of  
 $p^1$  or interspace  $p^1$ - $m^1$ . Tympanic narrow, annular. Premaxillæ  
 in simple contact anteriorly, very similar in shape to those of  
*Pteropus*, breadth at upper extremity subequal to breadth at alveolar  
 border. Deflection of brain-case moderate, the alveolar line pro-  
 jected backward passing through upper part of occipital condyle.  
 Postorbital processes strong, sometimes nearly or quite encircling  
 orbit; corresponding processes from zygoma always present.  
 Sagittal crest always well developed, extending forward nearly  
 to base of postorbital processes. Coronoid process broad, rather  
 steeply ascending; coronoid height of mandible less than  $c$ - $m_3$ ;  
 condyles considerably above alveolar line.

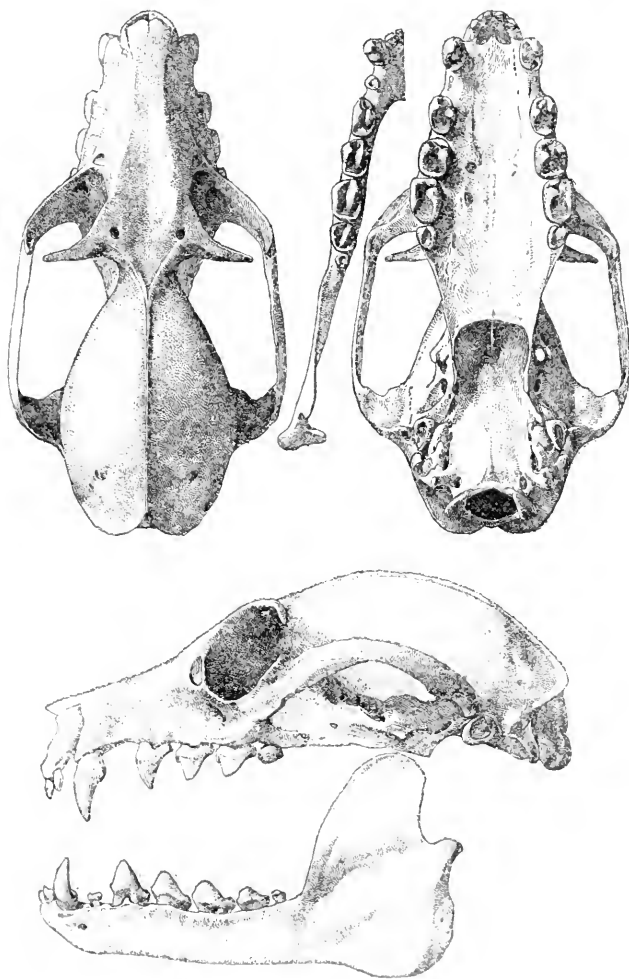
*Dentition* (fig. 20).—Dental formula as in *Pteropus*, viz.:  

$$\frac{i^1 i^2 c p^1 p^3 p^4 m^1 m^2}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2 m_3} \times 2 = 34^*.$$
 $p^1$  rudimentary, generally early  
 deciduous;  $p_1$ ,  $m_3$ , and  $m^2$  much reduced.

\* Only anomaly observed, in 30 skulls, representing all forms of *Acerodon*  
 known:  $p_1$  entirely wanting on one side, present on the other, *A. celebensis*.  
 ♂ ad., teeth slightly worn; Luwu, Celebes, B.M. 94.7.4.2.



Differential characters, as compared with dentition of *Pteropus*.—  
Cingulum of  $p^1$  and  $m^1$  forming a well differentiated tubercle



TEAZI.—

Fig. 20.—*Acerodon jubatus jubatus*, ♀. S. Negros. No. 77.12.10.11.  $\frac{1}{2}$ .  
antero-internally, making these teeth distinctly tritubercular: a  
high outer, low inner, and smaller antero-internal cusp; a similar,

but smaller, antero-internal tubercle developed in  $p^3$  of most species, and in  $p_3$  of *A. humilis*, *jubatus*, and *lucifer*. Posterior basal ledge of  $p_4$ ,  $m_1$ , and  $m_2$  unusually strong and extending along inner base of teeth as a broad, sharply defined shelf.  $m^2$  generally larger than in *Pteropus*, its cusps always distinct: a higher outer, lower inner, and occasionally even a small antero-internal cusp. Upper incisors slenderer, subterete, and more acutely pointed.

Other characters.—Cingulum of upper incisors narrow, particularly in *A. celebensis*, *mackloti*, and *gilvus*.  $i_2$  in crown area from twice and a half to three times the size of  $i_1$  (as in many species of *Pteropus*). Canines typical Pteropine, with well-developed cingulum.  $p^1$ , if present, a minute spicule, scarcely piercing gum, nearly always entirely lost in adults and young adults.  $p_1$  about twice the bulk of  $i_2$ .  $p^3$ ,  $p^4$ ,  $m^1$ , and  $p_3$ ,  $m_4$ ,  $m_1$ ,  $m_2$  shorter and broader than in *Pteropus*, this character less conspicuous in the weak-toothed *A. celebensis*, more so in *A. mackloti*, *gilvus*, and *humilis*, and strongly pronounced in the large and heavy-toothed *A. jubatus* and *lucifer*.  $m_1$  subequal in length to  $p_4$  (in *Pteropus* nearly always conspicuously longer than  $p_4$ ).  $m^2$  larger than, not infrequently twice the bulk of,  $p_1$ .  $m_3$  subequal to  $p_1$ .

Palate-ridges.—5+8+3 (number of middle, divided ridges larger than in any *Pteropus*, except *Pt. papuanus* and *neohibernicus*). First ridge terminating laterally at front of canine; second at back of canine; third at front of  $p^3$ ; fourth at front of  $p^4$ ; fifth at back of  $p^4$ ; sixth at back of  $m^1$ ; seventh at back of  $m^2$ ; eighth to sixteenth postdental. The description is taken from a single specimen of *A. jubatus*.

External characters.—*Acerodon* is externally indistinguishable from *Pteropus*. Interfemoral narrow, but not quite obliterated in centre. Distal phalanx of fifth digit nearly always shorter than proximal; this character is, however, more pronounced in the southern (*A. celebensis*, *mackloti*, *gilvus*; upper row in the subjoined table of wing-indices) than in the northern species (*A. humilis*, *jubatus*, *lucifer*; lower row), and, though rare, not perfectly unknown in *Pteropus*.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c.u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	449	488	115	112	678	469	659	665	385	394	699	298	256
1000	425	433	119	116	668	507	712	655	415	401	681	300	289

Fur short, rather closely adpressed on back, somewhat spreading round neck. A narrow line of short adpressed hair along upperside of humerus, extending also more or less thinly on proximal third or fourth of forearm, but generally leaving region round elbow naked. Femur furred; tibia naked above and below. Short thinly spread woolly fur on underside of lateral membrane between humerus and

femur and along outer side of forearm. Length and distribution of fur essentially alike in all species. Individual hairs on back and rump often finely crinkled, producing (on not too close examination) the impression of a narrow annulation of the hairs.

*Sexual differentiation.*—Canines in all species slightly heavier in males than in females. Males with a tuft of rigid unctuous hairs on each side of neck, more or less concealed by surrounding fur; neck-tufts entirely wanting or only indistinctly differentiated in females.

*Range.*—Celebes group (Celebes, Salayer, Sula Mangoli); Timor group (Timor, Flores, Alor, Sumba); Talaut Islands; Philippines.

*Affinities of genus.*—*Acerodon* is closely allied to *Pteropus*, from which it differs only in the more highly specialized dentition\*. But even these differences in dentition are by no means great when viewed in the light of certain modifications of the teeth occurring in various species of *Pteropus*. To the broad and sharply defined inner basal ledge in  $p_4$ ,  $m_1$ , and  $m_2$  of *Acerodon* there is a perfect analogy in one single species of *Pteropus*, *Pt. anetianus* (allied to *Pt. samoënsis*), the dentition of which is, however, in other respects unmodified Pteropine; a faint initial stage towards the development of a similar inner basal ledge is seen in some (not all) individuals of *Pt. samoënsis* (see above, p. 286), *pilosus* (p. 306), and *ornatus*, species which belong to three different groups of the genus. No known species of *Pteropus* possesses a well differentiated antero-internal basal cusp in  $p^4$  and  $m^1$ , but tendencies to the development of a similar cusp in  $p^3$  and  $p_3$ ,  $p^4$  and  $p_4$  are not quite unknown in that genus (see above, p. 70, under the heading "traces of antero-internal basal tubercles in  $p^3$ ,  $p^4$ ,  $p_3$ , and  $p_4$ "). It is evident, therefore, that the peculiar characters of the *Acerodon* dentition are scarcely more than further developments of tendencies already present, more or less clearly, in different species of *Pteropus*. The claim of *Acerodon* to be considered a distinct genus must therefore rest on the following facts and considerations only, viz., that it exhibits a higher degree of specialization of the dentition than any *Pteropus*, in so far as no form of *Pteropus* possesses an inner basal ledge in the lower molariform teeth combined with a well-developed antero-internal cusp in  $p^4$  and  $m^1$ ; that the six species here referred to *Acerodon* form a perfectly natural group, the members of which are undoubtedly more closely related to each other than to any living species of *Pteropus*, and therefore may be safely presumed to have a common origin; and that they cover a well-defined area of the Indian Archipelago, extending from Celebes southward to the Timor group and northward, through the Talaut Islands, to the Philippines.

\* Also the somewhat larger size of  $m^2$  in *Acerodon* is probably a secondary character, due to the general specialization of the dentition. The structure of this tooth is, allowing for its much smaller size, quite similar to that of  $m^1$ ; even a small antero-internal basal cusp is sometimes developed; and in *A. celebensis*, which in dentition is the most primitive species of the genus,  $m^2$  is not larger than in many *Pteropus*.

*Interrelations of species.*—The six species of *Acerodon* fall into two well-marked natural sections, the one confined to the Celebes and Timor groups, the other and more specialized to the Talaut Islands and Philippines. In the former section the antero-internal tubercle of  $p^4$  and  $m^1$  is rather smaller; a similar tubercle is often developed in  $p^3$ , but not in  $p_3$ ; the ears are longer and more sharply pointed; the general colour of the fur unusually pale, and showing no essential modification according to the species. Externally (ears, distribution of fur, colour, size) the species of this section bear much resemblance to the pale-coloured phase of *Pteropus caniceps*. Of the three species, *A. celebensis* is apparently the most primitive; the dentition is relatively weak, and the premolars show but little of the peculiar shortening and broadening of the crowns so pronounced in all other species of the genus; an antero-internal cusp in  $p^3$  (generally present, or at least indicated, in *A. mackloti* and *gilvus*) seems to be constantly wanting in this species. *A. mackloti* (Timor, Flores, Alor) and *A. gilvus* (Sumba) are closely related, differing from each other chiefly in size. In the second section of the genus, the antero-internal tubercle of  $p^4$  and  $m^1$  is larger; a similar, though smaller, tubercle is always present in  $p^3$  and  $p_3$ ; the ears are shorter and less pointed; the general colour of the body, mantle, and face much darker. The small *A. humilis* (Talaut Islands) is externally very similar to certain races of *Pteropus hypomelanus*. The large *A. jubatus* and *lucifer* (Philippines) show the extreme phase of the broadening and shortening of the large premolars and molars; externally they are at once distinguished from any species of *Acerodon* and *Pteropus* by the peculiar, sharply defined buffy nuchal patch contrasting with the general dark colour of the head, mantle, and body.

*Synopsis of the Species.*

- I. No antero-internal cusp in  $p_3$ . Ears longer than muzzle (front of eye to tip of nose), subacutely pointed. Colour pale: back and underparts approximately mars-brown or vandyck-brown lightened with golden buffy, head and mantle essentially buffy. (Celebes and Timor groups)
  - a. Dentition weaker:  $m^1$ , length (antero-posterior extent of crown) 4.7–5 mm. Skull, total length 62–63. Forearm 130–140. (Celebes group) . . . . . [p. 417.  
1. *A. celebensis*,
  - b. Dentition much heavier:  $m^1$ , length 5.6–6 mm. Skull, total length 66–72. (Timor group)
    - a'. Larger: skull, total length 69–72 mm.; forearm 139–156. (Timor, Flores, Alor) . . . . . [p. 418.  
2. *A. mackloti*,
    - b'. Smaller: skull, total length 66 mm.; forearm 135. (Sumba) . . . . . 3. *A. gilvus*,  
[p. 423.
- II. A distinct antero-internal cusp in  $p_3$ . Ears shorter than muzzle, narrowly rounded off above. Colour dark: back and underparts seal-brown or burnt-umber, more or less sprinkled with pale hairs; mantle chestnut or dark cinnamon-rufous. (Talaut Is.; Philippines)

- c. No pale nuchal patch. Small: forearm 140 mm. [p. 424.  
(Talaud Is.) ..... 4. *A. humilis*,  
d. A pale nuchal patch. Large: forearm 165-205  
mm. (Philippines). [p. 426.  
c'. Forearm 182-205 mm. (Philippines generally) 5. *A. jubatus*,  
d'. Forearm about 165 mm. (Panay) ..... 6. *A. lucifer*,  
[p. 432.

### 1. *Acerodon celebensis*, Pct.

*Pteropus mackloti* var.  $\alpha$ , Dobson, Cat. Chir. B. M. p. 67.

*Pteropus celebensis*, Peters, MB. Akad. Berlin, 1867 (27 May), p. 333 (Celebes); Jentink, Cat. Ost. Mamm. p. 262 (1887: Celebes; Gorontalo; Sula Mangoli); *id.*, Cat. Syst. Mamm. p. 150 (1888: Celebes; Gorontalo; Sula Mangoli).

*Pteropus mackloti* var. *celebensis*, Trouessart, Cat. Mamm. i. p. 83 (1897).

*Pteropus* (*Acerodon*) *mackloti*  $\alpha$ . *celebensis*, Matschie, Megachir. p. 10, pl. iv. fig. 7 (skull of type) (1899: Celebes: Masarang, Tomohon, Gorontalo; Sula Mangoli); Trouessart, Cat. Mamm., Suppl. p. 48 (1904).

*Acerodon celebensis*, K. Andersen, Ann. & Mag. N. H. (8) iii. p. 24 (1909: Celebes group).

*Pteropus mackloti* var.  $\alpha$ , Dobson, Cat. Chir. B. M. pp. 67, 70 (1878: Celebes).

*Pteropus mackloti* (*nec* Temm.), Trouessart, Rev. & Mag. Zool. (3) vi. p. 203 (pt.) (1879); Weber, Zool. Ergebn. Niederl. Ost-Ind. i. p. 96 (pt.) (1890: Celebes); Jentink, op. c. i. p. 126 (pt.) (1890: Maros, nr. Macassar; island opposite Palapo, Luwu); Matschie, Megachir. pl. vi. figs. 6, 6 a (skull, Sula Mangoli) (1899); A. B. Meyer, Abh. Mus. Dresden, vii. no. 7, p. 6 (1899: Tomohon, Minahassa; Salayer); Willink, Nat. Tijds. Nederl. Ind. lxx. p. 271 (1905: Celebes; Salayer).

*Diagnosis*.—Skull small: total length about 62.5-63 mm.; dentition weak:  $m^1$ , length (antero-posterior extent of crown) 4.7-5 mm.; no distinct antero-internal basal cusp in  $p^3$  and  $p_3$ . Ears longer than muzzle (eye to tip of nose), subacutely pointed. General colour of back mars-brown, crown, mantle, and underside of body yellowish buffy or golden buffy, throat dark brown. Forearm 130-140 mm. *Hab.* Celebes group.

*Skull and teeth*.—Skull smaller than in *A. mackloti* and *gilvus* (measurements pp. 422 and 425); palation border simple, without median notch. Dentition weaker than in any other species of the genus; molariform teeth not conspicuously broader, but  $m_1$  rather shorter than in typical *Pteropus*. Antero-internal basal tubercle more sharply marked off in  $m^1$  than in  $p^4$ ; edge of cingulum of  $p^3$  slightly elevated antero-internally, but not forming a distinct cusp; no trace of an antero-internal cusp in  $p_3$ . Basal ledge of  $p_1$ ,  $m_1$ , and  $m_2$  not extending quite so far forward on inner side of teeth as in *A. mackloti* and *gilvus*.

*Membranes* about 12-14 mm. apart at origin from back.

*Far*.—Approximate length, back 10-12, mantle 12-15, belly 10-12 mm. Least width of furred area of back about 30-40 mm.

*Colour*.—British Museum series, males and females, adult and slightly immature: Back and rump deep mars-brown, sometimes approaching vandyck-brown or burnt-umber, generally thinly, sometimes (one of two specimens from Luwu, 94.7.4.3) very thickly, mixed with golden buffy.—Breast, belly, and flanks glossy yellowish buffy or warm golden buffy, this colour confined to the tips of the hairs; base of fur vandyck-brown.—Mantle, sides of neck, and fore-neck buffy or golden buffy, lighter than breast, shading to nearly cream-buff on shoulders, occiput, and crown, in the latter place somewhat mixed with dark brown hairs; extreme base of pale-coloured hairs dark brown. Glandular neck-tufts (in males only) rich tawny at base, tips of hairs not much differing from surrounding fur.—Sides of head mixed buffy and dark brownish, sprinkled with longer silvery whitish hairs. Chin and throat seal-brown, contrasting with pale foreneck, and thinly sprinkled with buffy or silvery buffy hairs.

*Measurements*. On pp. 424, 425.

*Specimens examined*. Nine, in the collections of the Berlin (type; and 4753, 4754, Sula Mangoli), Leyden (*a*, *b*, with skulls), and British Museums.

*Range*. Celebes generally (Minahassa: Masarang and Tomohon; Gorontalo; Luwu; Macassar); Salayer; Sula Mangoli.

*Type* in the Berlin Museum.

*Pteropus celebensis*, Pet.; 1867.—Type locality, "Celebes"; type, adult mounted specimen, skull separate (figured in Megachir. Berl. Mus. pl. iv. fig. 7), collected by Rosenberg, acquired from the Leyden Museum, Berl. Mus. 4012. The originals of Megachir. Berl. Mus. pl. vi. fig. 6 (*Pt. mackloti* on plate) appear to be two skulls of *A. celebensis* from Sula Mangoli, Berl. Mus. 4753, 4754.

*Remarks*.—This species is readily distinguished from *A. mackloti* and *gilvus*, which it closely resembles in colour and other external characters, by its smaller skull and much weaker dentition. Externally all three species show no small resemblance to the pale-coloured phase of *Pteropus caniceps*.

- |              |             |                        |                         |              |
|--------------|-------------|------------------------|-------------------------|--------------|
| <i>a.</i>    | [♀] imm.    | Tomohon, Minahassa;    | Drs. Sarasin [C. & E.]. | 99.10.1.3.   |
|              | sk.; skull. | March, 1894.           |                         |              |
| <i>b, c.</i> | ♂ ad., ♀    | Luwu, Celebes.         | Prof. Max Weber [C.     | 94.7.4.2, 3. |
|              | ad. al.;    |                        | & E.].                  |              |
|              | skulls.     |                        |                         |              |
| <i>d.</i>    | ♂ yg. ad.   | Salayer I.; Nov. 1895. | A. Everett [C.].        | 97.1.3.2.    |
|              | sk.; skull. |                        |                         |              |

## 2. *Acerodon mackloti*, Temm.

*Pteropus mackloti* (pt.), Dobson, Cat. Chir. B. M. p. 66.

(Synonyms under the subspecies.)

*Diagnosis*.—Similar to *A. celebensis*, but with much larger skull and heavier dentition. External dimensions averaging larger: forearm 139–156 mm. *Hab.* Timor, Flores, Alor.

*Skull and teeth*.—Though small individuals of *A. mackloti* are

externally similar in size to large individuals of *A. celebensis*, the skull of the former species is invariably considerably larger and more heavily built; total length about 69–72 mm., against 62–63 in *A. celebensis* (detailed measurements on pp. 422 and 425). A well-marked palation notch present in all skulls examined.—Dentition much heavier than in *A. celebensis*; maxillary tooth-row (c-m<sup>2</sup>) 28.2–29.7 mm., against 24.8–25.8; m<sup>1</sup>, length 5.6–6 mm., against 4.7–5, breadth 4.1–4.7, against 3.5–3.9 (see tables, pp. 422 and 425). Structure of premolars and molars essentially as in *A. celebensis*, but inner basal ledges of p<sub>4</sub>, m<sub>1</sub>, and m<sub>2</sub> slightly broader and longer, and antero-internal cingulum of p<sup>3</sup> more developed, often forming a more or less distinctly differentiated small tubercle.

*Fur*.—Approximate length of hairs, back 11, mantle 16, belly 11–12 mm. Least width of furred area of back 35–45 mm.

*Colour*.—See the subspecies.

*Range*. Timor group; as yet recorded from Timor, Flores, and Alor. Each of these islands appears to be inhabited by a distinct race of this species.

### Key to the Subspecies of *Acerodon mackloti*.

- |   |                                       |
|---|---------------------------------------|
| a. Smaller: forearm 139–146 mm.                           |                                       |
| a'. Underside of body darker. (Timor)                     | 2 a. <i>A. m. mackloti</i> , p. 419.  |
| b'. Underside of body conspicuously paler. (Flores) ..... | 2 b. <i>A. m. floresii</i> , p. 420.  |
| b. Larger: forearm about 156 mm. (Alor)                   | 2 c. <i>A. m. alorensis</i> , p. 423. |

### 2 a. *Acerodon mackloti mackloti*, Temm.

*Pteropus mackloti*, Temminck, *Mon. Mamm.* ii. p. 69, pl. xxxv. fig. 5 (head), pl. xxxvi. figs. 4, 5, 6 (skulls) (1837: Timor); *Wagner, Schreber's Säug., Suppl.* i. p. 348 (1839: Timor); *S. Müller, in Temminck's Verh. Nat. Gesch. Nederl. Overz. Bez., Zoögl.* pp. 20, 59 (1839–44: Timor); *Lesson, N. Tabl. R. Au., Mamm.* p. 13, no. 174 (1842); *Schinz, Syst. Verz. Säug.* i. p. 123\* (1844); *E. Desmarest, Dict. Univ. d'Hist. Nat.* xi. p. 247 (1848); *Gray, Zool. 'Samarang.' Vert.* p. 11\* (1849: Timor); *Wagner, Schreber's Säug., Suppl.* v. p. 597 (1853–55: Timor); *Gervais, Hist. Nat. Mamm.* i. p. 187 (1854); *Giebel, Säug.* p. 996 (1855); *Schlegel, Dierkunde*, i. p. 53 (1857: Timor); *Peters, M.B. Akad. Berl.* 1867, p. 333 (pt.) (Timor); *Gray, Cat. Mamm. Soc.* p. 110 (pt., excl. var.) (1870: Timor); *Fitzinger, SB. Akad. Wien*, lv. Abth. i. p. 426 (1870); *Dobson, P. Z. S.* 1873, p. 248 (neck-glands); *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 516, pl. viii. fig. 3 (1873: structure of hairs); *Dobson, Cat. Chir. B. M.* pp. 66 (pt.), 70 (1878: Timor); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 203 (pt.) (1879); *Jentink, Cat. Ost. Mamm.* p. 262 (1887: Timor); *id., Cat. Syst. Mamm.* p. 150 (pt.) (1888: Timor); *Studer, Forschungsreise 'Gazelle,'* iii. p. 210 (1889: Timor); *Trouessart, Cat. Mamm.* i. p. 83 (pt.) (1897); *Seabra, J. Sci. Math. Lisboa*,

\* Misspelt *Pt. mackloti*.

- (2) v. p. 125 (1897: Timor); *id.*, t. c. p. 168 (1898: Timor); Willink, *Nat. Tijds. Nederl. Ind.* lxx. p. 271 (pt.) (1905).  
*Pteropus* (*Acerodon*) *mackloti*, Matschie, *Megachir.* p. 10 (1899: Timor); Trouessart, *Cat. Mamm., Suppl.* p. 48 (1904).  
*Acerodon mackloti mackloti*, K. Andersen, *Ann. & Mag. N. H.* (8) iii. p. 24 (1909: Timor).  
*Pteropus ochrophæus*, "Müller MS.," Jentink, *Cat. Ost. Mamm.* p. 262 (1887: Timor).

*Diagnosis*.—Underside of body darker than in *A. m. floresii*. Externally smaller than *A. m. aloreensis*. Forearm 139–146 mm. *Hab.* Timor.

*Colour*.—All specimens examined more or less faded. Apparently differing from *A. m. floresii* only in having the dark brownish colour of the underside of the body conspicuously less lightened with pale yellowish buffy tips to the hairs.

*Measurements*. On pp. 421, 422.

*Specimens examined*. Eight, in the collections of the Leyden, Berlin, and British Museums, including the cotypes of the species.

*Cotypes* in the Leyden and Berlin Museums.

*Pteropus mackloti*, Temm.; 1837.—Temminck based the species on "plusieurs individus" (mounted, alcoholic, one skeleton) obtained in Timor by Müller and Macklot. Of Temminck's series are now in the Leyden Museum five mounted specimens (*Cat. Syst.* a, b, c, d, e) with skulls *in situ*, and the skull of a sixth (*Cat. Ost.* a); no alcoholic specimen, no skeleton. A seventh cotype is in the Berlin Museum (no. 2630, ♂ ad. mounted, skull *in situ*, Timor, Müller and Macklot, from the Leyden Museum).

*Pteropus ochrophæus*, Jentink (e Müller, MS.); 1887.—Name copied from the label of one of the Leyden cotypes of *Pt. mackloti* (skull a, *Cat. Ost.*).

a. ♂ ad. st.; skull. Timor. Purchased (Frank). 58.11.18.1.

## 2 b. *Acerodon mackloti floresii*, Gray.

- Pteropus mackloti* (pt.), Peters, *MB. Akad. Berlin*, 1867, p. 333. (Flores); Dobson, *Cat. Chir. B.M.* p. 66 (1878: Flores); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 203 (1879); Weber, *Zool. Ergebn. Niederl. Ost-Ind.* i. p. 96 (1890: Flores); Jentink, *op. c. i.* p. 126 (1890: Sikka, Flores); Weber, *op. c. iii.* 1, p. 268 (1893); Trouessart, *Cat. Mamm.* i. p. 83 (1897); Willink, *Nat. Tijds. Nederl. Ind.* lxx. p. 271 (1905).  
*Pteropus floresii*, Gray, *Cat. Monk. &c.* p. 106 (1870: Flores).  
*Pteropus* (*Acerodon*) *mackloti d. floresii*, Matschie, *Megachir.* p. 11 (1899: Flores). c. *floresii*, Trouessart, *Cat. Mamm., Suppl.* p. 49 (1904).  
*Acerodon mackloti floresii*, K. Andersen, *Ann. & Mag. N. H.* (8) iii. p. 24 (1909: Flores).  
*Acerodon floresianus*, Heude, *Mém. Hist. Nat. Emp. Chîn.* iii. pp. 177, 178, pl. v. fig. 10 (teeth) (1896: Flores).  
*Pteropus floresianus*, Heude, t. c. pp. 177, 178 (1896: Flores).

*Diagnosis*.—Similar to *A. m. mackloti*, but underside of body conspicuously paler. Forearm about 140 mm. *Hab.* Flores.



*Teeth*.— $p^3$ ,  $p^1$ ,  $m^1$ , and  $m_1$  in the single skull examined distinctly heavier than in two skulls of *A. m. mackloti* (see measurements, *infra*).

*Colour*.—♂ ad., type of subspecies: Back and rump light mars-brown (nearly russet), palest anteriorly, darkest on rump, thighs, and interfemoral, and everywhere finely varied with glossy golden buffy or cream-buffy.—Fur of breast, belly, and flanks dark vandyck-brown or mummy-brown at base, glossy pale yellowish buffy at tip, and sprinkled with some silvery whitish hairs, producing the general effect of a pale yellowish buffy somewhat clouded with dark brown.—Mantle golden buffy, this colour shading to pale yellowish cream-buffy on shoulders, sides of neck, occiput, crown, sides of head, chin, throat, and foreneck; concealed base of fur everywhere, except in mantle, vandyck-brown or Prout's brown. Region of glandular neck-tufts in arranged fur rich tawny ochraceous, somewhat contrasting with surrounding paler fur; individual hairs of tufts deep cinnamon-rufous at concealed bases.

*External measurements of Acerodon mackloti.*

	<i>A. m. mackloti.</i> 7 ad.* (Incl. cotypes.)		<i>A. m. floresii.</i> ♂ ad. Type.	<i>A. m. alorensis.</i> ♂ ad. Type.
	MIN.	MAX.		
	mm.	mm.	mm.	mm.
Forearm .....	139	145.5	140	156
Pollex, total length, c. n. ....	...	...	65	69.5
" metacarpal .....		14	14.5	14
" 1st phalanx .....		34	33	36
2nd digit, metacarpal .....	66	70.5	71.5	72.5
" 1st phalanx .....	16	17.5	17	15.5
" 2nd-3rd phalanx, c. n. ....	16.5	17	15.5	17
3rd digit, metacarpal .....	93.5	97	100.5	103
" 1st phalanx .....	63	69	67	72.5
" 2nd phalanx .....	90	99.5	95	103.5
4th digit, metacarpal .....	90	95	98.5	102
" 1st phalanx .....	53	56.5	53	59.5
" 2nd phalanx .....	51	58	53	60
5th digit, metacarpal .....	97	101	102	108
" 1st phalanx .....	40	43	44	46.5
" 2nd phalanx .....	34	38	35	36
Ears, length from orifice .....	...	...	...	32.5
" greatest width, flattened .....	...	...	...	19.5
Front of eye to tip of muzzle .....	...	...	...	30
Interfemoral in centre, depth .....	...	...	...	6
Lower leg .....	2 62.5	...	...	68
Foot, c. n. ....	...	...	46	46
Calcaneus .....	...	...	13	14.5

\* Leyden Museum *a*, *b*, *c*, *d*, *e* (cotypes); Berlin Museum 2630 (cotype); B.M. 58.11.18.1.

*Measurements of skulls and teeth of Acerodon mackloti.*

	<i>A. m. mackloti.</i>		<i>A. m. floresii.</i>	<i>A. m. alorensis.</i>
	Cotype *, 58.11.18.1.		Type.	Type.
	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	69	70	71	71.8
„ palation to incisive foramina ...	33.8	35.2	35	35.5
„ front of orbit to tip of nasals ...	21.8	22.5	21.8	22.8
„ width of brain-case at zygomata	25.7	25.8	25.7	25.7
„ zygomatic width .....	40	40.2	40.8	40.8
„ width across m <sup>1</sup> , externally .....	21.8	22	23	23
„ lachrymal width .....	14.5	15.2	15	15
„ width across canines, externally.	15.2	14.2	15	15
„ postorbital constriction .....	...	7.8	8.5	7.2
„ interorbital constriction .....	...	9.7	9.3	8.5
„ width of mesopterygoid fossa ...	...	8.8	8.8	8.2
„ between p <sup>1</sup> -p <sup>1</sup> , internally.....	12	11	11.8	11
„ between cingula of canines .....	...	7	8	7.5
„ orbital diameter .....	15	14.5	14.8	14.5
Mandible, length .....	55.7	56	56.5	56.8
„ coronoid height .....	28	27.8	29	27.2
Upper teeth, c-m <sup>2</sup> ...	28.3	28.2	29.7	29.7
Lower teeth, c-m <sub>3</sub> .....	31	31.2	32.7	32.8
Upper incisors, combined width .....	6	5.8	5.8	5.7
p <sup>3</sup> , length .....	4.8	4.8	5.2	5.1
„ width .....	3.8	4.1	4.2	4.5
p <sup>4</sup> , length .....	5.2	5.2	5.8	5.7
„ width .....	4.7	4.5	4.9	4.8
m <sup>1</sup> , length .....	5.6	5.7	6	5.8
„ width .....	4.1	4.1	4.7	4.5
m <sup>2</sup> , length .....	3.7	3.8	3.8	3.2
„ width .....	2.9	3.2	3.1	3.1
p <sub>1</sub> , length .....	3	2.7	2.8	2.8
„ width .....	2.6	2.3	2.7	2.5
p <sub>3</sub> , length .....	5.2	5	5.2	5.5
„ width .....	3.1	3	3.3	3.2
p <sub>1</sub> , length .....	5.7	5.5	5.5	5.6
„ width .....	3.7	3.6	3.8	4
m <sub>1</sub> , length .....	5.2	5.2	5.8	5.7
„ width .....	3.8	3.8	4	4
m <sub>2</sub> , length .....	4.3	4.2	4.3	4
„ width .....	3.7	3.7	3.7	3.8
m <sub>3</sub> , length .....	2.8	2.7	2.8	2.5
„ width .....	2.1	2.2	2.8	

\* Leyden Museum, skull *a*.

*Measurements.* On pp. 421, 422.

*Specimens examined.* Two, in the collections of the Berlin and British Museums.

*Type* in collection.

*Remarks.*—The distinctness of this form is open to doubt. The characters on which it is provisionally kept separate here (predominance of pale element in colour of underparts, small differences in size of teeth) are such as must be expected to vary to a certain degree individually. As yet the evidence is not quite strong enough to unite it with *A. m. mackloti*.

*a.* ♂ ad. sk.; skull. Flores. Dr. A. R. Wallace [C.]. 63.12.26.11.  
(*Type* of subspecies.)

## 2 c. *Acerodon mackloti alorensis*, K. And.

*Acerodon mackloti alorensis*, K. Andersen, *Ann. & Mag. N. H.* (8) iii. pp. 24, 25 (2 Jan. 1909: Alor).

*Diagnosis.*—The largest form of *A. mackloti*; forearm about 156 mm. *Hab.* Alor Island.

Skull and teeth as in *A. m. floresii*. Colour of fur as in *A. m. mackloti*.

*Measurements.* On pp. 421, 422.

*Type* in collection.

*a.* ♂ ad. al.; skull. Alor, Lesser Sunda Is.; A. Everett [C.]. 98.3.11.1.  
16 Apr. 1896. (*Type* of subspecies.)

## 3. *Acerodon gilvus*, K. And.

*Acerodon gilvus*, K. Andersen, *Ann. & Mag. N. H.* (8) iii. pp. 24, 25 (2 Jan. 1909: Sumba).

*Diagnosis.*—Allied to *A. mackloti*, but skull and external dimensions smaller; colour of upperside paler. Forearm about 135 mm. *Hab.* Sumba.

*Skull and teeth.*—General characters of skull quite as in *A. mackloti*, but size conspicuously smaller: total length (type) 66 mm., against 69–72 in all races of *A. mackloti*. Upper teeth scarcely differing in size from those of *A. mackloti*, but lower incisors,  $p_1$ ,  $p_2$ , and  $m_1$  distinctly smaller. A small antero-internal tubercle in  $p^3$  of the single specimen examined.

*Colour* (type).—Similar to *A. m. floresii*, but back much paler owing to predominance of pale over brownish element of colour; general aspect light cream-buffy, with Prout's brown or vandyck-brown bases of hairs perfectly concealed on back, slightly showing through on rump.

*Measurements.* On pp. 424, 425.

*Type* in collection.

*a.* ♂ ad. sk.; skull. Waingapo, Sumba, A. Everett [C.]. 98.11.2.10.  
Nov. 1896. (*Type* of species.)

4. *Acerodon humilis*, K. Andl.

*Acerodon humilis*, K. Andersen, *Ann. & Mag. N. H.* (8) iii. pp. 24, 25 (2 Jan. 1909: Lirong, Talaut Is.).

*Diagnosis*.—A distinct antero-internal basal cusp in  $p_3$  (as well as in  $p^3$ ,  $p^4$ , and  $m^1$ ). Ears shorter than muzzle, not attenuated above, tip rounded off. General colour of head, back, and underparts nearly seal-brown, sprinkled with paler hairs; collar dark russet; no light unchal patch. Size small: forearm about 140 mm. *Hab.* Talaut Islands.

*Skull and teeth*.—Skull not differing appreciably from that of *A. celebensis*, except in the somewhat lower rostrum and slightly smaller orbits; palation border simple, without median notch (compare *A. mackloti*). Cheek-teeth short and broad as in *A. mackloti*, much heavier than in *A. celebensis*; antero-internal basal cusp of  $p^3$  distinct but small, that of  $p_3$  well differentiated.

*Ears*.—Very different from the long subacutely pointed ears of *A. celebensis*, *mackloti*, and *gilvus*, rather similar in shape to the ears of *Pteropus hypomelanus*.

*External measurements of Acerodon celebensis, gilvus, and humilis.*

	<i>A. celebensis</i> . ♂ ad.*		<i>A. gilvus</i> . ♂ ad. Type.	<i>A. humilis</i> . ♀ ad. Type.
	MIN.	MAX.		
	mm.	mm.	mm.	mm.
Forearm .....	130	140	135	140 †
Pollex, total length, c. u. ....	60.5	61	59.5	57
"  metacarpal .....	12.5	13.5	13.5	13.5
"  1st phalanx .....	31	32.5	31	30
2nd digit, metacarpal .....	65.5	68	65	66
"  1st phalanx .....	15.5	16	14.5	15
"  2nd-3rd phalanx, c. u. ....	14	14	15.5	15
3rd digit, metacarpal .....	91	93	91.5	89.5
"  1st phalanx .....	63	65.5	62.5	63.5
"  2nd phalanx .....	97.5	100	92	98.5
4th digit, metacarpal .....	89	93	90	88
"  1st phalanx .....	52	54.5	51	54
"  2nd phalanx .....	55	58	51	53
5th digit, metacarpal .....	92	96.5	94.5	92.5
"  1st phalanx .....	38.5	42.5	39	39
"  2nd phalanx .....	32	38.5	35.5	38
Ears, length from orifice .....	29	29	...	24 †
"  greatest width, flattened .....	18	19	...	16 †
Front of eye to tip of muzzle .....	24	25.5	...	...
Interfemoral in centre, depth.....	3	4	...	...
Lower leg .....	58.5	60	...	? 57
Foot, c. u. ....	...	41.5	? 43	...
Calcaneal .....	11	11	11.5	11.5

\* B.M. 94.7.4.2, 3, ♂ ad., ♀ ad., Luwu; Leyden Museum, a, "Celebes."

† Estimate (forearms incomplete).

‡ Resoftened ears of skin.

*Measurements of skulls and teeth of Acerodon celebensis, gilvus, and humilis.*

	<i>A. celebensis.</i> Skulls: 5 ad.* Teeth: 5 ad., 1 imm.* (Incl. type.)		<i>A. gilvus.</i> ♂ ad. Type.	<i>A. humilis.</i> ♀ ad. Type†.
	Min.	Max.		
	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	62.5	63	66	63.2
„ palation to incisive foramina ...	30.7	32.2	32.8	31.5
„ front of orbit to tip of nasals ...	19	20.5	21.2	19.2
„ width of brain-case at zygomata	23.5	24.8	24.8	22.2
„ zygomatic width .....	33.8	36	36	34
„ width across m <sup>1</sup> , externally.....	19.2	21	21	...
„ lachrymal width .....	12.8	13.8	14.8	13.8
„ width across canines, externally.	11.5	14	12.8	12.5
„ postorbital constriction .....	6.7	8.8	9	6.8
„ interorbital constriction .....	8.5	8.8	8.7	9
„ width of mesopterygoid fossa ...	8.2	8.2	8.5	7.8
„ between p <sup>4</sup> -p <sup>4</sup> , internally .....	9.8	11.2	10.2	9.7
„ between cingula of canines .....	6.7	7.2	6	6.2
„ orbital diameter.....	13.6	14.5	14	12.8
Mandible, length .....	49.5	50.5	52.2	49
„ coronoid height .....	24	25	26	26
Upper teeth, c-m <sup>2</sup> .....	24.8	25.8	27.7	24.8
Lower teeth, c-m <sub>3</sub> .....	26.8	28.7	30.8	27.5
Upper incisors, combined width.....	5	5.2	5	...
p <sup>3</sup> , length .....	4	4.5	4.8	4.9
„ width .....	3.3	4	4	3.9
p <sup>4</sup> , length .....	4.6	5	5.5	5.2
„ width .....	3.8	4.2	4.3	4.2
m <sup>1</sup> , length .....	4.7	5	5.8	...
„ width .....	3.5	3.9	4.2	...
m <sup>2</sup> , length .....	3	3.2	3.8	2.7
„ width .....	2.2	2.8	3	2.5
p <sub>1</sub> , length .....	2	2.5	2.2	2
„ width .....	1.8	2	2	2
p <sub>3</sub> , length .....	4.5	4.8	4.9	...
„ width .....	3	3.2	3.2	...
p <sub>4</sub> , length .....	4.8	5.1	5	...
„ width .....	3.1	3.5	3.7	...
m <sub>1</sub> , length .....	4.8	5	5	...
„ width .....	3.3	3.8	3.9	...
m <sub>2</sub> , length .....	3.7	4	4.2	...
„ width .....	3.1	3.3	3.7	...
m <sub>3</sub> , length .....	2	2.2	2.7	2.1
„ width .....	1.8	2	2.5	1.8

\* Skulls: Berlin Museum 4012, Celebes (type); Leyden Museum, skull *a*, Celebes; B.M. 94.7.4.2-3, Luwu, and 97.1.3.2, Salayer.

Teeth: the same skulls, and B.M. 99.10.1.3, Tomohon.

† Most of the cheek-teeth much worn.

*Fur*.—Approximate length, back 14, belly 15 mm. Width of furred area of back about 35 mm.

*Colour* (type).—Back and rump nearly seal-brown, sprinkled all over with broccoli-brown hairs, producing the general effect of a very dark shade of hair-brown.—Breast, belly, and flanks essentially like back, but pale hairs more buffy hair-brown.—Mantle, sides of neck, and foreneck dark russet, slightly paler on foreneck than on nape, forming a complete collar and a narrow circle round base of ears; base of hairs nearly seal-brown.—Occiput, crown, forehead, and sides of muzzle essentially similar to back. Temporal region, chin, and throat blackish seal-brown, mixed with a few silvery whitish or buffy hairs.

*Measurements*. On pp. 424, 425.

*Specimen examined*. The type.

*Range*. So far only known from Lirong, Talaut Islands.

*Type* in collection.

*Remarks*.—The diagnosis of this species gives its differential characters as compared with *A. celebensis*, *mackloti*, and *gilvus*. From *A. jubatus* and *lucifer*, with which it closely accords in its dentition, the form of the ears, and the general colour of the head and body, it differs chiefly in its much smaller size and the absence of any trace of a buffy nuchal patch. Externally (ears, colour, size) it shows much resemblance to *Pteropus hypomelanus macassaricus*, which also occurs in the Talaut Islands; from the ordinary (non-melanistic) phase of that form *A. humilis* is, however, easily distinguished externally by having the russet colour confined to the mantle, sides of neck, and foreneck, not extending to the crown nor to any part of the breast and belly.

a. ♀ ad. sk.; skull. Lirong, Talaut Is.; Hon. W. Rothschild [P.]. 8.7.26.6.  
March, 1897 (*John* (Type of species.)  
*Waterstradt*).

### 5. *Acerodon jubatus*, Eschsch.

*Pteropus jubatus*, Dobson, Cat. Chir. B. M. p. 68.

(Synonyms under the subspecies.)

*Diagnosis*.—General characters of teeth, form and relative size of ears, and colour of back and underside of body essentially as in *A. humilis*, but size much larger, crown, occiput, and nape buffy, strongly contrasting with blackish muzzle and chestnut mantle. Forearm 182–205 mm. *Hab*. Philippines.

*Teeth*.—Antero-internal basal cusp always distinct in  $p^3$ ,  $p^4$ ,  $m^1$ , and  $p_3$ , occasionally detectable also in  $m^2$ ; cusp smaller in  $p^3$  and  $p_3$  than in  $p^4$  and  $m^1$ .

*Fur*.—Approximate length, back 9–16, mantle 14–21, belly 13–16 mm. Least width of furred area of back 50–65 mm.

*Colour*.—See the subspecies.

*Range*. The Philippines generally (Panay perhaps excepted; see *A. j. jubatus*, below).

*Subspecies*. Two, differing in size only; the smaller race known from the islands north of Mindanao, the larger apparently confined to the southern island.

5 a. *Acerodon jubatus jubatus*, Eschsch.

? Calug vel Panicui, *Camel*, *Phil. Trans.* xxv. p. 2198 (1708: Philippines).

*Pteropus jubatus*, Eschscholtz, *Zool. Atl.* pt. iv. p. 1, pl. xvi. (animal; incisors and canines) (1831: Manila); Lesson, *Hist. Nat. Mamm.* (Compl. Buffon) v. p. 59 (1836); Temminck, *Mon. Mamm.* ii. p. 59 (1837: Luzon); Waterhouse, *Cat. Mamm. Mus. Zool. Soc.* 2 ed. p. 13, no. 103 (1838: Luzon); Wagner, *Schreber's Säug., Suppl.* i. p. 343 (1839: Luzon); Blainville, *Ost. Mamm., Chêr.* p. 100, pls. i.\*, ii.\* (skeleton), pl. ix. (vertebrae), pl. x. (sternum), pl. xi. (fore-limb; shoulder-girdle), pl. xii. (hind-limb; pelvis), pl. xiii. (teeth) (1840: Luzon); Waterhouse, *P. Z. S.* 1843, p. 67 (Philippines); Schinz, *Syst. Verz. Säug.* i. p. 120 (1844); E. Desmarest, *Dict. Univ. d'Hist. Nat.* xi. p. 250 (1848); Gray, *Zool.* 'Samarang,' *Vert.* p. 11 (1849: Philippines); Wagner, *Schreber's Säug., Suppl.* v. p. 595 (1853-55: Luzon); Gervais, *Hist. Nat. Mamm.* i. p. 187 (1854); Giebel, *Säug.* p. 995 (1855); Fitzinger, *SB. Akad. Wien*, xlii. p. 389 (1860: Manila); Peters, *MB. Akad. Berlin*, 1861, p. 707 (San Fernando, Albay, Luzon); *id.*, *op. cit.* 1867, p. 332 (Luzon); Zeebor, *Reise 'Novara,' Säug.* p. 12 (1869: Manila); Gray, *Cat. Monk. &c.* p. 105 (1870: Philippines); Fitzinger, *SB. Akad. Wien*, lx. Abth. i. p. 403 (1870); Marchi, *Atti Soc. Ital. Sci. Nat.* xv. p. 515 (1873: structure of hairs); Dobson, *Mon. Asiat. Chir.* pp. 21, 188 (1876: Luzon); *id.*, *Cat. Chir. B. M.* p. 68 (pt.), pl. iv. fig. 6 (dentition) (1878: Luzon; Dinagat); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 203 (pt.) (1879); Günther, *P. Z. S.* 1879, p. 74 (Dinagat; S. Leyte; S. Negros); Steere, *List Birds & Mamm. Steere Exp. Phil.* p. 28 (1890: Leyte; Panay); Elera, *Cat. Sist. Faun. Filip.* i. p. 6 (pt.) (1895: Luzon; Dinagat); Elliot, *Field Col. Mus. Publ., Zool.* i. p. 76 (1896: Panay); Trouessart, *Cat. Mamm.* i. p. 83 (pt.) (1897); Thomas, *Trans. Zool. Soc.* xiv. pt. vi. p. 383 (1898: Barit, Abra Dist., N. Luzon); Sanchez, *An. Soc. Españ. Hist. Nat.* xxix. pp. 242, 275, 288 (1900-1901); Elliot, *Cat. Mamm. Field Col. Mus.* p. 492 (pt.) (1907: Panay).

*Acerodon jubatus*, Lesson, *N. Tabl. R. An., Mamm.* p. 14, no. 195 (1842); Heude, *Mém. Hist. Nat. Emp. Chin.* iii. pl. v. figs. 11, 12 (dentition) (1896); Miller, *Fam. & Gen. Bats*, p. 59 (1907).

*Pteropus (Acerodon) jubatus* (pt.), Matschie, *Megachir.* p. 9 (1899: Luzon; Negros); Trouessart, *Cat. Mamm., Suppl.* p. 48 (1904).

*Acerodon jubatus jubatus*, K. Andersen, *Ann. & Mag. N. H.* (8) iii. pp. 24, 26-29 (1909: Philippines, north of Mindamo).

*Pteropus pyrrhocephalus*, Meyen, *N. Act. Acad. Cæs. Leop.-Car.* xvi. pt. ii. p. 604†, pl. xlv.† (col. fig.), pl. xlv.† figs. 1, 2, 3 (skull; teeth) (1833: Luzon); Schinz, *Syst. Verz. Säug.* ii. Anhang, p. 14 (1845).

\* "I. [espertilio] (*Pteropus jubatus*)" in Blainville, l. c., pls. i., ii.

† "*Pteropus pyrrhocephalus*" in text (pp. 604, 605), but "*Pteropus pyrrhocephalus*" on plates (xlv., xlv.).

*Pteropus* sp., *Nehring, SB. Ges. naturf. Fr.* 1890, p. 102 (nr. Manila).

*Pteropus aurinuchalis*, *Elliot, Field Col. Mus. Publ., Zool.* i. p. 77, pl. xii. (skull) (May, 1896: Leyte); *Sanchez, An. Soc. Españ. Hist. Nat.* xxix. p. 276 (1900-1901); *Elliot, Cat. Mamm. Field Col. Mus.* p. 492 (1907: Leyte).

*Pteropus* (*Acerodon*) *aurinuchalis*, *Trouessart, Cat. Mamm., Suppl.* p. 48 (1904).

*Diagnosis*.—Forearm 182-198 mm. *Hab.* Philippines, north of Mindanao.

*Colour* (♀ ad., Barit, N. Luzon, teeth somewhat worn, 95.8.2.4).—Back and rump nearly seal-brown, somewhat tinged with burnt-umber on rump, distinctly glossy, and everywhere finely powdered or “frosted” with silvery greyish. Individual hairs finely crinkled, producing the impression of a narrow annulation of the hairs.—Breast, belly, and flanks nearly seal-brown, not glossy, conspicuously mixed with longer, coarser yellowish buff hairs, particularly along middle of underside, and everywhere thinly sprinkled with highly glossy silvery white hairs.—Mantle chestnut, shading to chocolate on sides of neck, this again to chocolate seal-brown on foreneck; extreme bases of hairs blackish on mantle and foreneck, yellowish on sides of neck. Chocolate colour of sides of neck extending forward so as to encircle base of ears.—Crown, as far forward as a line between eyes, occiput, and narrow median portion of nape of neck light yellowish buff tinged with orange-ochraceous posteriorly on nape, forming a large sharply defined nuchal patch strongly contrasting with dark mantle, sides of neck, and face; bases of hairs of nuchal patch blackish. Muzzle, circumocular region, sides of face, chin, and throat nearly uniform glossy blackish.

Individual variation of colour.—Chiefly confined to the more blackish or more dark brownish tinge of the back, the thinner or thicker sprinkling of the underparts with pale hairs, the blackish or chocolate tinge of the foreneck, and the more buffy or more orange tinge of the nuchal patch.—Back generally more or less typically seal-brown, but in some specimens tinged with, or closely approaching, burnt-umber (perhaps sun-burnt pelage). General colour of breast, belly, and flanks sometimes dull, in other specimens warm and slightly glossy, seal-brown, in certain lights with a faint tinge of dark maroon; there is every transition (in specimens from the same island) from a very thin to a rather thick sprinkling of this colour with coarse buffy hairs. Foreneck in most specimens washed with dark chocolate or chestnut, but sometimes (and quite independent of the locality) blackish like chin and throat. Nuchal patch varying from nearly cream-buff, through buff, to yellowish buff, generally (not always) tinged with ochraceous buff on nape.

The variations of the colour, as here described, are independent of age, sex, and locality; practically all variations are represented in a series of specimens from Luzon. Closely similar variations are seen in the non-melanistic races of *Pteropus vampyrus*.



*Measurements.* On pp. 430, 431.

*Specimens examined.* Seventeen, in the collections of the Berlin, U.S. National, and British Museums, including the cotypes of *Pteropus pyrrhocephalus* and three topotypes of *Pt. aurinuchalis*.

*Range.* Specimens have been examined from Luzon, Leyte, Negros, and Dinagat (see Ann. & Mag. N. H. (8) iii. p. 26, 1909). Recorded from Panay by Elliot (*l. s. c.*; Panay is the type locality of the very closely related *A. lucifer*).

*Type* in the Dorpat Museum; preserved in alcohol, and, "abgesehen von einigen haarlosen Stellen, ganz wohl erhalten; die Etikette ist zwar nicht von der Hand Eschscholtz's, sondern von seinem Nachfolger Assmus geschrieben, der die damals noch kleine Sammlung ordnete; aber es ist auf der Etikette auf Eschscholtz's Tagebuch hingewiesen, und das Exemplar gehört zum ältesten Besitz des Museums, denn es trägt die Katalognummer 16" (Prof. Dr. J. von Kennel, *in litt.*).

*Pteropus jubatus*, Eschscholtz: 1831.—Type locality, Manila; type obtained during Capt. von Kotzebue's second voyage, 1823-26. The description and figure admit of no doubt as to the identification of the species.

*Pteropus pyrrhocephalus*, Meyen: 1833.—Type locality, Luzon. Cotypes, ♂ ad. and ♀ ad. mounted, skulls separate, Berlin Museum, 340 and 341; the skull of no. 340 (marked no. 7202) is the original of Meyen's figure, pl. xlv. figs. 1-3.

*Pteropus aurinuchalis*, Elliot: 1896.—Type locality, Leyte; based on two specimens (Steore expedition). Three topotypes examined by the present writer are in every respect indistinguishable from *A. j. jubatus*.

a. [♀] ad. sk.; skull.	Philippines.	H. Cuming Coll.	54.3.11.1.
b. [♀] ad. sk.; skull.	Philippines.	Haslar Hospital.	55.10.16.204.
c-f. 2 ♀ ad., 2 ♂ pull. al.; skulls of c, d.	Luzon.	Dr. A. B. Meyer [C.].	72.8.20.9-12.
g. Ad. head st.	Luzon.	Dr. A. B. Meyer [C.].	72.8.20.13.
h, i. ♂ ad. st., ♀ ad. sk.; skulls.	Barit, N. Luzon, 15 & 10 Nov. 1894.	J. Whitehead [C.].	95.8.2.3-4.
j. ♂ ad. sk.; skull.	Barit, N. Luzon, 15 Nov. 1894.	J. Whitehead [C.].	97.5.2.4.
k. ♀ ad. sk. in al.; skull.	S. Leyte.	A. Everett [C.].	77.12.10.12.
l. Ad. skel.; viscera in al.	S. Leyte.	A. Everett [C.].	78.6.27.2.
m, n. ♂ ad., ♀ ad. al.; skulls.	S. Negros.	A. Everett [C.].	77.12.10.10-11.
o. ♀ ad. al.; skull.	Dinagat.	A. Everett [C.].	77.10.6.7.

### 5 b. *Acerodon jubatus mindanensis*, K. Aul.

*Pteropus jubatus*, Günther. *P. Z. S.* 1876, p. 735 (1877: Mindanao); Dobson, *Cat. Chir. B. M.* p. 68 (pt.) (1878: Mindanao); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 203 (pt.) (1879); Elera, *Cat. Sist. Faun. Filip.* i. p. 6 (pt.) (1895: Mindanao); Trouessart, *Cat. Mamm.* i. p. 83 (pt.) (1897).

*Pteropus* (*Acerodon*) *jubatus* (pt.), *Matschie, Megachir.* p. 9 (1899):  
Davao, Mindanao); *Trouessart, Cat. Mamm., Suppl.* p. 48  
(1904).

*Acerodon jubatus mindanensis*, *K. Andersen, Ann. & Mag. N. H.* (8)  
iii. pp. 24, 26-29 (2 Jan. 1909: Mindanao).

*Diagnosis.*—Distinguishable from *A. j. jubatus* only by its rather larger size; the difference will no doubt prove to be one of average only. Colour of fur quite as in the northern race. Forearm about 205 mm. *Hab.* Mindanao.

*Measurements.* On pp. 430, 431.

*Specimen examined.* The type, in collection.

*a.* ♂ ad. st.; skull. Mindanao. Dr. Steere [C.]. 76.10.4.1.  
(Type of subspecies.)

*External measurements of Acerodon jubatus and lucifer.*

	<i>A. j. jubatus.</i> 15 ad.* (Incl. cotypes of <i>A. pyrrhoccephalus</i> .)		<i>A. j.</i> <i>mindanensis.</i> ♂ ad. Type.	<i>A. lucifer.</i> ♀ ad. Topotype †
	MIN.	MAX.		
	mm.	mm.	mm.	mm.
Forearm .....	182	193	205	? 165 †
Pollex, total length, c. u. ....	77	86.5	...	72
" metacarpal .....	16.5	19	...	16.5
" 1st phalanx .....	39	45	...	38
2nd digit, metacarpal .....	85	99	93.5	82
" 1st phalanx .....	18	25	20	21
" 2nd-3rd phalanx, c. u. ....	19	24	25	20.5
3rd digit, metacarpal .....	120	132.5	132	115
" 1st phalanx .....	92	99.5	100.5	88.5
" 2nd phalanx .....	127	143.5	...	116
4th digit, metacarpal .....	117	130	128	114
" 1st phalanx .....	74.5	82	81.5	70.5
" 2nd phalanx .....	70	82	81	64
5th digit, metacarpal .....	122	136	136	120
" 1st phalanx .....	54	59.5	56	52.5
" 2nd phalanx .....	50	59	60.5	49
Ears, length from orifice .....	30.5	23	...	...
" greatest width, flattened ....	19	21.5	...	...
Front of eye to tip of muzzle.....	32	35	...	...
Interfemoral, depth in centre ....	6	10	...	...
Lower leg .....	86	94	96	79
Foot, c. u. ....	56	60	62	? 50
Calcaneal .....	21.5	29	...	...

\* Specimens from Luzon, Leyte, Negros, and Dinagat. For separate measurements of specimens from each of these islands, see *Ann. & Mag. N. H.* (8) iii. p. 27 (1909).

† U.S. N. M. 105448.

‡ Approximate measurement (one forearm incomplete, the other broken). Forearm of type, according to Elliot,  $6\frac{1}{2}$  in. = 165 mm.

Measurements of skulls and teeth of *Acerodon jubatus* and *lucifer*.

	<i>A. j. jubatus</i> . 15 ad.* (Incl. ectypes of <i>A. pyrrhocephalus</i> .)		<i>A. j.</i> <i>mindanensis</i> . ♂ ad. Type.	<i>A. lucifer</i> . ♀ ad. Topotype †.
	MIN.	MAX.		
	mm.	mm.	mm.	mm.
Skull, total length to gnathion .....	77.2	84	85	71.8
„ palation to incisive foramina ...	39.2	43	...	37.5
„ front of orbit to tip of nasals ...	25	29	29	23.3
„ width of brain-case at zygomata ..	26.7	27.5	29.5	26.2
„ zygomatic width .....	41.3	47	46.8	38.5
„ width across $m^1$ , externally .....	23.5	27	26.5	24
„ lacrymal width .....	16.5	19	...	16.2
„ width across canines, externally ..	15	17.2	18	15.2
„ postorbital constriction .....	8	10.2	11	9
„ interorbital constriction .....	10.5	13.2	14	11.8
„ width of mesopterygoid fossa ...	9	11	...	9.2
„ between $p^1$ - $p^4$ , internally .....	11.7	13.3	13.7	12
„ between cingula of canines .....	7	9	9.2	7.8
„ orbital diameter .....	14.8	16	16	15
Mandible, length .....	62	68	69.5	58
„ coronoid height .....	31.5	33.8	35	28.3
Upper teeth, $c$ - $m^2$ .....	32	36	34	30.8
Lower teeth, $c$ - $m_3$ .....	34.2	40	37.8	32.8
Upper incisors, combined width.....	7	8.5	8.8	7.8
$p^1$ , length .....	5.7	6.6	6.5	5.7
„ width .....	4.7	5.2	4.8	4.8
$p^1$ , length .....	6.1	7.2	6.8	6.7
„ width .....	5.1	6	5.8	5.2
$m^1$ , length .....	6.8	7.8	7	6.8
„ width .....	5	5.8	5.2	5.2
$m^2$ , length .....	3.8	4.5	4.3	3.8
„ width .....	2.8	3.7	3.7	3
$p^2$ , length .....	2.6	3.6	3	2.8
„ width .....	2.5	3.1	2.8	2.8
$p^3$ , length .....	5.8	6.8	6.2	5.8
„ width .....	3.7	4	3.8	3.8
$p^4$ , length .....	6.2	7.2	6.5	6.8
„ width .....	4.5	5.2	4.8	4.7
$m^1$ , length .....	6.5	7.7	6.2	6.2
„ width .....	4.9	5.8	5.4	5
$m^2$ , length .....	4.8	5.8	5.2	5
„ width .....	4.1	5.2	5	4.1
$m^3$ , length .....	2.7	3.2	3	2.5
„ width .....	2.2	2.8	2.8	2.4

\* Luzon, Leyte, Negros, and Dinagat. For separate measurements of skulls and teeth of specimens from each of these islands, see Ann. & Mag. N. H. (8) iii. pp. 28, 29 (1909).

† U.S. N. M. 105448.

6. *Acerodon lucifer*, *Elliot*.

*Pteropus lucifer*, *Elliot*, *Field Col. Mus. Publ.*, Zool. i. p. 78, pl. xiii. (skull) (May, 1896: Panay); *Sanchez, An. Soc. Españ. Hist. Nat.* xxix. p. 276 (1900-1901); *Elliot, Cat. Mamm. Field Col. Mus.* p. 492 (1907: Panay).

*Pteropus* (*Acerodon*) *lucifer*, *Trouessart, Cat. Mamm., Suppl.* p. 48 (1904).

*Acerodon lucifer*, *K. Andersen, Ann. & Mag. N. H.* (8) iii. p. 24 (Jan. 1909: Panay.)

*Characters*.—Differing from *A. jubatus* only by its considerably smaller size; skull, total length 72 mm., against 77-85; forearm about 165 mm., against 182-205. Colour of fur quite as in the larger species. *Hab.* Panay.

*Measurements*. On pp. 430, 431.

*Specimen examined*. One topotype, U.S. National Museum, no. 105448.

*Type* in the Field Museum, Chicago; type locality, Concepcion, Panay (Steere Collection).

6. *PTERALOPEX*, *Thos.*

Type.

1888. *Pteralopex*, *Thomas, Ann. & Mag. N. H.* (6) i. p. 155

(1 Feb. 1888) ..... *Pt. atrata*.

*Pteralopex*, *Thomas, P. Z. S.* 1888. p. 473 (1889: characters; affinities); *Winge, E. Mus. Lundii*, ii. pt. i. p. 58 (1892: affinities); *Matschie, Megachir.* p. 11 (1899: subgenus of *Pteropus*); *Miller, Fam. & Gen. Bats*, p. 60 (1907: characters; affinities); *K. Andersen, Ann. & Mag. N. H.* (8) iii. p. 213 (Feb. 1909: characters; affinities).

*Diagnosis*.—Allied to *Pteropus*, but  $i_2$  about twelve to fifteen times the bulk of  $i_1$ , upper canines excessively heavy, with large posterior secondary cusp, upper molariform teeth subsquarish with prominent anterior and posterior basal ledges, and external main cusp of  $p_4$ ,  $m_1$ , and  $m_2$  bifid. Wings from spinal line: ears broadly rounded off above. Size (two species known) as an average *Pteropus*; forearm about 140 mm. Apparently confined to the Solomon Islands.

*Skull* (fig. 21).—Essentially Pteropine, most closely approaching the skull of typical species of the *Pteropus pselaphon* and *samoënsis* groups (cf. fig. 15, p. 302, *Pt. pselaphon*, and fig. 14, p. 289, *Pt. anetianus*). Rostrum short and very broad, not conspicuously tapering anteriorly, lateral margins subparallel; length of rostrum, from front of orbit to tip of nasals (17.2-19 mm.), contained nearly four times in total length of skull (66.5-70.2 mm.), and subequal to breadth across external surfaces of upper canines (17.2-17.5); front of orbit vertically above middle or posterior half of  $p_4$ . Interpremaxillary suture distinct in young, obsolete in aged individuals. Maxillary tooth-rows subparallel; palate Pteropine, except for its

relatively greater breadth in front. Sagittal crest unusually high throughout its whole length; zygoma heavy, with well-marked

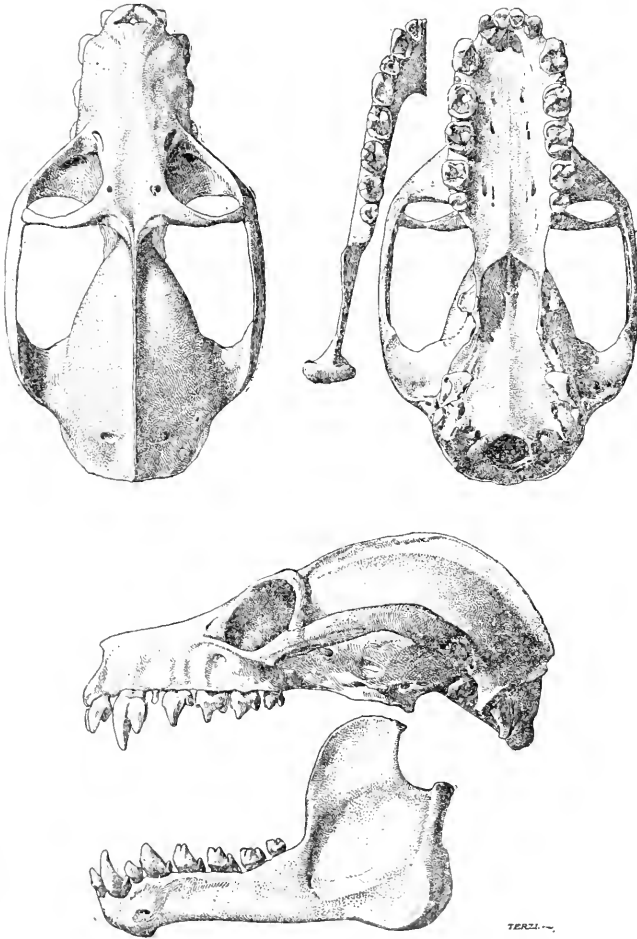


Fig. 21. — *Pteralopex atrata*, ♂, type of species. Guadalcanar. No. 88.1.5.9 (tympanics and part of sagittal crest from a topotype in collection).  $\frac{1}{4}$ .

masseteric ridge; postorbital processes very long, generally reaching zygoma. Ectopterygoid, post-tympanic, and paroccipital processes

unusually large. Tympanic annular, but rather broader than in *Pteropus*. Occipital and hinder parietal region conspicuously deflected, the alveolar margin if projected backward passing through base of post-tympanic process and middle of supraoccipital. Mandibular rami deep, symphysis broad, angular process heavy with unusually prominent masseteric ridge; condyle higher above level of alveolar margin than in any *Pteropus* (vertical from top of condyle to lower edge of mandible subequal to combined length of all lower cheek-teeth); coronoid broad antero-posteriorly and steeply ascending, its front edge at right angle with alveolar margin.

*Dentition* (figs. 21, 22).—Dental formula as in *Pteropus*:— $i^1 i^2 c p^1 p^3 p^4 m^1 m^2$

$i_1 i_2 c p_1 p_3 p_4 m_1 m_2 m_3 = 34.$   $p^1, m^2, i_1,$  and  $m_3$  reduced.

Upper incisors large,  $i^2$  noticeably heavier and longer than  $i^1$ ; posterior ledge very large, shelf-like, rendering antero-posterior equal to or greater than transverse diameter of crown; margin of cingulum of  $i^2$  raised postero-internally into a distinct obtuse cusp (at least in *Pt. atrata*); cutting-edge of  $i^1$  obtusely, of  $i^2$  subacutely pointed. Diastema  $i^2$ -c rather narrow, subequal to interspace  $c$ - $p^3$ . Upper canine enormously thick, chiefly owing to presence of a large secondary cusp halfway up its hinder edge; greatest antero-posterior diameter of crown more than half (about three-fifths) its length from alveolar border; inner cingulum broad, its margin raised into two cusps, viz. a smaller anterior (perhaps undeveloped in *Pt. anceps*) at base of inner vertical ridge of crown, and a larger posterior opposite secondary cusp; vertical groove on front face of crown shallow or even obsolete.  $p^1$  rudimentary, subequal to  $i_1$ , nearly styloid, crown only slightly differentiated from shaft.  $p^3, p^4,$  and  $m^1$  short and broad, subsquarish; anterior and posterior basal ledge prominently developed, shelf-like with raised margin, in one species (*anceps*) restricted to respectively anterior and posterior portion of teeth, in the other (*atrata*) extending on inner side of teeth; inner longitudinal "ridge" in one species (*anceps*) essentially Pteropine, ridge-like, in the other much shortened antero-posteriorly, conical and cusp-like.  $m^1$  slightly smaller than  $p^4$  (*cf. Pteropus*:  $m^1$  with rare exceptions the largest of the upper cheek-teeth).  $m^2$  subsimilar in structure to  $m^1$ , except for complete suppression of anterior basal ledge; size as  $m_3$ .

$i_1$  reduced (relatively a little smaller than in typical Pteropi, but looking quite rudimentary by contrast with large  $i_2$ ), subterete, cutting-edge slightly bifid.  $i_2$  much enlarged, about twelve to fifteen times the bulk of, and much higher than,  $i_1$ ; posterior ledge very long antero-posteriorly, rendering longitudinal greater than transverse diameter of crown; cutting-edge distinctly trifid, with middle cusp much the broadest. Lower canine short and stout, cingulum forming a broad ledge at posterior base of tooth and generally raised into a small rounded tubercle postero-externally.  $p_1$  large, lower than, but subequal in cross section of crown to  $i_2$ , which it closely resembles in structure (broad inner ledge, cutting-edge trifid with middle broader than lateral cusps).  $p_3$ - $m_2$  broader

than in *Pteropus*,  $m_1$  slightly smaller than  $p_1$  (in *Pteropus* the largest of the lower cheek-teeth).  $p_2$  typical Pteropine in structure; posterior basal ledge short, separated postero-externally by a distinct notch from base of outer main cusp. Inner main cusp of  $p_1$  and  $m_1$  nearly Pteropine (ridge-like) in *Pt. anceps*, shortened antero-posteriorly and more cusp-like in *Pt. atrata*; cutting-edge of outer main cusp of same teeth slightly bifid in *Pt. anceps*, more deeply so in *Pt. atrata* (fig. 22, *C*, *C'*, p. 438); posterior basal ledge heavy, particularly postero-internally, and separated by a rather deep notch from base of outer main cusp (as in Pteropi with large basal ledges).  $m_2$  subsquarish, structure essentially as in  $p_1$  and  $m_1$ , but all characters much less pronounced.  $m_3$  subcircular with concave crushing surface; a shallow notch, generally present in external margin, is homologous with postero-external notch in anterior molars.

*Palate-ridges*.—5+6+3; number quite, arrangement very nearly Pteropine. First ridge immediately behind upper incisors; second between canines; median point of third at level of back of canines, extremities at front of  $p^3$ ; fourth between  $p^3$ - $p^3$ , with extremities at back of  $p^3$ ; median point of fifth at level of back of  $p^3$ , with extremities at front of  $p^4$ . Of the six middle ridges, the five anterior are interrupted in the median line, the sixth undivided; median point of this latter at level of back of last molar. Three posterior ridges situated near palation border.

*Ears*.—Short, quite (*Pt. anceps*) or partly (*Pt. atrata*) concealed by surrounding fur. Upper margin semicircularly rounded off (*Pt. atrata*), or with only a slight indication of a blunt tip (*Pt. anceps*). No antitragal lobe.

*Wings*.—Lateral membranes arising from spinal line (or so close together that the interspace is scarcely appreciable) and inserted posteriorly at base of first and second toes. Wing-structure Pteropine, but second phalanx of fourth digit conspicuously (one-fifth to one-fourth) longer than first phalanx; in *Pteropus* the former phalanx is generally slightly shorter than or equal to the latter (cf. wing-indices, p. 73), but even if longer (cf. e.g. *Pt. solomonis*, *ualanus*, *rubianus*, *grandis*, *tuberculatus*, *leucopterus*, *ariel*, *gouldi*), the discrepancy is apparently never so pronounced as in *Pteralopex*. The subjoined wing-indices are calculated from measurements of only three adult individuals:—

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	411	486	133	133	690	458	740	652	406	497	708	295	285

*Affinities*.—Among known bats *Pteralopex* has no closer relatives than the species of the *Pteropus pselaphon* group. Highly peculiar

though the dentition of this genus is, it presents in fact scarcely a single character which is not either developed to a certain extent or at least distinctly foreshadowed in *Pteropus pscelaphon*, *pilosus*, *tuberculatus*, or *leucopterus*. The only essential modifications required to transform the dentition of those species into that of *Pteralopex* are:—(1) a rather slight further increase of the size of the upper incisors and somewhat stronger development of their cingula (upper incisors larger and cingula stronger than usual in the *pscelaphon* group); (2) a considerable enlargement of  $i_2$  (a remarkable enlargement has already taken place in the *pscelaphon* group,  $i_2$  being as much as five times the bulk of  $i_1$ ; cf. also the related *lombocensis* and *samoënsis* groups); (3) a considerable increase of the bulk of the upper canines combined with an enlargement of the inner basal cusps and the posterior marginal cusp (canines already in *Pt. pscelaphon* and some allied species unusually stout with margin of cingulum broken up into separate tubercles, these latter in *Pt. pilosus* exactly similar in number and position to those of *Pteralopex*; a small posterior marginal cusp already present in *Pt. tuberculatus*); (4) a relatively slight further enlargement of  $p_1$  (considerably enlarged in most species of the *pscelaphon* group; cf. also the *samoënsis* group); (5) a conspicuous shortening and broadening of the upper molariform teeth and stronger development of their posterior and anterior basal ledges (to the shortening of these teeth there is a parallel in *Pt. leucopterus*; in all species of the *pscelaphon* and *samoënsis* groups the posterior basal ledges are unusually heavy, in all the anterior ledges at least distinctly indicated, and in one, *Pt. leucopterus*, scarcely less developed than in the more primitive species of *Pteralopex*, viz. *Pt. uniceps*); (6) a transverse depression or notch in the cutting-edge of the outer longitudinal ridge of  $p_1$ ,  $m_1$ , and  $m_2$ , producing a more or less distinct, but never complete, splitting of the ridge into two cusps (a similar depression or notch developed in the inner ridge of  $m_1$  of *Pt. pscelaphon*, and both in inner and outer ridges of  $m_1$  and  $m_2$  of *Pt. leucopterus*).—In general shape the skull of *Pteralopex* closely approaches that of *Pt. pscelaphon* and allied species; such (relatively slight) modifications as have taken place are, probably without exception, consequences of the extremely heavy dentition and the correspondingly increased size and strength of the muscles which direct the movements of the lower jaw, viz. the temporal muscles (very high sagittal crest, long postorbital processes, heavy zygomata, very broad coronoid), the masseter (well-marked horizontal ridge along anterior third of zygoma near its lower margin, very heavy angular process of mandible, condyle very high above alveolar margin, unusually prominent masseteric crest from condyle vertically downward to lower margin of angular process), and pterygoid and digastric muscles (large ectopterygoid, post-tympanic, and paroccipital processes).—The only noteworthy external characters of *Pteralopex* are those given in the diagnosis and description of the genus, viz. the origin of the membranes from the spinal line (to this there are



leanings in certain species of *Pteropus*, e. g. *melanopus*, *papuanus*, *neohibernicus*, and *molossinus*), and the broadly rounded ears (as in *Pt. livingstonei*); in all other respects *Pteralopex* is externally closely similar to *Pteropus pscaphon*.

*Differentiation of species.*—The two known species represent two stages of specialization of the dentition. *Pt. anceps* (W. Solomon Is.) possesses all the essential dental characters of *Pt. atrata* (E. Solomon Is.), some of these fully as highly developed as in the eastern species (enlargement of upper incisors, outer lower incisors, and  $p_1$ , secondary cusp of upper canines), others decidedly less developed (anterior basal ledge of upper molariform teeth not extending on inner face of crown, less pronounced splitting of outer cusp of  $p_1$  and  $m_1$ ), but at the same time it has preserved more of the Pteropine shape of the cheek-teeth (inner cusps of upper cheek-teeth more ridge-like, not conical, less excessive shortening of upper and lower cheek-teeth). So far as the two latter categories of characters are concerned, *Pt. anceps* therefore shows one of the stages through which the still more highly specialized *Pt. atrata* must, in all probability, have passed. In the length and distribution of the fur *Pt. anceps* is nearer *Pteropus pscaphon* than is *Pt. atrata*, and the ear-conch has retained some trace of a blunt tip.

### Key to the Species.

- a. Anterior basal ledge of  $p^1$  not extending on inner side of tooth; fur of back about 20 mm.; tibia and metatarsus densely clothed above; belly drab. (Bougainville) 1. *Pt. anceps*, p. 437.
- b. Anterior basal ledge of  $p^1$  extending on inner side of tooth; fur of back 12–14 mm.; metatarsus and distal fourth of tibia naked; uniform blackish or seal-brown above and beneath. (Guadalcanar) ..... 2. *Pt. atrata*, p. 439.

### 1. *Pteralopex anceps*, K. And.

*Pteralopex anceps*, K. Andersen, *Ann. & Mag. N. H.* (8) iii. p. 266 (1 March, 1909: Bougainville).

*Diagnosis.*—Dentition less specialized than in *Pt. atrata*; ears broadly rounded off above, but with a distinct trace of a blunt tip; fur much longer than in *atrata*, upperside of tibia and metatarsus densely clothed, underparts conspicuously paler. Size as the allied species. *Hab.* Bougainville.

*Teeth* (fig. 22, A, B, C).— $p^1$  more Pteropine in shape and structure than corresponding tooth of *Pt. atrata*; about one-fifth longer than broad (actual measurements, antero-posterior diameter of crown 5.8 mm., transverse diameter 4.8); anterior basal ledge narrow, not extending on inner side of tooth round base of inner main cusp; posterior ledge less heavy, particularly postero-internally, and not extending on inner side of tooth; inner main

cuspid not essentially different from that of  $p^4$  of a *Pteropus*, i. e. ridge-like and constituting inner wall of tooth, not conical and pressed inward on crushing surface.  $p^3$  and  $m^1$  rather similar in general structure to  $p^4$ .— $p_3$ ,  $p_4$ , and  $m_1$  less shortened than in *Pt. atrata*, about one-half longer than broad. A shallow notch in cutting edge of outer main cusp of  $p_4$  and  $m_1$  (fig. 22, C); inner main cusps of same teeth more ridge-like, less cusp-like (conical)

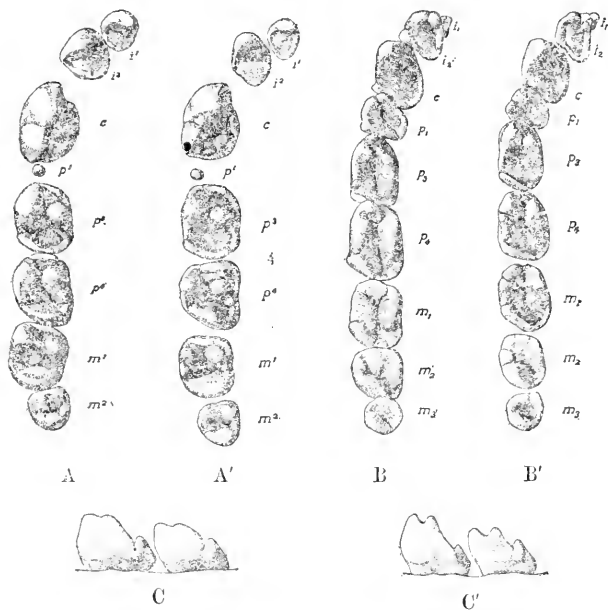


Fig. 22.—A, upper right, B, lower left tooth-rows of *Pteralopex anceps* (type of species). A', B', corresponding tooth-rows of *Pteralopex atrata* (type of species). C,  $p_4$  and  $m_1$  of *Pt. anceps* (type). C', corresponding teeth of *Pt. atrata* (89.4.3.1). All figures  $\frac{1}{2}$  (linear).

than in *atrata*.—Upper incisors and canines, outer lower incisor, and lower canines heavier than in *atrata* (see measurements, p. 441). Cingulum of  $i^2$  not raised as a distinct cusp postero-internally. Posterior basal (cingulum) cusp of upper canine lower, broader, and more obtuse than in *atrata*; anterior basal cusp (in single skull examined) indistinct.

*Ears* (dried skin).—Concealed in surrounding long fur; upper margin triangularly rounded off. Clothed with thinly spread long hairs on both surfaces, from base to tip.

*Fur*.—Long, directed posteriorly on back but not adpressed.

Approximate length, back 20 mm., mantle 30, belly 21. Least width of furred area of back about 42 mm. Forearm thinly clothed above with rather long adpressed hair for proximal third; tibia thickly covered with long hair, the fur extending backward on upperside of metatarsus to base of phalanges; long thinly scattered hairs on phalanges.

*Colour*.—Glossy blackish above, tinged with seal-brown on mantle; base of fur dark vandyck-brown. Foreneck similar to mantle; fur of breast and belly seal-brown or dark vandyck-brown at base, with long drab or pale broccoli-brown tips to the hairs.

*Measurements*. On pp. 440, 441.

*Specimen examined*. The type of the species.

*Range*. West Solomon Islands; thus far only known from Bougainville.

*Type* in collection.

$\alpha$ . ♀ imm. sk.; skull. Bougainville; April, A. S. Meek [C.]. 8.11.167.  
1904. (Type of species.)

## 2. *Pteralopex atrata*, *Thos*.

*Pteralopex atrata*, *Thomas*, *Ann. & Mag. N. H.* (6) i. p. 155 (1 Feb. 1888: Aola); *id.*, *P. Z. S.* 1888, p. 475, pl. xx. fig. 3 (head), pl. xxi. figs. 4-7 (skull and teeth of type) (1 Apr. 1889: detailed description); *Woodford*, *Nat. among the Head-hunters*, p. 49 (1890: Guadalcanar); *Heude*, *Mém. Hist. Nat. Emp. Chin.* iii. p. 179, pl. v. fig. 13 (teeth) (1896); *Trouessart*, *Cat. Mamm.* i. p. 83 (1897); *Miller*, *Fam. & Gen. Bats*, p. 60 (1907).

*Pteropus* (*Pteralopex*) *atrata*, *Matschie*, *Megachir.* p. 11 (1899); *Trouessart*, *Cat. Mamm., Suppl.* p. 49 (1904).

*Diagnosis*.—Dentition more specialized; ears semicircularly rounded off above; fur much shorter, metatarsus and extremity of tibia naked; colour uniform blackish or seal-brown above and beneath. Forearm 139-143.5 mm. *Hab.* Guadalcanar.

*Teeth* (fig. 22, A', B', C').— $p^1$  quite or very nearly as broad as long (actual measurements from four individuals, antero-posterior diameter of crown 4.8-5.2 mm., transverse diameter 4.7-4.8); anterior basal ledge broad, extending as a well-marked shelf on inner side of tooth round base of inner main cusp, which is consequently cut off from inner side of tooth and practically situated on the crushing surface; posterior ledge heavy, particularly postero-internally, and generally extending forward along inner base of tooth, thus nearly reaching inner prolongation of anterior ledge (fig. 22, A'); inner main cusp shortened antero-posteriorly, *i. e.* it has entirely lost its character of a longitudinal ridge and is transformed into a conical cusp.  $p^3$  and  $m^1$  differing from corresponding teeth of *Pt. anceps* in essentially the same characters as  $p^1$ .— $p_1$ ,  $m_1$ , and  $m_2$  more shortened than in *Pt. anceps*, about one-fourth longer than broad. Notch in cutting-edge of outer main cusp of  $p_1$  and  $m_1$  considerably deeper (compare fig. 22 C' with C); inner main cusp of same teeth cusp-like (conical), less ridge-like, than in *anceps*.—

Upper incisors and canines, outer lower incisors, and lower canines less heavy than in *anceps* (measurements, p. 441). Cingulum of i<sup>2</sup> raised into a conspicuous obtusely-pointed cusp postero-internally. Posterior basal (cingulum) cusp of upper canine higher, slenderer, and more narrowly pointed than in *anceps*; anterior basal cusp distinctly differentiated, always much smaller than posterior one, but actual size varying somewhat individually.

*Ears* (P. Z. S. 1888, pl. xx. fig. 3).—Partly exposed (owing not to larger size than in *Pt. anceps*, but to shorter fur of head); semi-circularly rounded off above, without any trace of an obtusely angular tip. Hairing of conch as in the allied species.

*Fur*.—Much shorter than in *Pt. anceps*, and closely adpressed on back. Approximate length, back, median line 12–14 mm., laterally 5–6, mantle 18–20, belly 13–15. Least width of furred area of back about 30–32 mm. Forearm nearly naked above; tibia rather thinly covered with moderately long hair above for proximal

*External measurements of the species of Pteralopex.*

	<i>Pt. anceps</i> , ♀ imm.* Type.	<i>Pt. atrata</i> , 3 ad. (Incl. type.)	
		MIN.	MAX.
	mm.	mm.	mm.
Forearm .....	137	139	143·5
Pollex, total length, c. u. ....	61·5	56·5	59
„ metacarpal .....	15·5	13	13·5
„ 1st phalanx .....	27·5	28	31
2nd digit, metacarpal .....	70	68	70
„ 1st phalanx .....	22	18	19·5
„ 2nd-3rd phalanx, c. u. ....	19	18	20
3rd digit, metacarpal .....	100	95·5	99·5
„ 1st phalanx .....	67	62	66·5
„ 2nd phalanx .....	108	101·5	108
4th digit, metacarpal .....	96·5	88	96·5
„ 1st phalanx .....	56·5	57	58·5
„ 2nd phalanx .....	70	67	73
5th digit, metacarpal .....	102·5	97	102
„ 1st phalanx .....	41·5	41	42·5
„ 2nd phalanx .....	38·5	39·5	41·5
Ears, length from orifice .....	...	16·5	19·5
„ greatest width, flattened .....	...	14·5	17
Front of eye to tip of muzzle .....	..	22·5	25·5
Back of eye to base of ear .....	...	30	35
Interfemoral .....	...	1	2
Lower leg .....	...	58	62·5
Foot, c. u. ....	...	42·5	43
Calcæar .....	...	15	18·5

\* So nearly full-grown that most of the measurements given in this table are directly comparable with those of *Pt. atrata*.

Measurements of skulls and teeth of the species of *Pteralopex*.

	<i>Pt. anceps</i> , ♀ im:m.* Type.	<i>Pt. atrata</i> , Skulls: 3 ad. Teeth: 3 ad., 1 juv. (Incl. type.)	
		MIN.	MAX.
	mm.	mm.	mm.
Skull, total length to gnathion .....	65*	66.5	70.2
„ pulation to incisive foramina .....	29 *	30.2	31.5
„ front of orbit to tip of nasals .....	17.2 *	17.2	19
„ width of brain-case at zygomata .....	25	23	23.8
„ zygomatic width .....	...	38.8	40
„ across crowns of m <sup>1</sup> -m <sup>1</sup> , externally .....	20.7	20.5	22
„ lachrymal width .....	14	13	14
„ across crowns of canines, externally .....	17.2	17.2	17.5
„ postorbital constriction .....	...	6	7
„ interorbital constriction .....	9.5	8.7	9
„ width of mesopterygoid fossa .....	8.2 *	8.8	9.5
„ between p <sup>1</sup> -p <sup>1</sup> , internally .....	10 *	10.8	11.5
„ between cingula of canines .....	8 *	8.5	8.5
„ orbital diameter .....	12.5	13	13
Mandible, length .....	52.8 *	54	57
„ coronoid height .....	...	30	32.8
Upper teeth, c-m <sup>2</sup> .....	25.8	25.8	26.2
Lower teeth, c-m <sub>3</sub> .....	28.7	28	28.5
Upper incisors, combined width .....	10.8	9.7	10
„ canines, ant.-post. diam. of crown .....	10	8.7	9.2
„ „ vertical extent from alv. .	6.2	5.2	5.7
p <sup>3</sup> , length .....	5	4.8	5.5
„ width .....	4.7	4.2	4.8
p <sup>4</sup> , length .....	5.8	4.8	5.2
„ width .....	4.8	4.7	4.8
m <sup>1</sup> , length .....	5	4.7	5
„ width .....	4.2	4	4
m <sup>2</sup> , length .....	3.2	2.8	3.2
„ width .....	3	3	3
p <sub>1</sub> , length .....	3.7	3	3.2
„ width .....	3.7	3.2	3.7
p <sub>3</sub> , length .....	5.7	4.8	5
„ width .....	3.6	3.2	3.6
p <sub>4</sub> , length .....	6	4.8	5.2
„ width .....	3.9	3.8	4
m <sub>1</sub> , length .....	5.7	4.7	5
„ width .....	3.9	3.8	4
m <sub>2</sub> , length .....	4	3.8	4
„ width .....	3.8	3.5	3.7
m <sub>3</sub> , length .....	3.5	2.8	3
„ width .....	3	2.8	3

\* Of the skull measurements those marked with an asterisk are probably a trifle smaller than in fully-adult individuals.

three-fourths; distal fourth, metatarsus, and phalanges naked save for some thinly scattered hairs.

*Colour*.—Glossy blackish or blackish seal-brown above; base of fur not differing. Entire underside nearly typical seal-brown (a tinge slightly paler and less glossy than that of back), sprinkled with some longer shiny blackish hairs; no trace of drab on underparts. Individual variation inconspicuous; females not differing appreciably in colour from males, nor immature individuals from adult.

*Measurements*. On pp. 440, 441.

*Specimens examined*. Those registered below.

*Range*. East Solomon Islands; as yet only recorded from Guadalcanar.

*Type* in collection.

<i>a, b.</i> 2 ♂ ad. al.; skull of <i>a</i> .	Aola, Guadalcanar.	C. M. Woodford, 88.1.5.9, 10. Esq. [C]. (88.1.5.9: <i>Type</i> of species.)
<i>c-c.</i> ♀ ad., ♀ juv. al., ♂ yg. ad. sk.; skulls.	Guadalcanar.	C. M. Woodford, 89.4.5.1-3. Esq. [C].

## 7. STYLOCTENIUM, *Matschie*.

*Pteropus* (pt.), Dobson, Cat. Chir. B. M. p. 15.

Type.

1899. *Styloctenium*, *Matschie*, *Megachir*. p. 33 . . . . . *S. wallacei*.

*Pteropus* (pt.), Gray, P. Z. S. 1866, p. 65; *Peters*, MB. Akad. Berlin, 1867, p. 329; Gray, Cat. Monk. Sc. p. 111 (1870); *Dobson*, l. s. c. (1878).

*Styloctenium*, *Miller*, Fam. & Gen. Bats, p. 62 (1907).

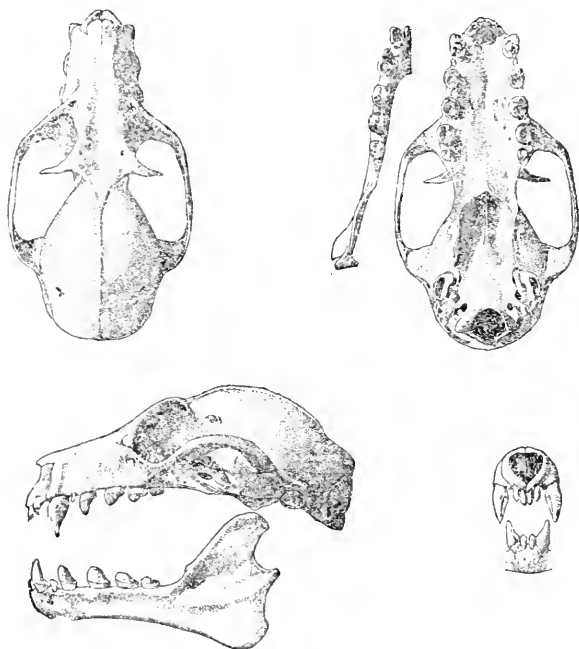
*Diagnosis*.—Allied to *Pteropus*, but  $i_1$  and  $m_3$  wanting, incisors slender, cylindrical, acutely pointed at tips, canines short and thick, and molariform teeth subcircular or oval in outline with low and smoothly rounded ridges and cusps. Cranial and external characters Pteropine. Size as the smallest species of *Pteropus* (forearm 90-96 mm.). Apparently confined to Celebes.

*Skull* (fig. 23).—Perfectly Pteropine, differing only in trivial characters from skulls of *Pteropus lombocensis*, *temmincki*, and *capistratus*. Brain-case conspicuously deflected posteriorly, alveolar line projected backward passing through middle of supraoccipital. Rostrum short and broad; length from front of orbit to tip of nasals less than one-third of total length of skull; breadth across crowns of canines not much less than across lower edges of lachrymal foramina. Orbits large, diameter subequal to lachrymal breadth; front of orbit above front of  $m^1$  or diastema  $p^1-m^1$ . Zygoma slender, without postorbital processes; upper postorbital processes slender, not reaching much more than halfway to zygoma; sagittal crest fully developed but low. Coronoid rather high but narrow antero-

posteriorly, profile of front margin sloping backward; coronoid height of mandible a little more than  $e-m_2$ ; condyle above level of alveolar line.

Dentition (fig. 23).— $\frac{i^1 i^2 e p^1 p^3 p^4 m^1 m^2}{i_2 e p_1 p_3 p_4 m_1 m_2} = 30$ .  $p^1$  rudimentary,  $m^2$  and  $p_1$  considerably reduced.

Upper incisors slender, terete, abruptly and sharply pointed at tip;  $i^1$  markedly longer than, but not differing in form from,  $i^2$ .  $i_1$  entirely wanting;  $i_2-i_2$  quite or very nearly in contact with each other and with canines, similar in shape and size to  $i^2$ . Upper and lower canines short, unusually thick; cingulum narrow; vertical



TEAZI —

Fig. 23.—*Styloctenium wallacei*, ♂. Mt. Masarang, N. Celebes.  
No. 97.1.2.4. ♀.

groove on front face of upper canines well marked.  $p^1$  a minute spicule, deciduous;  $p_1$  similar to that of *Pteropus*.  $p^3$  and  $p_3$  essentially as in *Pteropus*, but rather lower and broader.  $p^4$  and  $m^1$ ,  $p_4$ ,  $m_1$ , and  $m_2$  peculiarly short and broad, upper teeth subcircular, lower teeth oval in outline; cusps and ridges broadened and

smoothly rounded; no trace of posterior and anterior basal ledges.  $m_2$  Pteropine, equal in size to  $p_1$ ;  $m_3$  entirely wanting.

*External characters.*—Wings from sides of back and base of second toe; wing-indices not differing appreciably from those of *Pteropus*. No tail. Interfemoral scarcely developed in centre. Calcar short, about one-sixth (in *Pteropus* generally about one-third, rarely only one-fourth) of total length of foot with claws.

*Affinities.*—*Styloctenium* is a rather slightly specialized offshoot of that branch of *Pteropus* which, in another direction, has developed into the species of the *Pteropus temminckii* and *lombocensis* groups. In nearly all important dental, cranial, and external characters it is either closely approached by, or perfectly similar to, the living representatives of those groups:—(1) In *Pt. lombocensis* the canines are short and thick, and the middle pair of lower incisors ( $i_1$ ) so much reduced as to be nearly rudimentary; in *Styloctenium* the canines are still thicker, and  $i_1$  has entirely disappeared: (2) in *Pt. lombocensis*  $m_3$  is conspicuously reduced, almost rudimentary, in *Styloctenium* it has disappeared: (3) in general shape and nearly all details the skull of *Styloctenium* is closely similar to that of *Pt. lombocensis* and *temminckii* (compare fig. 23 with fig. 13, p. 270, skull of *Pt. solitarius*); the mandible is weaker than in the heavy-toothed *Pt. lombocensis*, but in every respect similar to that of *Pt. capistratus*: (4) the ears of *Styloctenium* are similar in shape and size to those of *Pt. lombocensis* and *temminckii*: (5) the quality of the fur (soft and silky) quite as in the species of the *Pt. temminckii* group; distribution of fur, even to the smallest details (hairing of forearm, tibia, and metatarsus) as in *Pt. personatus*: (6) one of the most conspicuous external features of the three species of the *Pt. temminckii* group is the unusually light (silvery greyish or silvery buffy) colour of the fur, which on spreading shows sharply contrasting seal-brown bases to the hairs: precisely the same colour characters are found in *Styloctenium*: (7) *Pt. personatus* and *capistratus* are unique in the genus *Pteropus* in having the head marked with sharply defined white and seal-brown stripes and spots; the same peculiar pattern is found in *Styloctenium* (the seal-brown colour lightened to cinnamon) to such extent that the white stripes and spots are exactly similar in position to those of *Pt. personatus* (white median stripe on muzzle, white supraocular spot, white spot at angle of mouth extending forward along upper and lower lips): (8) the calcar is somewhat shorter than usual in the *Pt. temminckii* group, in *Styloctenium* more conspicuously shortened. In size the single species of *Styloctenium* is similar to *Pt. personatus*.—The slender terete shape of the incisors of *Styloctenium* is in all probability a secondary character; it re-occurs in *Acerodon*. To the circular or oval form of the molariform teeth, with broadened and smoothly rounded cusps and ridges, there are more or less close parallels in different species of *Pteropus* (*Pt. papuanus*, *neohibernicus*, *macrotis*, *epularius*).



1. *Styloctenium wallacei*, Gray.*Pteropus wallacei*, Dobson, Cat. Chir. B. M. p. 40.

*Pteropus wallacei*, Gray, P. Z. S. 1866, p. 65, fig. 1 (head) (Macassar, ♂ juv.); *id.*, Cat. Monk. Sc. i. p. 111, fig. 21 A (head) (1870: same specimen); Dobson, Cat. Chir. B. M. p. 40 (1878: same specimen); Trouessart, Rev. & Mag. Zool. (3) vi. p. 205 (1878); Jentink, Notes Leyd. Mus. v. p. 172 (1883: Amurang, one adult); *id.*, Cat. Syst. Mamm. p. 140 (1888: same specimen); ? Hickson, Naturalist in N. Celebes, p. 84 (1889: Talisse); Trouessart, Cat. Mamm. i. p. 79 (1897); A. B. Meyer, Abh. Mus. Dresden, vii. no. 7, p. 5, pl. iv. fig. 1 (col. fig. of animal) (1899: Tomohon). *Styloctenium wallacei*, Matschie, Megachir. p. 33, pl. iv. figs. 1-4 (skull: ♀ yg. adult, Minahassa) (1899: Lotta; Mt. Masarang; Tomohon); Trouessart, Cat. Mamm., Suppl. p. 55 (1904); Wil-link, Nat. Tijds. Nederl. Ind. lxx. p. 275 (1905); Miller, Fam. & Gen. Bats, p. 62 (1907).

*Pteropus personatus* (pt., nec Temm.), Peters, MB. Akad. Berlin, 1867, p. 329 (type of species considered the young of *Pt. personatus*).

Forearm about 90-96 mm.

Ears.—As in *Pteropus temminckii* and *lombocensis*: moderate (nearly reaching eye), exposed, rather broadly rounded off above: naked except at base posteriorly.

Fur.—Soft and silky: directed posteriorly but not closely adpressed on back; everywhere interspersed with conspicuously longer semierect hairs. Approximate length, back and mantle 7-9 mm. (fur) and 12-13 (longer hairs), belly 7-8 (fur) and 11-12 (longer hairs). Width of furred area of back about 35-40 mm. (skins).

Forearm clothed with rather long adpressed hairs above nearly to carpal extremity; tibia densely furred above, the hair extending backward in a thin line along upperside of metatarsus; short scattered hairs on toes; thinly spread hair on the whole of the lateral membrane between fifth digit and body. Underside of forearm and tibia covered for proximal half; hairing on underside of antebrachial and lateral membranes slightly thicker than in typical species of *Pteropus*.

Colour (B. M. series).—General colour of back and rump whitish grey slightly tinged with cream-buff on forearms and with pale cinnamon on tibiae (lightest extreme: 97.1.2.4); or essentially the same colour but conspicuously washed on the whole of the back, rump, and tibiae with light cinnamon (99.10.1.2); or nearly uniform warm cinnamon (darkest extreme: 66.2.13.11). An elongate patch of white hair on each shoulder along antebrachial membrane. Concealed base of fur of upperside always strongly contrasting seal-brown.—Throat, foreneck, breast, belly, and underside of tibiae a light tinge of cinnamon (golden buffy cinnamon), generally deepest on median tract of underside, palest on sides of breast and flanks. Concealed base of fur seal-brown.—Occiput, region round base of ears, mantle, and sides of neck whitish or creamy-white with concealed seal brown bases to the hairs. Head, nearly as far back as

front of ears, approximately cinnamon (a tinge essentially similar to that of breast and belly but slightly darker). A narrow white stripe along upperside of muzzle, terminating posteriorly midway between eyes; a circular or elongate white patch above posterior half of each eye (not touching eyelid); a large white patch at angle of mouth extending forward along upper lip to some distance from nostrils and along lower lip to chin; all white markings sharply defined against surrounding cinnamon fur. Cinnamon hair of head seal-brown at extreme base, whitish hair uniform from base to tip.

No appreciable sexual difference in colour.

*Measurements.* On pp. 446, 447.

*Specimens examined.* Four, in the collections of the Leyden (one, Amurang) and British Museums.

*Range.* Celebes generally; so far recorded from Minahassa (Lotta, Tomohon, Mt. Masarang, Amurang) and Macassar.

*Type* in collection.

- a. ♀ yg. ad. sk.; Tomohon, Minahassa; Drs. Sarasin [C. & 99.10.1.2.  
skull. 5 Nov. 1894. E.].  
b. ♂ yg. ad. sk.; Mt. Masarang, Minahassa, 3500'; Oct. Dr. Chas. Hose [C.]. 97.1.2.4.  
skull. 1895.  
c. ♂ juv. sk.; Macassar; 1857. Dr. A. R. Wallace 66.2.13.11.  
skull. [C.].

(*Type* of species.)

*External measurements of Styloctenium wallacei.*

	2 ad.*	
	Min.	Max.
	mm.	mm.
Forearm .....	90	95.5
Pollex, total length, c. u. ....	40	44
" metacarpal .....	...	10
" 1st phalanx .....	...	23
2nd digit, metacarpal .....	...	48.5
" 1st phalanx .....	...	11
" 2nd-3rd phalanx, c. u. ....	...	13.5
3rd digit, metacarpal .....	66	68
" 1st phalanx .....	47	47
" 2nd phalanx .....	61.5	65
4th digit, metacarpal .....	65.5	68.5
" 1st phalanx .....	37.5	38
" 2nd phalanx .....	...	40
5th digit, metacarpal .....	67	70
" 1st phalanx .....	30	31
" 2nd phalanx .....	29	29
Lower leg .....	...	? 38
Foot, c. u. ....	...	? 32
Calcar .....	...	? 5 †

\* Leyden specimen (Amurang) and B.M. 97.1.2.4 (Mt. Masarang).

† Estimate (skin).

*Measurements of skulls and teeth of Styloctenium wallacei.*

	Skull : 1 ad. Teeth : 1 ad., 2 imm.*		
	MIN.		MAX.
	mm.	mm.	mm.
Skull, total length to gnathion .....		49	
„ palation to incisive foramina .....		22	
„ front of orbit to tip of nasals .....		15.2	
„ width of brain-case at zygomata .....		18.8	
„ zygomatic width .....		28	
„ across crowns of $m^1$ - $m^1$ , externally .....		14.2	
„ lachrymal width .....		11.2	
„ across crowns of canines, externally .....		10.2	
„ postorbital constriction .....		6.8	
„ interorbital constriction .....		6.8	
„ width of mesopterygoid fossa .....		7.2	
„ between $p^4$ - $p^4$ , internally .....		7.5	
„ between cingula of canines .....		4.8	
„ orbital diameter .....		11.5	
Mandible, length .....		38	
„ coronoid height .....		20.5	
Upper teeth, $c$ - $m^2$ .....		18.2	
Lower teeth, $c$ - $m_2$ .....		19.7	
Upper incisors, combined width .....		4.3	
$p^3$ , length .....	2.8		3.2
„ width .....	2.5		2.7
$p^4$ , length .....	3		3.2
„ width .....	3		3.5
$m^1$ , length .....	3.2		3.6
„ width .....	2.8		3
$m^2$ , length .....	2		2.2
„ width .....	1.9		2.5
$p_1$ , length .....	1.7		1.8
„ width .....	1.7		1.8
$p_3$ , length .....	2.8		2.8
„ width .....	2.1		2.2
$p_4$ , length .....	3.1		3.2
„ width .....	2.7		3
$m_1$ , length .....	3.7		3.8
„ width .....	3		3.2
$m_2$ , length .....	3.1		3.2
„ width .....	2.7		2.8

\* Skull and tooth-rows, B.M. 97.1.2.4 (Mt. Masarang); individual teeth, the three skulls in collection.

S. DOBSONIA, *Palmer*.*Cephalotes*, Dobson, Cat. Chir. B. M. p. 91.

Type.

1815. *Pteronotus*, *Rafinesque*, *Anal. Nat.* p. 54 (nom. nud.) ..... [D. "palliata."]  
 1828. *Hypoderma*, *E. Geoffroy*, *Cours Hist. Nat. Mamm.*, 13 leçon (for 27 June, 1828\*), p. 28 [nec *Hypoderma*, *Latreille*, 1825, a genus of Diptera] ..... D. "palliata."  
 1829. *Tribonophorus*, *Burnett*, *Quart. J. Sci. Lit. Art.*, April-June, 1829, p. 269 (nom. nud.) ..... [D. "palliata."]  
 1898. *Dobsonia*, *Palmer*, *Proc. Biol. Soc. Wash.* xii. p. 114 (30 April, 1898) ..... D. *peroni*.  
*Pteropus*, third section, "Roussettes à ailes sur le dos," *E. Geoffroy*, *Ann. Mus. d'Hist. Nat.* xv. p. 98 (1810).  
*Cephalotes*, *E. Geoffroy*, *Ann. Mus. d'Hist. Nat.* xv. p. 104 (pt.) (1810); *Temminck*, *Mon. Mamm.* ii. pp. 50, 103 (1837); *Gray*, *Mag. Zool. & Bot.* ii. p. 504 (1838); *id.*, *Voy. 'Sulphur'*, *Zool.* i. p. 29 (1844); *id.*, *Zool. 'Samarang'*, *Vert.* p. 13 (1849); *Peters*, *MB. Akad. Berlin*, 1865, p. 256; *Gray*, *P. Z. S.* 1866, p. 64; *Peters*, *MB. Akad. Berlin*, 1867, p. 871; *Gray*, *Cat. Monk. &c.* p. 119 (1870); *Dobson*, *Ann. & Mag. N. H.* (4) xvi. p. 354 (1875); *id.*, *Cat. Chir. B. M.* p. 91 (1878); *Flower & Lydekker*, *Mamm.* p. 65 (1891); *Winge*, *E. Mus. Lundii*, ii. pt. i. pp. 24, 27, 28, 56 (1892: affinities; dental formula); *Matschie*, *Megachir.* p. 85 (1899).  
*Pteronotus*, *K. Andersen*, *Ann. & Mag. N. H.* (8) i. p. 432 (1908: identification).  
*Hypoderma*, *Is. Geoffroy*, *Dict. Class. d'Hist. Nat.* xiv. p. 707 (Sept. 1828); *id.*, *Ann. Sci. Nat.* xv., Oct. 1828, pp. 192, 195; *Wagner*, *Schreber's Säug., Suppl.* i. p. 371 (1839); *Blyth*, *Cuvier's An. Kingd.* p. 69† (1840); *Wagner*, *Schreber's Säug., Suppl.* v. p. 612 (1853-55).  
*Tribonophorus*, *Palmer*, *Ind. Gen. Mamm.* pp. 688, 805 (1904: identification); *K. Andersen*, *Ann. & Mag. N. H.* (8) i. p. 432, footnote (1908: identification).  
*Dobsonia*, *Thomas*, *Proc. Biol. Soc. Wash.* xv. p. 198 (1902); *Miller*, *Fam. & Gen. Bats*, p. 63 (1907: characters; affinities); *K. Andersen*, *Ann. & Mag. N. H.* (8) iv. p. 528 (1909: revision of genus).

*Diagnosis*.—Cranial rostrum shortened, front of orbit to tip of nasals never much more than, often subequal to, lachrymal breadth; premaxillæ much reduced, subvertical. Incisors  $\frac{1}{1}-\frac{1}{1}$ ; upper incisors between (not in front of) canines; upper canines slanted forward, lower canines closely approximated or in perfect

\* *E. Geoffroy's Cours de l'histoire naturelle des mammifères* ("Leçons sténographiques"), though dated on the titlepage of the complete volume 1829, was issued in 20 livraisons in the course of the year 1828 (*Is. Geoffroy*, *Vie d'Ét. Geoffroy Saint-Hilaire*, p. 422, 1847). In *Dict. Class. d'Hist. Nat.* vol. xiv. (dated Sept. 1828), p. 706, *Is. Geoffroy* refers to his father's "Leçons sténographiques" (or in any case to the 13th leçon here under consideration) as "un travail publié tout récemment," therefore evidently before Sept. 1828.

† Miswritten *Hypodermis*.

contact; cheek-teeth  $\frac{1}{6}$  ( $p^1$  lost). Tail present; index without claw; wings from spinal line; notopatagium practically naked; ears pointed. Size medium or large: forearm 80-153 mm. [Twelve species. Range, the whole of the Austro-Malayan sub-region.]

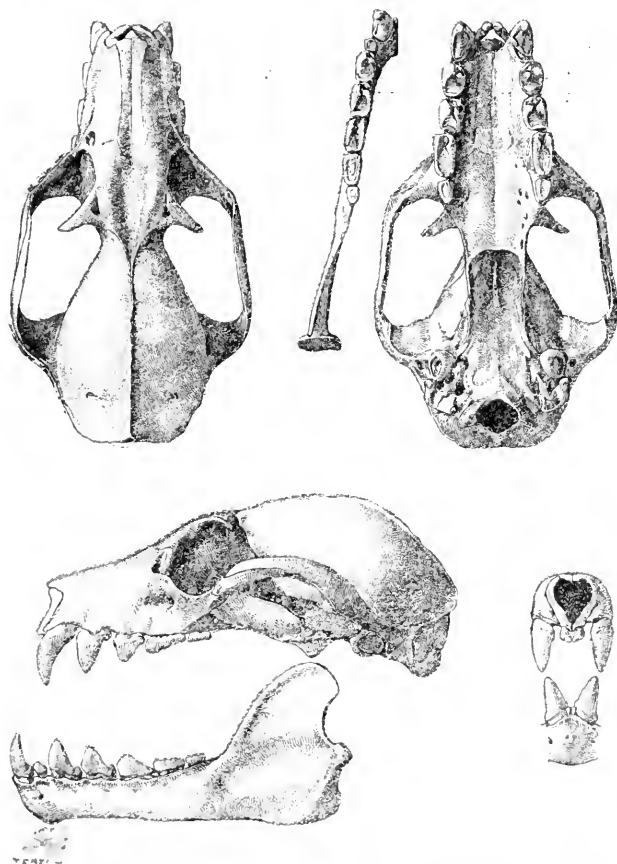


Fig. 24.—*Dobsonia magna*, ♂. Ighibirei. Kemp Welch River, British New Guinea. No. 97.8.7.5. †.

*Skull* (fig. 24).—General aspect Pteropine with the following peculiar modifications:—Premaxillæ much reduced, forming two thin rods (breadth subequal to that of crown of an upper incisor),

and directed almost vertically downward; in sharp profile of rostrum, the tip of the incisor, very often the whole of the crown of the incisor, even including the distal extremity of the premaxilla, are hidden from view between the powerful anteriorly slanted canines; in conformance with the reduction of the premaxillæ also the nasals are conspicuously shortened, tip vertically above front or more often middle (in some species even hinder edge) of alveolus of canine; diastema  $c-p^3$  much narrower than in *Pteropus* and *Rousettus*. As a total effect of all these modifications, rostrum very considerably shortened, from front of orbit to tip of nasals only slightly more than, in certain species equal to or a little less than, breadth across lower edges of lachrymal foramina.

Other cranial characters essentially Pteropine, or with slight reminiscences of the Rousettine type of skull:—Palate decidedly Pteropine, narrower than in *Rousettus*, particularly in the post-dental portion; occiput slightly more tubular than in *Rousettus*, but rather less so than in *Pteropus*; tympanic ring rather broader than in *Pteropus*, very nearly as in *Rousettus*; ectopterygoid processes short, as in *Rousettus*; premaxillæ in simple contact anteriorly or slightly separated; sagittal crest well developed.—Symphysis of lower jaw much shorter than in *Rousettus* and *Pteropus* and sub-vertically ascending; all other characters of lower jaw perfectly Pteropine: coronoid broad and rather steeply ascending, angular process broadly rounded off, condyle distinctly above level of alveolar line.

Dentition (figs. 24, 25).— $\frac{i^2 c \quad p^3 p^4 m^1 m^2}{i_2 c p_1 p_3 p_4 m_1 m_2 m_3} = 28$ .  $i_2$  rudimentary, sometimes deciduous;  $p_1$ ,  $m_3$ , and  $m^2$  much reduced in size.—The dentition of *Dobsonia* differs from that of *Rousettus* and *Pteropus* chiefly in the following characters:—

Incisors.—Upper incisors ( $i^2-i^1$ ) small, in intercanine line, generally distinctly spaced; crown chisel-shaped, the outer half (acted upon by tip of lower canines) shorter than inner, cutting-edge bilobate or irregularly crenulate. Lower incisors ( $i_2-i_1$ ) styliform, almost functionless, closely wedged in between canines, sometimes deciduous (*D. viridis*, *crenulata*).

Canines.—Upper canines slanted considerably forward, profile of front margin of crown conspicuously convex, of hinder margin concave; anterior and external surfaces of crown smooth (no distinct vertical groove); cingulum generally well developed. Lower canines moved forward to anterior extremity of jaw, closely approximated, sometimes practically in contact.

Premolars and molars.—Tooth for tooth remarkably Pteropine, in general outline and even in relative size, as well as in the degree of reduction of  $p_1$ ,  $m_3$ , and  $m^2$ ; but  $p^1$  (rudimentary in *Pteropus*) has entirely disappeared, and the diastemas  $c-p^3$  and  $c-p_3$  are narrowed. In detailed structure the premolars and molars show the following four progressive stages of specialization:—

(1) Nearly unmodified, *i. e.* differing (apart from loss of  $p^1$ ) from

the Roussetine and primitive Pteropine type in no essential characters but the larger size of  $p^3$  and  $p_3$  and the more prominent longitudinal ridges; no well-developed posterior or antero-internal basal ledges (but traces of such may be detectable), no median surface ridges (one species, *D. minor*): (2) a well-developed posterior basal ledge in  $p^3$ ,  $p^4$ ,  $p_3$ , and  $p_4$ ; a well-marked antero-internal basal ledge or cusp in  $p^3$  and  $p^4$ , generally at least a trace of a similar ledge in  $p_3$  and  $p_4$ , but never in  $m_1$ ; median surface-ridges in  $m^1$  and  $m_2$ , sometimes also in  $p^4$  and  $m_1$  (four species, *D. exoleta*, *pannietensis*, *moluccensis*, *magna*): (3) essentially as foregoing, but with a strong antero-internal ledge also in  $m_1$ , but not in  $m^1$  (two species, *D. peroni*, *sumbana*): (4) essentially as foregoing, but a

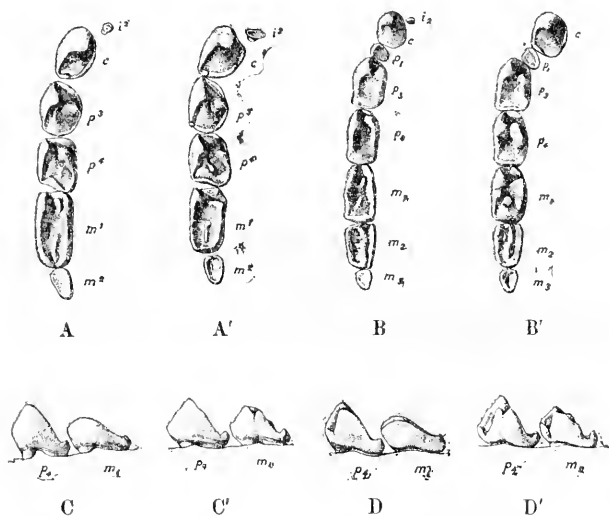


Fig. 25.—A, B, C, D, *Dobsonia exoleta* (99.10.1.4, type of species).  
A', B', C', D', *D. viridis* (7.1.1.261; no lower incisors).  
A, A', upper right, B, B', lower left tooth-rows.  
C, C', external, D, D', internal profile of  $p_4$  and  $m_1$ .  
All figures about  $\frac{2}{3}$  (linear).

strong antero-internal ledge also in  $m^1$  (this ledge therefore well-differentiated in  $p^3$ ,  $p^4$ ,  $m^1$ ,  $p_3$ ,  $p_4$ , and  $m_1$ ), the posterior basal ledge still more strongly developed, as are generally also the surface-ridges; outer and inner longitudinal ridges of  $p^4$ ,  $m^1$ ,  $p_3$ , and  $m_1$  (or at least some of these teeth, but rarely also  $p^3$  and  $p_3$ ) showing a distinct tendency to break up into two or more separate cusps

(five species, *D. viridis*, *crenulata*, *prædatrix*, *inermis*, *nesea*); this marks the final phase of specialization of the postcanine teeth in *Dobsonia* \*.

*Palate-ridges* (fig. 26).—5+4+3, i. e. five anterior undivided, four middle interrupted in median line, and three posterior. For arrangement of ridges see figure. There appears to be but little

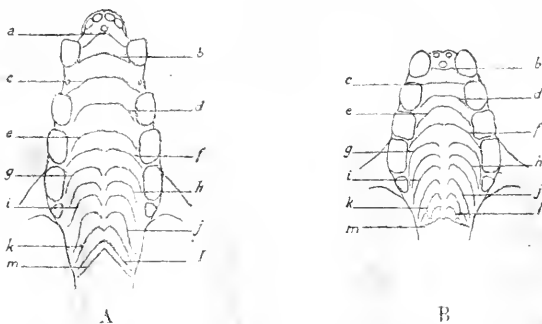


Fig. 26.—Palate-ridges. A, *Pteropus hypomelanus tonesi* (94.7.14.3), for comparison with B, *Dobsonia exoleta* (97.1.3.18). The probable homologies of the ridges is indicated by the lettering of the figures. Both figures  $\frac{1}{2}$ .

specific and individual variation.—The homologies of the ridges, as compared with those of typical species of *Pteropus*, will be readily

\* *Milk dentition and homologies of incisors*.—The peculiar modifications of the upper and lower incisors and canines so conspicuous in the permanent set of teeth of *Dobsonia* have not reacted in the slightest degree on the milk dentition. A young *D. prædatrix* in the collection (77.7.18.4, forearm about 62 mm., as against 111–121 in adults of same species) has the following milk teeth (added, in upper and lower row, the permanent set for comparison):

$$\begin{array}{ccccccc} i^2 & c & & p^3 & p^4 & m^1 & m^2 \\ di^1 & di^2 & de & dp^3 & dp^4 & & \end{array} \quad \text{Four upper milk incisors spiculiform, slightly} \\
\begin{array}{ccccccc} di_1 & di_2 & de & dp_3 & dp_4 & & \end{array}$$

$$\begin{array}{ccccccc} i_2 & c & p_1 & p_3 & p_4 & m_1 & m_2 & m_3 \end{array}$$
 recurved, very distinctly spaced (interspaces a little less than 1 mm.), perfectly alike in shape and size. Permanent  $i^2$  visible above and external to  $di^2$  (jaw cut open), but no trace of a permanent incisor belonging to  $di^1$ . This appears to be conclusive evidence that the missing pair of upper incisors in the permanent set is  $i^1$ , not  $i^2$  (compare *Boneia*, anteâ, p. 56, in which the missing upper incisor is also  $i^1$ ; in the Roussettine branch of Megachiroptera *Boneia* and *Dobsonia* are the only genera with 1—1 upper incisors; in certain specialized genera of the Cynopterine branch it is  $i^2$  that is reduced). Middle lower milk incisors ( $di_1$ ) extremely small, barely cutting gum, spiculiform, not recurved, in perfect contact with each other; outer lower milk incisors ( $di_2$ ) separated from  $di_1$  (interspace nearly 1 mm.), considerably higher and broader, crown slightly differentiated from shaft. The single permanent lower incisor is



understood by an inspection of figs. 26 A & B. The only explanation required is that the first Pteropine ridge is wanting in *Dobsonia*, evidently owing to the shortening of the extremity of the rostrum. The fifth (last "undivided") ridge of *Dobsonia* (f in the figure) thus corresponds to the sixth (first divided) of *Pteropus* (same letter in figure), and it is in fact in *Dobsonia* not infrequently slightly interrupted in the middle.

*Ears*.—In all species rather abruptly attenuated above, tip narrowly pointed, both characters slightly less pronounced in *D. minor* than in the other species.

*Wings*.—Terminal (third) phalanx of second digit present, about one-fourth or one-fifth of second phalanx, but claw wanting. Wing-membranes perfectly continuous across back, and connected with integument of dorsum only along spinal line (the only parallel to this is seen in the MacroGLOSSINE genus *Notopteris*); posteriorly inserted on distal extremity of first or second metatarsal or on base of proximal phalanx of same toes (the variation in this respect is individual). Ratio of metacarpals and phalanges differing from Rousettine type chiefly in two characters:—(1) In typical *Rousettus*, third metacarpal longer than fourth, this again longer than fifth; in *Dobsonia* third metacarpal longer than fifth, this again nearly always longer than fourth, the modification due not to a lengthening of the fifth but to a distinct shortening of the fourth metacarpal: (2) terminal (second) phalanx of third digit conspicuously lengthened, longer than metacarpal of same digit, in *Rousettus* much shorter than metacarpal.—The subjoined wing-indices are calculated from

situated below the roots of  $di_1$ – $di_2$ . In *Rousettus*  $i_1$  is often slightly smaller than  $i_2$ , in *Pteropus* always conspicuously smaller, in certain species of *Pteropus* (e. g. the *Pt. lombocensis* group) still more reduced than usual, and finally in *Styloctenium* it has quite disappeared. This evidence in itself renders it almost certain that the missing lower incisor in *Dobsonia* is  $i_1$ , not  $i_2$ , and the correctness of this conclusion is confirmed by the very small size of  $di_1$  as compared with  $di_2$ .

Upper milk canine even more widely separated from  $di^2$  than is the permanent canine of a *Pteropus* from  $i^2$  (diastema nearly equal to the whole set of four upper milk incisors), and directed vertically downward, not showing the slightest trace of the conspicuous forward slant of the permanent canine of *Dobsonia*; crown faintly recurved, a little thickened at middle, as if tending to develop a minute secondary cusp from anterior margin. Permanent upper canine situated in jaw above and in front of root of milk canine. Lower milk canine perfectly Pteropine in position, not moved forward to the slightest degree (compare extreme anterior position of permanent canine), separated from  $di_2$  by a diastema of nearly 2 mm., crown styliform, faintly recurved. The large permanent lower canine fills out the entire space in the jaw between the roots of  $di_2$  and  $dc$ .— $dp^3$ ,  $dp^4$ ,  $dp_3$ , and  $dp_4$  small, spiculiform, slightly recurved.

There must be sufficient space, in the maxillary bone in front of  $dc$  and in the lower jaw between  $di_1$  and  $dc$ , for the growth of the powerful upper and lower permanent canines. This may be the simple explanation of the wide diastemas  $di^2$ – $dc$  and  $di_1$ – $dc$ , in other words, of the fact that, though the permanent canines have moved anteriorly, their predecessors have not.

measurements of fifty adult specimens representing all species known :—

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	375	430	111	69	621	456	616	568	390	421	586	311	359

*Tail*.—As in *Rousettus*; shorter than, rarely equal to, hind foot, basal portion connected with underside of interfemoral by its dorsal integument, tip freely projecting.

*Fur*.—Notopatagium (membrane covering back from shoulders to interfemoral) so thinly haired as to appear practically naked; in some specimens a distinct indication of a narrow line of hair down the spinal tract; pelvic region and central interfemoral often distinctly though sparsely furred; short closely adpressed hairs on proximal third of forearm; tibia naked; underside of membrane along forearm and between humerus and femur thinly covered with woolly hair. Fur of body short, adpressed, as in *Rousettus*. Dorsum beneath notopatagium densely furred.

*Colour*.—The species are very uniform in colour (the difference, if any, not well-marked); the individual variation, on the other hand, is often conspicuous. General aspect of colour recalling the sombre tinges of *Rousettus*; darkest, generally bistre or blackish bistre, on head, distinctly paler and more approaching hair-brown on back of neck, palest and nearly always approaching drab or fawn-drab on underside of body. But in the majority of individuals the brownish colours are washed with a peculiar tinge of olive, and very often this tinge lightens on the underparts and nape of the neck to raw-umber or tawny-olive or even light golden tawny-olive; these tinges often with an indefinable greenish hue; individuals which do not show some raw-umber or tawny-olive admixture at least on the centre of the breast and belly are rare. So far as the available material goes, sexual and age differences in colour appear to be inconspicuous.

*Size*.—Of the twelve species known, one, *D. minor*, is similar in size to a *Rousettus* (forearm 80 mm.), nine to a small *Pteropus* (forearm 108–129 mm.), two, *D. moluccensis* and *magna*, to an average *Pteropus* (forearm 133–153 mm.).

*Range*.—From Celebes, Flores, and Timor in the West, through the Moluccas, to New Guinea, the Bismarck Archipelago, and Solomon Islands, as far as the islands of San Christoval and Ugi, but not extending to Australia. The range of the genus covers exactly the Austro-Malayan subregion as understood by Wallace. If not otherwise stated, the subjoined tabular view of the distribution of the species and primary groups of the genus is based entirely on specimens examined by the writer :—

	<i>minor</i> group.	<i>moluccensis</i> group.	<i>peroni</i> group.	<i>viridis</i> group.
Sumba .....	.....	.....	sumbana	
Flores .....	.....	.....	peroni †	
Timor .....	.....	.....	peroni	
Wetter .....	.....	.....	peroni	
Alor .....	.....	.....	peroni	
Samao .....	.....	[? <i>moluccensis</i> *]	[peroni †]	
Celebes .....	.....	exoleta		
Buru .....	.....	<i>moluccensis</i>	.....	[ <i>viridis</i> †]
Amboina .....	.....	<i>moluccensis</i>	.....	<i>viridis</i>
Ceram .....	.....	<i>moluccensis</i>	.....	<i>viridis</i>
Banda Is. ....	.....	[ <i>moluccensis</i> †]	.....	<i>viridis</i>
Key Is. ....	.....	[ <i>moluccensis</i> †]	.....	<i>viridis</i>
Aru Is. ....	.....	<i>moluccensis</i>		
Morotai .....	.....	.....		<i>crenulata</i>
Rau .....	.....	.....		<i>crenulata</i>
Gilolo .....	.....	.....		<i>crenulata</i>
Ternate .....	.....	.....		<i>crenulata</i>
Batchian .....	.....	.....		<i>crenulata</i>
Mysol .....	.....	<i>magna</i>		
Waigeou .....	.....	<i>magna</i>		
New Guinea .....	<i>minor</i>	<i>magna</i>		
Bismarck Arch. ....	.....	.....	.....	<i>prædatrix</i>
Kiriwina .....	.....	<i>pannietensis</i>		
Fergusson I. ....	.....	<i>pannietensis</i>		
Panniet I. ....	.....	<i>pannietensis</i>		
Shortland .....	.....	.....	.....	<i>nesea</i>
Rubiana .....	.....	.....	.....	<i>nesea</i>
San Christoval .....	.....	.....	.....	<i>inermis</i>
Ugi .....	.....	.....	.....	<i>inermis</i>

\* Specimen examined, but locality perhaps questionable.

† Probably occurring, but no specimens examined.

‡ Recorded, but no specimens examined.

*Habits*.—The bats of this genus are said to hide in caves, rarely in trees (S. Müller); in the island of Alor, Timor group, A. Everett found *D. peroni* “in rock shelters on the coast at sea-level” (collector’s label, B.M.); *D. inermis* was obtained by Dr. Guppy in Ugi, Solomon Islands, in a “cave in coral limestone” (collector’s label B.M.); and Père Heude’s specimens of *D. viridis* were found in similar surroundings in the Key Islands. Apart from these meagre facts, their habits appear to be unknown.

*Affinities*.—*Dobsonia* is a peculiarly modified offshoot of the Rousetto-Pteropine branch. It has originated from a bat which had all the essential cranial and dental characters seen in typical species of *Pteropus*, but externally was more similar to a *Rousettus*. Cover the tip of the rostrum of a typical Pteropine skull as far back as the front of  $p^3$  and  $p_3$ , similarly a skull of *Dobsonia* (preferably *D. magna*, because it is equal in size to an average *Pteropus*), and the differences between the two skulls become perfectly trivial; compare similarly the skull of a typical *Rousettus*, and the differences

are conspicuous. The bony palate of *Dobsonia*, both in its interdental and postdental portions, is decidedly Pteropine, not Rousettine, in outline; the occiput slightly lengthened (tubular), though not quite as much as in *Pteropus*; the angular and coronoid processes perfectly Pteropine; the outline of all premolars and molars, tooth for tooth, Pteropine; the degree of reduction of  $p_1$ ,  $m_2$ , and  $m^2$  precisely as in *Pteropus*; the crowns of the single pair of upper incisors ( $i^2$ ) modified Pteropine, not Rousettine: the palate-ridges differing from those of *Pteropus* only in the disappearance of the first ridge. But the tympanic ring is a trifle broader and the ectopterygoid processes distinctly smaller than in *Pteropus*.

The peculiar modifications of the dentition and skull are these:—The upper canines are slanted obliquely forward, the lower canines moved forward to the anterior extremity of the mandible. The shifted position of the canines has put the lower incisors quite, the upper incisors partly out of function;  $i_1$  has disappeared,  $i_2$  is rudimentary, wedged in between the closely approximated canines, and in some species deciduous,  $i^1$  has disappeared, and  $i^2$  is smaller than in *Pteropus* and somewhat modified in shape, because acting not against  $i_2$  but against the tip of the lower canine; as a consequence, the premaxillæ are greatly reduced in breadth and directed (not obliquely forward but) nearly vertically downward between the canines, the nasals are shortened proportionately, the symphysis of the mandible, which in *Pteropus* and *Rousettus* is sloping, is very short and almost vertically ascending. The disappearance of  $p^1$  and narrowing of the diastemas  $e-p^3$  and  $c-p_2$  contribute to the shortening of the rostrum. The detailed structure of the premolars and molars is in the most primitive species (*D. minor*) essentially Rousettine or primitive Pteropine; in all other species modified by the development of more or less sharply differentiated posterior and antero-internal basal ledges and of median surface-ridges, in some species also by a distinct tendency to a splitting of the longitudinal ridges into separate cusps. But even when most completely differentiated the structure of the premolars and molars of *Dobsonia* is only the extreme phase of characters developed or tendencies traceable in other offshoots of the Rousettine section; posterior basal ledges are present in most species of *Pteropus* (see *ant. a.*, p. 69), antero-internal ledges are slightly indicated in certain species of *Pteropus* (p. 70) and well-developed in *Acerodon* and *Pteralopex*, tendency to a splitting of the longitudinal ridges is seen in a few species of *Pteropus* (p. 70), and much more pronounced in *Pteralopex*; median surface-ridges are not developed in other genera of the Rousetto-Pteropine section, but they are common in the Cynopterine group, which is derived from a Rousettine type of bat.

The tail is similar in length to that of *Rousettus* (absent in *Pteropus*), the proportionate length of the metacarpals and phalanges nearer the Rousettine than the Pteropine type, the style of colour of the fur Rousettine not Pteropine. But *Dobsonia* is highly peculiar in having the furred back completely covered by the naked dorsal wing-membranes, and in the loss of the claw of the index.

The pointed ears are so persistent a character in all known species that they may be presumed to be an inheritance from the extinct prototype of the genus.

*Plastic characters.*—All known species of *Dobsonia* are essentially alike in the characters of the skull, incisors, canines, and palate-ridges, the shape and relative size of the ears, the length of the tail, the wing-structure and insertion of the membranes, and the distribution, quality, length, and colour of the fur. The plastic characters are, first and chiefly, the detailed structure of the molars and premolars, second and only to a small extent, the degree of shortening of the rostrum (shortest in species with highly specialized cheek-teeth), and third, the general size of the animal. The primary groups of the genus are here based on the four progressive stages of molar-structure (see Synopsis, p. 459). Between the *D. minor* group and the three other main groups of the genus the gap is in this respect a little broader than between these latter *inter se*.

*History of species in literature.*—Bats of this genus were unknown to zoologists until E. Geoffroy, in 1810, described his *Pteropus palliatus* and *Cephalotes peroni* (Geoffroy's "*Pteropus cephalotes*," 1803, is in reality *Pteropus palliatus* mixed up with characters borrowed from Pallas's description of "*Vespertilio cephalotes*"). *Pt. palliatus* is, and since the type is lost will always remain, indeterminable: *Cephalotes peroni* is the earliest name of the species inhabiting Timor and some neighbouring islands. The collections made during the voyage of the 'Astrolabe' added one species, *Hypoderma moluccense*, Quoy and Gaimard, 1830, from Amboina; though in fact a distinct species, it was by Temminck, in 1837, put down as synonymous with *Cephalotes peroni*, and till quite recently (1909) all writers accepted Temminck's decision. Nearly half a century passed without further additions to the list of species; the three principal revisers of the genus during this long period, viz. Peters in 1867, Gray in 1870, and Dobson in 1878, simply copied Temminck in recognizing only one species, *Cephalotes peroni*, with the synonyms *Pteropus palliatus* and *Hypoderma moluccense*. In 1879 Dobson described a new species from N.W. New Guinea, *Cephalotes minor*; the type in the Paris Museum remained for many years the only specimen known, until in 1909 a second example was discovered in the rich collection of *Dobsonia* preserved in Leyden. In 1896 Heude named and briefly described the Key Island species, *Cephalotes viridis*. The next reviser (Matschie, 1899) again failed to work out the genus; all the then described four species were united under one heading, *Cephalotes palliatus*. The year 1905 added two new species, *Dobsonia magna*, Thomas, from New Guinea, and *Cephalotes pannietensis*, De Vis, from the Louisiade Archipelago. The latest reviser (K. Andersen, 1909) pointed out the differential characters of *Dobsonia peroni*, *moluccensis*, *minor*, *viridis*, *magna*, and *panniensis*, and added six new species, *D. exoleta* (Celebes), *sumbana* (Sumba), *crenulata* (Gilolo group), *prædatrix* (Bismarck Archipelago), *inermis* (E. Solomon Is.), and *nescia* (W. and Central Solomon Is.).

*History of generic names.*—As already referred to above, the earliest species of *Dobsonia* known are E. Geoffroy's *Pteropus palliatus* and *Cephalotes peroni*, both described in 1810. The history of the technical names of the present genus is intimately connected with the history of these two "species" in literature.

Geoffroy classed the eleven species of "*Pteropus*" known to him in three sections, viz. "Roussettes sans queue," corresponding to the genus *Pteropus* in modern sense, "Roussettes à queue," equivalent to *Eidolon*, *Rousettus*, *Cynopterus*, and *Macroglossus*, and "Roussettes à ailes sur le dos," with the single species *Pt. palliatus*. He considered it probable that this third section, which presented certain striking external characters of its own, would eventually, when better known, be elevated to the rank of a distinct genus intermediate between *Pteropus* and *Cephalotes*. Following this hint Rafinesque, in 1815, proposed the generic name *Pteronotus* for the "Roussette à ailes sur le dos," and this is in fact the earliest name suggested for the present genus; the reasons for not accepting it as such are purely formal; there is no doubt that Rafinesque really intended it for *Pt. palliatus*, but he failed to express this intention clearly in words (perhaps because he regarded it as sufficiently clearly indicated by the very name, *πτερόν*, "aile," *νώτος*, "dos," and by the place of the genus in his system, immediately after the names of Geoffroy's first and second sections), and according to modern nomenclatural rules it is therefore a nomen nudum. Again, in 1829, Burnett proposed for a species of *Pteropus* styled by him "*desmaresti*," and which is undoubtedly *Pt. palliatus*, the generic name *Tribonophorus* (*i. e.* mantle-bearer; compare the French name of *Pt. palliatus*, Roussette mantelée), but technically *Pt. desmaresti* is a nomen nudum, and *Tribonophorus*, as based without description on a nomen nudum, inadmissible. With these still-born generic names the history of Geoffroy's third section of *Pteropus* comes to an end; already in 1825 Temminck had declared *Pt. palliatus* the young of *Cephalotes peroni*, and in 1828 Geoffroy himself adopted this view.

Geoffroy's genus *Cephalotes* (1810) numbered two species, *C. peroni* and *C. pallasi*, the latter being only a new name for Pallas's *Vespertilio cephalotes*. As soon as it was realized that these two species represented entirely different genera, the question arose as to whether the name *Cephalotes* ought to stand for the former or the latter species. Temminck, in 1825, retained *Cephalotes* for *C. peroni*, and adopted Illiger's *Harpyia* for *C. pallasi*; and a glance at the secondary references given above (p. 448) will show that his decision was accepted by all the principal revisers of, and the large majority of writers on, the genus. But as far back as 1828, Étienne Geoffroy had pointed out that *Cephalotes* rightly belonged to the species *C. pallasi*, and proposed for *C. peroni* (or rather *palliatus*, which he now considered the young of *C. peroni*) the generic name *Hypoderma*; he was followed only by a few French writers (and their translators) and by Wagner.—According to the now current nomenclatural rules the type of *Cephalotes* is

*Vespertilio cephalotes*, leaving *Hypoderma* as a name of *C. peroni*; but as *Hypoderma* is preoccupied in Entomology, *C. peroni* remained in reality without a technically acceptable generic name, until *Dobsonia* was proposed by Palmer, in 1898.

*Synopsis of the Groups and Species.*

- A. Premolars and molars simple; no well-marked antero-internal and posterior basal ledges, no surface-ridges . . . . . A. D. MINOR GROUP.
- a. Smallest species, forearm about 80 mm. (N.W. New Guinea) . . . . . 1. *D. minor*, p. 460.
- B. A well-marked antero-internal basal ledge (or cusp) at least in  $p^1$  and  $p_4$ , a posterior basal ledge at least in  $p^3$ ,  $p_3$ , and  $p_4$ , a median surface-ridge (or cusp) at least in  $m^1$  and  $m_2$ , often also in  $p^4$  and  $m_1$ .
- I. Antero-internal corner of  $m_1$  not differentiated as a distinct cusp or ledge . . . . . B. D. MOLUCCENSIS GROUP
- a. Much smaller:  $c-m^2$  (crowns) 19·8–21·3 mm., forearm 109–116.
- a'. Rather larger: skull 52 mm.,  $c-m^2$  20·5–21·3, maxillary teeth on the whole heavier, forearm about 112·5–116; surface-ridge distinct in  $m^1$ ,  $m_1$ , and  $m_2$ . (Celebes) . . . . . 2. *D. exoleta*, p. 461.
- b'. Rather smaller: skull 47–48 mm.,  $c-m^2$  about 19·8, maxillary teeth on the whole weaker, forearm about 109–112; surface-ridge distinct in  $m^1$  and  $m_2$ , rarely (if ever) in  $m_1$ . (Trobriand; D'Entrecasteaux; Louisiade Arch.) . . . . . [p. 463.]
- b. Much larger, with relatively considerably heavier dentition:  $c-m^2$  24·5–27·8 mm., forearm 133·5–152·5.
- c'. Forearm about 133·5–141 mm. (Amboina group; Aru Is.) . . . . . [p. 464.]
- d'. Forearm about 146–152·5 mm. (New Guinea; Mysol; Waigeou) . . . . . 4. *D. moluccensis*,
5. *D. magna*, p. 466.
- II. Antero-internal corner of  $m_1$  sharply marked off as a distinct cusp or ledge.
- c. No well-marked antero-internal basal ledge in  $m^1$ ; longitudinal ridges of cheek-teeth simple . . . . . C. D. PERONI GROUP.
- e'. Skull 48·8–51·7 mm.,  $c-m^2$  20–22, forearm 108·5–117. (Timor group) . . . . . 6. *D. peroni*, p. 467.
- f'. Skull 46·5 mm.,  $c-m^2$  18·8, forearm 106. (Sunba) . . . . . [p. 471.]
7. *D. sambana*,
- d. Antero-internal corner of  $m^1$  sharply marked off as a distinct ledge; generally a more or less distinct notch in longitudinal ridges of  $p^4$ ,  $m^1$ ,  $p_1$ , and  $m_1$  behind main cusp of ridge . . . . . D. D. VIRIDIS GROUP.
- g'. Forearm 111–128·5 mm.
- a<sup>2</sup>. Lachrymal breadth of rostrum 11·5–12·8 mm.

- a*<sup>3</sup>. Teeth smaller (measurements p. 482); forearm 111-118 mm. (Amboina group; Banda Is.: Key Is.) ..... 8. *D. viridis*, p. 471.
- b*<sup>3</sup>. Teeth larger (measurements p. 482); forearm 125-128.5 mm. (Gilolo group) ..... [p. 473. 9. *D. crenulata*,
- b*<sup>2</sup>. Rostrum conspicuously heavier: breadth across lower edges of lachrymal foramina 12.8-13.8 mm.; forearm 111.5-121.5 mm. (Bismarck Arch.) ..... [p. 474. 10. *D. prædatrix*,
- h*<sup>1</sup>. Forearm 105.5-109.5 mm.
- c*<sup>2</sup>. Tip of nasals above middle or front half of alveole of canine; teeth smaller (measurements p. 482). (E. Solomon Is.) ..... [p. 475. 11. *D. inermis*,
- d*<sup>2</sup>. Tip of nasals above hinder edge of alveole of canines; teeth conspicuously heavier (measurements p. 482). (W. and C. Solomon Is.). 12. *D. neseu*, p. 476.

### 1. *Dobsonia minor*, *Dobs.*

*Cephalotes minor*, *Dobson*, *P. Z. S.* 1878, p. 875 (1 April, 1879: Amberhaki); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 203, n. 331 (1879); *Dobson, Rep. Brit. Assoc.* 1880, p. 174; *Trouessart, Cat. Mamm.* i. p. 88, n. 471 (1897); *Heller, Abh. Mus. Dresden*, vi. n. 8, p. 4 (1897).

*Dobsonia minor*, *Palmer, Proc. Biol. Soc. Wash.* xii. p. 114 (1898); *Trouessart, Cat. Mamm.* ii. p. 1278 (1899); *Miller, Fam. & Gen. Bats*, p. 64 (1907); *K. Andersen, Ann. & Mag. N. H.* (8) iv. pp. 529, 533 (1909: characters; Leyden specimen).

*Cephalotes peroni* (*nec E. Geoff.*), *Jentink, Cat. Ost. Mamm.* p. 267, skull dd (1887: locality unknown); *id.*, *Cat. Syst. Mamm.* p. 156, specimen rr (1888: skin of same individual).

*Diagnosis*.—Premolars and molars simple. Smallest species: forearm about 80 mm. *Hab.* N.W. New Guinea.

*Skull and dentition*.—Cranial characters not peculiar. Upper canines slenderer at base than in other species, ingulum narrower. Premolars and molars essentially Roussettine in structure: no distinct antero-internal basal cusp (a faint indication may be seen in *p*<sup>4</sup>), no distinct posterior basal ledge (in one of the specimens examined a slight notch at postero-external base of *p*<sub>4</sub> and *m*<sub>1</sub> evidently indicating an initial stage toward the development of a posterior basal ledge), no trace whatever of surface-ridges.

*External characters*.—Essentially typical. Ears distinctly attenuated above, though rather less abruptly so than in other species, and with the narrow terminal portion relatively somewhat shorter; extreme tip narrowly rounded off. Tibia conspicuously shorter than usual, only  $\frac{5}{4}$  (in other species from  $\frac{3}{2}$  to nearly twice) the length of the hind foot with claws. Terminal phalanges of third, fourth, and fifth digits relatively shorter. Membranes from base or basal half of first phalanx of first toe. General size considerably



smaller than usual: forearm about 80 mm., in the smallest of the other species (*D. inermis* and *nesea*) 105–110 mm. Colour of fur unknown (much faded in single skin available).

*Measurements.* On pp. 477, 479, 481.

*Specimens examined.* Two, the type of the species and a mounted specimen from uncertain locality (Leyden Museum, *Cephalotes peroni*, rr, with skull dd, a fully adult male, teeth somewhat worn, collected by Dr. Bernstein, presumably dating from his seventh and last journey, and, if so, no doubt obtained in Sorong, Salawati, Batanta, or neighbourhood). These are the only specimens known to exist in collections.

*Range.* Amberbaki, N.W. New Guinea.

*Type*, in the Paris Museum, a female, preserved in alcohol, skull extracted in 1909. The specimen is slightly immature (finger joints unconsolidated, sagittal crest not fully developed, frontoparietal suture unobliterated), but apparently full-grown; measurements practically the same as those of the adult male in Leyden.

*Remarks.*—This is the only known representative of a section of *Dobsonia* characterized by the simple cheek-teeth, with only inconspicuous traces of the antero-internal and posterior ledges so prominent in other species. Externally, apart from its small size, it is closely similar to the typical species of the genus.

## 2. *Dobsonia exoleta*, K. And.

*Cephalotes peroni* (pt.), Dobson, Cat. Chir. B. M. p. 91.

*Cephalotes peroni* (nec E. Geoff.), Gray, Zool. 'Samarang,' Vert. p. 13 (pt.) (1849: Celebes); Dobson, Cat. Chir. B. M. p. 91 (pt.) (1878: Celebes); Rosenberg, Malay. Arch. p. 268 (1878: not seen in Celebes); Trouessart, Rev. & Mag. Zool. (3) vi. p. 208, n. 330 (pt.) (1879); Jentink, Notes Leyd. Mus. v. p. 174 (1883: Amurang); id., Cat. Ost. Mamm. p. 267 (pt.) (1887: Gorontalo); id., Cat. Syst. Mamm. p. 156 (pt.) (1888: Gorontalo; Menado: Celebes); Hickson, Nat. in N. Celebes, pp. 85, 359, 360 (1889: Menado); A. B. Meyer, Abh. Mus. Dresden, vii. n. 7, p. 9 (1899: Tomohon; Kotobangon; Buol).

*Dobsonia peroni* (pt.), Trouessart, Cat. Mamm. ii. p. 1278 (1899).

*Cephalotes palliatus* (pt.), Trouessart, Cat. Mamm. i. p. 87, n. 470 (1897); Matschie, Megachir. p. 87 (1899: Menado); Trouessart, Cat. Mamm., Suppl. p. 64, n. 555 (1904).

*Dobsonia palliata* (pt.), Jentink, Notes Leyd. Mus. xxviii. p. 166 (1906: Celebes).

*Dobsonia exoleta*, K. Andersen, Ann. & Mag. N. II. (8) iv. pp. 531, 533 (1 Dec. 1909: characters; affinities).

*Diagnosis.*—A well developed antero-internal basal ledge in  $p^3$  and  $p^4$ ; no trace of a similar ledge in  $m_1$ ; posterior basal ledge well marked in  $p^3$ ,  $p^4$ ,  $p_3$ , and  $p_4$ ; median ridge distinct in  $m^1$ ,  $m_1$ , and  $m_2$ . Skull, total length about 52 mm., maxillary tooth-row,  $c-m^2$  (crowns) 20.5–21.3, forearm 112.5–116. *Hab.* Celebes.

*Skull and dentition* \*.—Rostrum (front of orbit to tip of nasals) slightly more than breadth across lower edges of lachrymal

\* Figs. 25 A, B, C, D, p. 451

foramina. Antero-internal portion of  $p^1$  sharply separated from inner main cusp of tooth as a conspicuous ledge with raised rim; a similar but narrower ledge in  $p^3$ ; ledge in  $m^1$  either entirely absent or merely indicated by a more or less distinct notch antero-internally in longitudinal ridge (see B.M. skull 97.1.3.18), but never as completely differentiated as in *D. viridis* and allied species; generally a mere trace of a similar ledge in  $p_3$  and  $p_4$ , never in  $m_1$ , the inner longitudinal ridge of which is perfectly simple throughout. Posterior basal ledge well marked in  $p^3$ ,  $p^1$ ,  $p_3$ , and  $p_4$ , particularly in the lower teeth. Median surface-ridges somewhat variable individually (as in all species which possess these ridges): generally absent or barely traceable in  $p^1$ , distinct but low in  $m^1$ ,  $m_1$ , and  $m_2$ , sometimes running through the entire length of these teeth, sometimes interrupted in the middle (divided into an anterior and posterior ridge), sometimes again confined to the posterior half or third of the surface.

*Colour*.—Type, ♀ ad. skin, Tomohon, October: Back of neck approximately raw-umber, tinged with drab-brown posteriorly, and darkening to bistre at edge of naked notopatagium. Occiput, crown, and sides of head bistre, darkest on crown. Rump seal-brown, shading posteriorly into Prout's brown washed with raw-umber. Entire underside dull isabella drab, strongly tinged with shiny golden tawny-olive on breast and belly; hair on underside of membranes light tawny-olive.

♂ ad. al., Macassar, September: Differing from foregoing chiefly in the more ashy drab or hair-brown total aspect of the colour and the much less conspicuous admixture of tawny-olive. Back of neck light brownish drab, shading into brownish bistre on head. Rump Prout's brown. Underparts, including hair on underside of membranes, between drab and hair-brown, slightly washed with golden tawny-olive on middle of breast and belly.—Individual differences in colour similar to those between this and the foregoing specimen are common also in other species of the genus. They depend chiefly on the more ashy drab or more hair-brown or more pale olive character of the general colour, and on the richer or more inconspicuous or sometimes scarcely noticeable admixture of tawny-olive on the nape of the neck and underparts.

*Measurements*. On pp. 477, 479, 481.

*Specimens examined*. Seven, in the collections of the Leyden (four), Berlin (one), and British Museums, representing the following localities:—Menado (two), Tomohon (type, with skull), Gorontalo (one, with skull), Macassar (one, with skull), "Celebes" (two).

*Range*. Celebes, generally distributed. So far recorded from the following provinces and places:—Minahassa (Menado; Tomohon; Amurang); Mongondow (Kotobangon); Gorontalo; Buol; Macassar.

*Type* in collection.

- a. ♀ ad. sk.; skull. Tomohon, Minahassa; Drs. P. & F. Sarasin 99.10.1.4.  
10 Oct. 1894. [C. & E.]  
(Type of species.)  
b. ♂ ad. al.; skull Macassar; Sept. 1895. A. Everett [C.]. 97.1.3.18.  
in al.

3. *Dobsonia pannietensis*, *De Vis*.

*Cephalotes peroni* (*nec E. Geoff.*), *Thomas*, *Nor. Zool.* ii. p. 163 (1895: Fergusson I.); *id*, *op. cit.* iii. p. 526 (1896: Kiriwina); *Heller*, *Abh. Mus. Dresden*, vi. n. 8, p. 4 (pt.) (1897).

*Cephalotes pannietensis*, *De Vis*, *Ann. Queensl. Mus.* vi. p. 36 (1905: Panniet I.).

*Dobsonia pannietensis*, *K. Andersen*, *Ann. & Mag. N. H.* (8) iv. pp. 530, 533 (1909: characters; affinities).

*Diagnosis*.—Similar to *D. exoleta*, but rather smaller, with noticeably smaller skull and maxillary teeth; median surface-ridges distinct in  $m^1$  and  $m_2$ , rarely (if ever) in  $m_1$ . Forearm about 109–112 mm. *Hab.* Trobriand, D'Entrecasteaux, and Louisiade Archipelagos.

*Skull and dentition*.—Skull similar to that of *D. exoleta*, but conspicuously smaller and more delicately built; total length 47–48 mm. (against 52 in *exoleta*), zygomatic breadth 28 (32), lower jaw 37 (41–42.5), maxillary tooth-row,  $c-m^2$  19.8 (20.5–21.3).—Dentition essentially as in *exoleta* (inner ridge of  $m_1$  perfectly simple, without trace of antero-internal basal ledge or cusp), but maxillary teeth on the whole noticeably weaker; length, antero-posteriorly, of  $p^3$  3.8–4.3 mm. (4.2–4.7 in *exoleta*), of  $p^4$  3.8–4.3 (4.3–4.8), of  $m^1$  4.8–5.2 (5.7–5.8). Median surface-ridges obsolescent or entirely absent in  $p^4$  and  $m_1$ , more or less distinct in  $m^1$  and  $m_2$ , but apparently never as well marked as in *exoleta*. Inner cingulum of  $m^1$  peculiarly thickened, tending to form a basal ledge or projecting keel along anterior third or half of inner surface of tooth (approximations to this sometimes seen in *D. exoleta*, *moluccensis*, and *magna*).

*Colour*.—Ad. skin, Kiriwina, February, 96.11.5.7: Back of neck dark drab-brown slightly tinged with wood-brown. Occiput, crown, and sides of head dark shiny bistre. Underparts light drab, approaching ecru-drab, and mixed with whitish grey and light tawny-olive on breast and belly; hair on underside of membranes tinged with tawny olive.—An adult female from Kiriwina, preserved in alcohol, is practically identical in colour. An immature individual (skin) from same place is similar to the adult skin, but with the new fur of the underparts of a warmer ecru-drab tinge. Two immature specimens from Fergusson Island come nearest in colour to this latter, but the general aspect is on the whole a shade darker.

*Measurements*. On pp. 477, 479, 481.

*Specimens examined*. Five, as registered below.

*Range*. Apparently generally distributed over the islands S.E. of New Guinea; as yet recorded from the Trobriand group (Kiriwina), D'Entrecasteaux group (Fergusson), and Louisiades (Panniet).

*Cotypes* in the Queensland Museum, Brisbane. Species based on one male and three females (skull of one) obtained in Panniet Island, Louisiades. The cotypes have not been available for re-examination, but the description and measurements accord perfectly with the specimens here referred to *D. pannietensis*, except in one

point. The male is described as having "a small but distinct gular sac secreting a waxy substance"; as no Fruit-bat is known to possess a gular sac, the statement is probably due to some error of observation. The "strong vermiform integumentary fold from over the clavicle to the back of the neck," referred to by De Vis as another distinctive character of this species, is evidently the occipitopolicalis muscle, a cutaneous muscle which in alcoholic bats, Megachiroptera as well as Microchiroptera, owing to contraction of the integument often shows in strong relief on the sides of the neck.

*Remarks.*—Though geographically widely separated, *D. exoleta* (Celebes) and *pamitensis* are very closely related. The broad intervening area is occupied by the allied but much larger *D. moluccensis* (Amboina group and Aru Islands) and *D. magna* (New Guinea).

a, b. 1 juv., 1 ad. sks.; skulls.	Kiriwina; 15 Feb., 15 May, 1895.	A. S. Meek [C].	96.11.5.6.7.
c. ♀ ad. al.; skull.	Kiriwina.	A. S. Meek [C].	96.11.5.8.
d. ♂ imm. al.; skull.	Fergusson I.	A. S. Meek [C].	95.5.8.4.
e. Imm. sk.; skull.	Fergusson I.	A. S. Meek [C].	96.11.5.19.

#### 4. *Dobsonia moluccensis*, Q. & G.

*Cephalotes peroni* (pt.), Dobson, Cat. Chir. B. M. p. 91.

*Hypoderma moluccense*, Quoy & Gaimard, Voy. 'Astrolabe,' Zool. i. p. 86, Atl. pl. xi. (animal; skull; external sexual organs; stomach) (1830: Amboina); Lesson, Hist. Nat. Mamm. (Compl. Buffon), v. p. 69 (1836).

*Pteropus moluccensis*, Oken, Atlg. Naturg. vii. Abth. ii. p. 990 (1838).

*Cephalotes peroni* var. *moluccensis*, Lesson, N. Tabl. R. An., Mamm. p. 15 (1842).

*Dobsonia moluccensis*, K. Andersen, Ann. & Mag. N. H. (8) iv. pp. 529, 533 (1909: characters; affinities).

*Cephalotes peroni* (pt., nec E. Geoff.), Temminck, Mon. Mamm. ii. p. 106, pl. xxxv. fig. 7 (head of specimen *g*, Amboina, Leyden Mus.) (1837: Amboina); S. Müller, Temminck's Nat. Gesch. Ned. Overz. Bez., Zoogd. pp. 20, 22, 59 (1839-44: Amboina; habits); Gray, List Ost. Spec. B. M. p. 10 (1847); id., Zool. 'Samarang,' Vert. p. 13 (pt.) (1849); Gerrard, Cat. Bones Mamm. B. M. p. 59, skull *a* (1862); Finsch, New-Guinea, p. 150 (1865: Amboina); Peters, MB. Akad. Berlin, 1867, p. 871 (Amboina); Fitzinger, SB. Akad. Wien, lx. Abth. i. p. 647 (1870); Dobson, Cat. Chir. B. M. p. 91 (1878: Buru; Ceram); Trouessart, Rev. & Mag. Zool. (3) vi. p. 208, n. 330 (1879); Peters & Doria, Ann. Mus. Civ. Genova, xvi. p. 691 (1881: Aru Is.); Jentink, Cat. Ost. Mamm. p. 267 (pt.) (1887: Amboina; Aru); id., Cat. Syst. Mamm. p. 156 (pt.) (1888: Buru; Amboina; Aru); Trouessart, Cat. Mamm. i. p. 87, n. 470 (1897); Heller, Abh. Mus. Dresden, vi. n. 8, p. 4 (1897).

*Hypoderma peroni* (pt.), Schinz, Syst. Verz. Säug. i. p. 137, n. 1 (1844); Giebel, Säug. p. 992 (1855).

*Cephalotes palliatus* (pt.), Matschie, Megachir. p. 87 (1899: Aru); Trouessart, Cat. Mamm., Suppl. p. 64, n. 555 (1904); Willink, Nat. Tijds. Ned. Ind. lxx. p. 278 (1905).

*Dobsonia palliata* (pt.), *Jentink, Notes Leyd. Mus.* xxviii. p. 166 (1906: Buru; Amboina; Ara).

? *Nyctimene palliatus*, *Elliot, Cat. Mamm. Field Col. Mus.* p. 494, n. 870 (1907: Moluccas).

*Diagnosis*.—Allied to *D. exoleta* (Celebes), but much larger, and with relatively much heavier dentition. Forearm 133.5–141 mm. *Hab.* Amboina group and Aru Islands.

*Dentition*.—Individual teeth absolutely and relatively much heavier than in *D. exoleta* (see measurements p. 481), but scarcely differing in structure. Median surface-ridge absent in  $p^1$  (nine skulls examined); generally obsolescent (barely detectable on close examination) in  $m^1$ , but sometimes developed as a low ridge along posterior third of surface; generally absent or quite rudimentary in  $m^2$ , sometimes represented by a distinct tubercle; generally well developed, though low, in  $m^3$ , and running through entire length of tooth, rarely reduced to a small central tubercle.

*Colour*.—♂ ad. skin, Buru: Back of neck between hair-brown and bistre. Head dark bistre. Entire underside dull drab faintly washed with fawn, and tinged with golden olive-buff on centre of breast and belly and on hairs on underside of membranes.—A young adult individual from Ceram (skin) is similar in colour, though on the whole distinctly paler.

*Measurements*. On pp. 477, 479, 481.

*Specimens examined*. Sixteen, in the collections of the Leyden (eleven), Berlin (one), Paris (one), and British Museums, from the following localities:—Buru (two, skull of one), Amboina (six, skulls of two; including type of species), Ceram (one, with skull), Aru Islands (six, skulls of four), and uncertain locality (one skull).

*Range*. Amboina group (Buru; Amboina; Ceram) and Aru Islands. A mounted adult female in the Leyden Museum ticketed Samao, S. Müller (" *Cephalotes peroni*" qq, skull *in situ*), is at least externally indistinguishable from *D. moluccensis*; if there is no mistake in the locality (S. Müller collected also in Amboina), the range of this species probably extends to the Timor group.

*Type*, in the Paris Museum, an immature (not quite full-grown) mounted specimen of doubtful sex, skull extracted, fur faded; recent register number, 118 B; marked on underside of stand " *Hypoderma Peronii* (Geoff.); Quoy et Gaimard, 1829; d'Amboine; no. de Voyage 223; figuré dans la Zoologie du Voyage de l'Astrolabe." The skull of this specimen appears to be number A 6753 of the Galeries of the Muséum d'anatomie comparée; written on skull (half effaced) "Amboine, Quoy et Gaimard," and in a different handwriting (all the bracketed characters completely effaced) "*H[ypoderm]peron[a] [moluc]ecuse*," and perhaps by the same hand "*Ceph. Peroni*, n. 2." The skull is young, fronto-parietal suture quite distinct, no sagittal crest; occipital region wanting, dentition complete. In the MS. Catalogue of the Galeries this skull is stated to have been figured in Blainville's 'Osteographie,' pl. vi., presumably because Blainville himself says (text, p. 100)

that the figure is "d'après un crâne rapporté par MM. Quoy et Gaimard": there can be no doubt that Blainville's statement is erroneous; the figure is not drawn from the type nor from any other skull of *D. moluccensis*, but agrees very closely with the type skull of *D. peroni* in the Paris Museum. The type specimen and skull of *D. moluccensis* were figured by Quoy and Gaimard (l. c.).

*History in literature.*—Until recently (1909) all revisers of the genus followed Temminck (1837) in considering *D. moluccensis* indistinguishable from *D. peroni*.

*Remarks.*—This species is easily discriminated from all other forms of the genus, except the closely allied *D. magna*, by its large size and heavy dentition. In the Amboina group it occurs together with *D. viridis*, which is at once distinguished by the different structure of the premolars and molars and by its much smaller size.

a. Ad. skull.		Purchased (Frank).	46.5 5.5.
b. ♂ ad. sk.; skull.	Buru.	Dr. A. R. Wallace [C.].	62.5, 24.2.
c. Yg. ad. sk.; skull.	Ceram; 1860.	Dr. A. R. Wallace [C.].	61.12, 11.3.

### 5. *Dobsonia magna*, Thos.

*Cephalotes peroni* (nec E. Geoff.), *Peters & Doria, Ann. Mus. Civ. Genova*, xvi. p. 691 (pt.) (1881: Andai); *Jentink, Cat. Ost. Mamm.* p. 267 (pt.) (1887: Mysol; Waigeou; Andai); *id., Cat. Syst. Mamm.* p. 156 (pt.) (1888: Mysol; Waigeou; Andai); *Thomas, Ann. Mus. Civ. Genova*, (2) xviii. p. 608 (1897: Ighibirei); *Heller, Abh. Mus. Dresden*, vi. n. 8, p. 4 (pt.) (1897: Mysol; Waigeou; Andai; Bongu); *Matschie, Krieger's Neu-Guinea*, p. 77 (1899).

*Cephalotes palliatus* (pt.), *Matschie, Megachir.* p. 87 (1899: Astrolabe Bay); *Trouessart, Cat. Mamm., Suppl.* p. 64, n. 555 (1904).

*Dobsonia paliata*, *Jentink, Notes Leyd. Mus.* xxviii. p. 166 (pt.) (1906: Mysol; Waigeou; New Guinea); *id., Nova Guinea*, v. p. 362 (1907: Mosso R.; Sentani Lake; Humboldt Bay Exp.); *id., op. cit.* ix. p. 4, pl. i. fig. 2 (palate-ridges) (1908: Noerd R.; van Weel's Camp; Alkmaar).

*Dobsonia magna*, *Thomas, Ann. & Mag. N. H.* (7) xvi. p. 423 (1 Oct. 1905: Tamata, Mambare R.); *Miller, Fam. & Gen. Bats*, p. 64 (1907): *K. Andersen, Ann. & Mag. N. H.* (8) iv. pp. 530, 533 (1909: characters; affinities).

*Diagnosis.*—Similar to *D. moluccensis*, but larger. Forearm 146–152.5 mm. *Hab.* New Guinea; Mysol; Waigeou.

*Colour.*—Two ♀ ad. skins, Yodda River, August, 7.2.1.1 and 2: Back of neck bistre, darkest in centre, palest on sides of neck, and shading to shiny blackish bistre on head. Underparts warm drab (a tinge of drab faintly washed with fawn), conspicuously mixed with raw-umber and light tawny-olive on middle of breast and belly; hairs on underside of membranes light tawny-olive.—An adult male from Mambare River (type of species, April) and a young adult male from Aroa River (May) are practically similar in colour to the Yodda River specimens.

*Measurements.* On pp. 477, 479, 481.

*Specimens examined.* Thirteen, in the collections of the Leyden

(six), Berlin (two), and British Museums, from the following localities:—Mysol (two immatures, with skulls), Waigeou (two immatures, with skulls), Andai (one, with skull), Ottilien River (one), Stephansort (two), Tamata (type, with skull), Kokoda (two, with skulls), Aroa River (one, with skull), Ighibirei (one, with skull).

*Range.* New Guinea, generally distributed; Mysol; Waigeou. In Dutch New Guinea recorded from Andai, Noord R. (van Weel's Camp and Alkmaar), and Humboldt Bay (Mosso R. and Sentani Lake); in German New Guinea from Ottilien R. and Astrolabe Bay (Stephansort and Bongu); in British New Guinea from Mambare R. (Tamata), Yodda R. (Kokoda), Aroa R., and Kemp Welch R. (Ighibirei).

*Type* in collection.

*Remarks.*—*D. magna* is the New Guinea representative of *D. moluccensis* (Amboina group and Aru Islands), from which it is scarcely distinguishable by any other character than the somewhat larger size. The four Mysol and Waigeou specimens examined (Leyden Museum) are all immature: they are either *D. magna* or *D. moluccensis*, and judging from the size of the largest specimen (forearm 146 mm.) probably *D. magna*.

- |                             |  |                               |            |
|-----------------------------|--|-------------------------------|------------|
| a. ♂ ad. sk.; skull.        | Tamata, Mambare R.,                      | W. Stalker [C.].              | 6.1.8.1.   |
|                             | 100'; 9 Apr. 1904.                       | (Type of species.)            |            |
| b. c. 2 ♀ ad. sks.; skulls. | Kokoda, Yodda R.,                        | C. A. W. Monckton, Esq. [P.]. | 7.2.1.1.2. |
|                             | 1000'; 28 Aug. 1906.                     |                               |            |
| d. ♂ yg. ad. sk.; skull.    | Head of Aroa R.; 22 May, 1905.           | A. S. Meek [C.].              | 5.11.28.1. |
| e. ♂ yg. ad. al.; skull.    | Ighibirei, Kemp Welch R.; July–Aug. 1890 | Genoa Museum [P.].            | 97.8.7.5.  |
|                             | ( <i>Dr. L. Loria</i> ).                 |                               |            |

## 6. *Dobsonia peroni*, *E. Geoff.*

*Cephalotes peroni* (pt.), Dobson, Cat. Chir. B. M. p. 91.

- 2 *Pteropus cephalotes* (pt.), *E. Geoffroy*, Cat. Mamm. Mus. Nation. d'Hist. Nat. p. 49 (1803: specimen redescribed by same author in 1810 as *Pteropus palliatus*); *Desmarest*, N. Dict. d'Hist. Nat. xxiv., Tabl. Méth. Mamm. p. 11 (1804).
- 2 *Pteropus palliatus*, *E. Geoffroy*, Ann. Mus. d'Hist. Nat. xv. p. 99 (1810: locality unknown); *Desmarest*, Mamm. i. p. 112, n. 148 (1820).
- 2 *Pteropus palliatus*, *Oken*, Lehrb. Naturg. iii. Abth. ii. p. 938 (1816); *Desmarest*, N. Dict. d'Hist. Nat., new ed. xxix. p. 515 (1819); *Schinz*, Thierr. i. p. 156 (1821); *id.*, Naturg. u. Abbild. Säug. i. p. 70 (1824); *Temminck*, Mon. Mamm. i. pp. 169, 170 (1825: *Pt. palliatus* the young of *Cephalotes peroni*); *Lesson*, Man. Mamm. p. 113, n. 293 (1827); *Gray*, Griffith's An. Kingd. v. p. 58, n. 165 (1827); *Desmarest*, Dict. Sci. Nat. xlvii. p. 368 (1827); *E. Geoffroy*, Cours Hist. Nat. Mamm., 13 leçon (27 June, 1828), pp. 29, 30 (*Pt. palliatus* the young of *Cephalotes peroni*); *Is. Geoffroy*, Ann. Sci. Nat. xv., Oct. 1828, p. 295; *K. Andersen*, Ann. & Mag. N. H. (8) iv. p. 528 (1909: remarks).
- Cephalotes palliatus* (pt.), *Matschie*, Megachir. p. 87 (1899: Timor),

- Trouessart, Cat. Mamm., Suppl.* p. 64, n. 555 (1904); *Willink, Nat. Tijds. Ned. Ind.* lxx. p. 278 (1905).
- Dobsonia palia* (pt.), *Thomas, Ann. & Mag. N. H.* (7) xvi. pp. 423, 424 (1905: measurements of skull from Alor, by mistake stated to be from Sumba); *Jentink, Notes Leyd. Mus.* xxviii. p. 166 (1906: Timor; Wetter).
- Dobsonia palliata* (pt.), *Miller, Fam. & Gen. Bats*, p. 64 (1907).
- Cephalotes peroni*, *E. Geoffroy, Ann. Mus. d'Hist. Nat.* xv. p. 104, pl. vii. (animal, skull) (1810: Timor); *Oken, Lehrb. Naturg.* iii. Abth. ii. p. 939 (1816); *G. Cuvier, R. An.* i. p. 124 (1817); *Desmarest, Mamm.* i. p. 112, n. 149, pl. suppl. iii. figs. 9, 9A (animal; skull: copies from Geoffroy) (1820); *Goldfuss, Handb. Zool.* ii. p. 459 (1820); *Gray, London Medic. Repos.* xv. p. 299 (1821); *Schinz, Thierr.* i. p. 157 (1821); *id., Naturg. u. Abbild. Säug.* i. p. 70, pl. L. fig. 1 (animal: copy from Geoffroy) (1824); *Lesson, Man. Mamm.* p. 114, n. 296 (1827); *Gray, Griffith's An. Kingd.* v. p. 6, n. 166 (1827); *Desmarest, Dict. Sci. Nat.* xli. p. 374, pl. xiii. fig. 2 (animal) (1827); *J. B. Fischer, Syn. Mamm.* p. 89, n. 2, p. 550 (1829); *Burnett, Quart. J. Sci. Lit. Art*, Apr.-June 1829, p. 269; *G. Cuvier, R. An.*, 3 ed. i. p. 138, pl. xxiii. figs. 4, 4a, 4b (1836: animal; dentition); *Temminck, Mon. Mamm.* ii. p. 106 (pt.), pl. xxxvi. figs. 24-29 (drawn from skull c, Timor, Leyden Mus.) (1837); *Gray, Mag. Zool. & Bot.* ii. p. 505 (1838); *S. Müller, Temminck's Nat. Gesch. Ned. Overz. Bez., Zoogd.* pp. 20, 22, 59 (pt.) (1839-44: Timor; habits); *Lesson, N. Tabl. R. An., Mamm.* p. 15, n. 205 (1842); *Gray, Zool. Samarang, Vert.* p. 13 (pt.) (1849); *Schlegel, Dierk.* i. p. 54 (1857); *Gerrard, Cat. Bones Mamm. B. M.* p. 59, skull b (1862: Timor); *Finsch, Neu-Guinea*, p. 150 (pt.) (1865: Timor); *Gray, P. Z. S.* 1866, p. 64; *Peters, M.B. Akad. Berlin*, 1867, p. 871 (pt.) (Timor); *Fitzinger, S.B. Akad. Wien*, ix. Abth. i. p. 647 (pt.) (1870); *Gray, Cat. Monk. &c.* p. 119 (pt.) (1870: Timor); *Schlegel, Dierent., Zoogd.* p. 66 (1872); *Dobson, Cat. Chir. B. M.* p. 91 (pt.) (1878: Timor); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 208, n. 330 (pt.) (1879); *Jentink, Cat. Ost. Mamm.* p. 267 (pt.) (1887: Timor; Wetter); *id., Cat. Syst. Mamm.* p. 156 (pt.) (1888: Timor; Wetter); *Heude, Mém. Hist. Nat. Emp. Chin.* iii. p. 176, footnote, pl. v. fig. 2 (dentition) (1896: Flores); *Trouessart, Cat. Mamm.* i. p. 87, n. 470 (pt.) (1897); *Hartert, Nov. Zool.* v. p. 456 (1898: Alor); *Weber, Säug.* p. 399 (1904).
- Hypoderma peroni*, *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 708 (Sept. 1828): *id., Ann. Sci. Nat.* xv., Oct. 1828, p. 205; *Lesson, Hist. Nat. Mamm. (Compl. Buffon)*, v. p. 68 (1836); *Wagner, Schreber's Säug., Suppl.* i. p. 372 (pt.) (1839); *Schinz, Syst. Verz. Säug.* i. p. 137, n. 1 (pt.) (1844); *Wagner, Schreber's Säug., Suppl.* v. p. 612 (pt.) (1853-55); *Gervais, Hist. Nat. Mamm.* i. p. 192, c. fig. (head) (1854); *Giebel, Säug.* p. 992 (pt.) (1855); *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 519, pl. viii. figs. 7 a-c (1873: structure of hairs).
- Pteropus peroni*, *Oken, Allg. Naturg.* vii. Abth. ii. p. 992 (1838); *Blainville, Ost. Mamm.* i. Chêir. pp. 100, 103, Atl. i. Chêir. pl. vi. fig. 4 (skull, probably of type, in any case a *D. peroni*, not a *D. moluccensis*), pl. xiii. fig. 5 (dentition, same specimen).
- Dobsonia peroni*, *Palmer, Proc. Biol. Soc. Wash.* xii. p. 114 (1898); *Trouessart, Cat. Mamm.* ii. p. 1278 (pt.) (1899); *K. Andersen, Ann. & Mag. N. H.* (8) iv. pp. 529, 533 (1909: characters; affinities).



? *Tribonophorus desmaresti*, *Burnett, Quart. J. Sci. Lit. Art*, Apr.-June 1829, p. 269 (nom. nud.) [cf. *Palmer, Ind. Gen. Mamm.* p. 683, 1904].

? [*Pteropus*] *desmaresti*, *K. Andersen, Ann. & Mag. N. H.* (8) i. p. 432, footnote (1908: identification).

*Diagnosis*.—Antero-internal corner of  $m_1$  sharply marked off as a distinct cusp or ledge; no well-marked antero-internal ledge in  $m^1$ ; outer and inner longitudinal ridges of cheek-teeth simple (not slightly bilobed). Skull, total length 48.8–51.7 mm.; maxillary tooth-row ( $c-m^2$ , crowns) 20–22; forearm 108.5–117. *Hab.* Timor group.

*Skull and dentition*.—Skull similar to that of *D. exoleta*, though apparently averaging a trifle smaller. Antero-internal basal ledge in  $p^3$  and  $p^4$  well-developed and sharply marked off, on the whole rather larger than in *exoleta*; undeveloped in  $m^1$ , though often indicated by a shallow rounded depression near anterior extremity of inner longitudinal ridge; in  $p_3$  small, sometimes not quite distinctly differentiated; in  $p_4$  strong, sharply marked off; in  $m_1$  differentiated as a distinct cusp sharply separated by a deep notch from inner longitudinal ridge. Posterior basal ledges and median surface-ridges essentially as in *D. exoleta*.

*Colour*.—♂ ad. skin, teeth somewhat worn, Alor I., April (beginning of dry season), 98.11.3.17:—Back of neck olive, shading to dark olive-bistre on head. Rump brownish olive. Flanks drab, mixed with very light tawny-olive anteriorly; breast and belly much suffused with light golden tawny-olive; hairs on underside of membranes similar to flanks.—An adult female, same place and date (skin 98.11.3.18, teeth well worn), differs chiefly in the colour of the underparts, which are nearly uniform drab with only a slight admixture of tawny-olive on breast. All available specimens from Timor are more or less faded, but would seem to have differed in no noteworthy colour character from the Alor skins.

*Measurements*. On pp. 477, 479, 481.

*Specimens examined*. Eleven, in the collections of the Leyden (six), Paris (two), and British Museums, from the following localities:—Timor (eight, skulls of four; including cotypes of species), Alor (two, with skulls), and Wetter (one immature, with skull).

*Range*. Timor group; so far recorded from the islands of Flores, Timor, Alor, and Wetter.

*Cotypes* in the Paris Museum. Original description based on two males obtained in Timor by Péron, Register numbers A 118 (n. 786) and A 119 (n. 786 A), both mounted and much faded, and both now ticketed "*Cephalotes Peronii* (Geoff.), type, ancienne collection," without locality on the labels. Specimen A 118 has the notopatagium of the right side partly removed to show the furred back (compare left side of Geoffroy's figure); the skull of this specimen is A 6735 of the Muséum d'anatomie comparée, teeth worn, dentition complete (except for want of right  $i_2$ ), skull somewhat broken on right side, occipital portion once cut off and

again replaced; this is the original of Geoffroy's skull figures (same plate as skin), but the artist has erroneously united  $m_2$  and  $m_3$  to form one single tooth; also Blainville's figures of the skull and dentition of "*Pteropus Peronii*" (l. c.) are probably drawn from this skull (see *antea*, p. 466). The skull of A 119 is *in situ*, but with the jaws sufficiently ajar to allow an examination of the characters of the premolars and anterior molars.

*Pteropus palliatus*, E. Geoff.; 1810.—Based on an alcoholic specimen from unknown locality, received in exchange by the Paris Museum from Martin van Marum, Museum Teyler, Haarlem. Geoffroy found  $\frac{2-2}{2-2}$  incisors in this specimen, therefore referred it to the genus "*Pteropus*" (not to "*Cephalotes*"); but at the same time he clearly saw its peculiar external characters, viz., absence of claw of index and insertion of membranes along spinal line, and therefore made it the sole representative of a distinct (third) section of *Pteropus*, "*Roussettes à ailes sur le dos*," which, he surmised, probably "*sera un jour retirée des roussettes, pour être élevée au rang de genre*" (this hint was followed by Rafinesque in 1815, who proposed the generic name *Pteronotus*, and by Burnett in 1829, who proposed *Tribonophorus*, but both of these names are technically *nomina nuda*). There is no doubt whatever that *Pt. palliatus* was a *Dobsonia*, but as the type locality is unknown, the description confined to characters common to all forms of *Dobsonia*, and the type no longer in existence, the species is absolutely indeterminable. It is evident from the measurements given of the type that it was a quite young individual (head in flesh only 40 mm., "envergure" 380 mm., from which it may safely be inferred that the forearm cannot have been more than about 65 mm.), and from the number of the incisors that it had not shed the milk teeth (compare note on milk dentition of *Dobsonia*, *antea*, p. 452).—The specimen which Geoffroy in 1810 described as *Pt. palliatus* had, in 1803, by the same author in his subsequently suppressed Catalogue been referred to "*Pteropus cephalotes*," Pallas [*Nyctimene cephalotes* of modern authors], the description of which, as given by Geoffroy, was partly taken from Pallas's description of "*Vespertilio cephalotes*," partly (incisors and ears) from the young *Dobsonia*.

*Tribonophorus desmaresti*, Burnett; 1829.—Name proposed for the "*Mantled Roussette*." No other bat but *Pteropus palliatus* has ever been called "*Roussette mantelée*"; hence there is practically no doubt whatever that *T. desmaresti* is simply a re-naming of *Pt. palliatus* (re-named, perhaps, because the combination *Tribonophorus palliatus* would be tautologous, meaning the mantled Mantled Bat: and re-named in honour of Desmarest, evidently because Burnett believed Desmarest to be the first author who had hinted at the possibility that the Roussette mantelée, when better known, ought to form a distinct genus; but Desmarest's remark (N. Diet. d'Hist. Nat., new ed. xxix. p. 515; 1819) is in fact only copied from Geoffroy's original description of *Pt. palliatus*). As resting only on a vernacular name, *T. desmaresti* is from a formal technical point of view a *nomen nudum*.

*Remarks*.—*D. peroni* differs from all other species, except *D. sumbana* (infra), by the combination of these two characters, viz., presence of a well-marked antero-internal cusp or ledge in  $m_1$ , and absence of a similar ledge in  $m^1$ ; from its closest relative, *D. sumbana*, by its larger size.

a. ♂ ad. sk.; skull. Timor. Purchased (Verreaux). { 47.7.87.  
49.8.16 1.  
b. c. ♂ ad., ♀ ad. Alor: 29 Apr. 1897. A. Everett [C.]. 98.11.3.17.18.  
sks.; skulls.

### 7. *Dobsonia sumbana*, K. And.

*Dobsonia sumbana*, K. Andersen, *Ann. & Mag. N. H.* (8) iv. pp. 531, 533 (1 Dec. 1909: characters; affinities).

*Diagnosis*.—Similar to *D. peroni*, but noticeably smaller. Skull, total length about 46.5 mm.; maxillary tooth-row ( $c-m^2$ , crowns) 18.8; forearm 106. *Hab.* Sumba.

*Colour* (type, ad. al., teeth almost unworn, October, dry season).—Similar in colour to the adult female from Alor described p. 469, but rather paler, particularly on head and neck. Back of neck drab-brown, shading to brownish bistre on head. Rump similar to head. Underparts warm drab, conspicuously mixed with very light golden tawny-olive (nearly golden buff) on middle of breast and belly; hair on underside of membranes similar to flanks.

*Measurements*. On pp. 478, 480, 482.

*Type* in collection.

a. Ad. al.; skull. Sumba; 3 Oct. 1896. A. Everett [C.]. 97.4.18.12.  
(*Type* of species.)

### 8. *Dobsonia viridis*, Heude.

*Cephalotes peroni* (pt.), Dobson, *Cat. Chir. B. M.* p. 91.

*Cephalotes peroni* (pt., nec E. Geoff.), Temminck, *Mon. Mamm.* ii. p. 106 (1837: Banda Is.); S. Müller, *Temminck's Nat. Gesch. Ned. Overz. Bez.* pp. 20, 22, 59 (1839–44: Banda; habits); Gray, *Zool. 'Samarang.'* *Vert.* p. 13 (1849); Finsch, *Neu-Guinea*, p. 150 (1865: Banda); Peters, *MB. Akad. Berlin*, 1867, p. 871 (Banda); Gray, *Cat. Monk. &c.* p. 119 (1870: Amboina); Dobson, *Cat. Chir. B. M.* p. 91 (1878: Amboina; Ceram); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 208, n. 330 (1879); Peters & Doria, *Ann. Mus. Civ. Genova*, xvi. p. 691 (1881: Key Is.); Jentink, *Cat. Ost. Mamm.* p. 267 (pt.) (1887: Amboina); id., *Cat. Syst. Mamm.* p. 156 (pt.) (1888: Amboina; Banda); Trouessart, *Cat. Mamm.* i. p. 87, n. 470 (1897); Heller, *Abh. Mus. Dresden*, vi. n. 8, p. 4 (1897).

*Hypoderma peroni* (pt.), Wagner, *Schreber's Säug., Suppl.* i. p. 372 (1839); Schinz, *Syst. Verz. Säug.* i. p. 137, n. 1 (1844); Wagner, *Schreber's Säug., Suppl.* v. p. 612 (1853–55); Giebel, *Säug.* p. 992 (1855).

*Dobsonia peroni* (pt.), Trouessart, *Cat. Mamm.* ii. p. 1278 (1899).

*Xantharpyia amplexicaudata* (errore), Gray, *List Mamm. B. M.* p. 37 (1843: Amboina); id., *Voy. 'Sulphur.'* *Zool.* i. p. 30 (1844: Amboina) [error corrected. *P. Z. S.* 1866, p. 64, footnote].

*Cephalotes viridis*, Heude, *Mém. Hist. Nat. Emp. Chin.* iii. p. 176, footnote. pl. v. fig. 1 (dentition) (1896: Key Is.).

*Dobsonia viridis*, K. Andersen, *Ann. & Mag. N. H.* (8) iv. pp. 530, 533 (1909: characters; affinities).

*Cephalotes palliatus* (pt.), Matschie, *Megachir.* p. 87 (1899: Key Is.); Trouessart, *Cat. Mamm., Suppl.* p. 61, n. 555 (1904).

*Dobsonia palia* (pt.), Sventenius, *Notes Leyd. Mus.* xxviii. p. 166 (1906: Banda: Amboina).

? *Nyctimene palliatus*, Elliot, *Cat. Mamm. Field Col. Mus.* p. 494, n. 870 (1907: Moluccas).

*Diagnosis*.— $m_1$  and  $m^1$  with well differentiated antero-internal cusp; generally a distinct notch or depression in outer and inner longitudinal ridges of  $p^4$ ,  $m^1$ ,  $p_3$ , and  $m_1$ , behind main cusp of teeth. Maxillary tooth-row ( $c$ — $m^2$ , crowns) 18.2–19.8 mm.; forearm 111–118. *Hab.* Amboina group; Banda Is.; Key Is.

*Skull*.—Essential characters as in *D. peroni*, but rostrum distinctly shorter, front of orbit to tip of nasals equal to or even slightly less than (in the *moluccensis* and *peroni* type of skull more than) breadth across lower edges of lachrymal foramina.

*Dentition* \*.—A well-marked antero-internal basal ledge in  $m^1$ , with free margin raised as a distinct pointed cusp, and separated by a generally deep notch from inner main cusp of tooth; corresponding ledge in  $p^3$ ,  $p^4$ ,  $p_3$ ,  $p_4$ , and  $m_1$  as strongly differentiated as (or rather averaging larger than) in *D. peroni*. Posterior basal ledge in  $p^3$ ,  $p^4$ ,  $p_3$ ,  $p_4$ , and  $m_1$  unusually large. Median surface-ridge in  $p^4$ ,  $m^1$ ,  $m_1$ , and  $m_2$ , as always in *Dobsonia*, individually somewhat varying in development, but on the whole decidedly reaching a greater prominence than in the foregoing species; in  $p^4$  and  $m_1$  often taking shape of a high freely projecting conical cusp, in  $m^1$  and  $m_2$  generally forming a sharp keel. (Generally a more or less distinct notch in cutting-edge of outer and inner longitudinal ridges of  $p^4$ ,  $m^1$ ,  $p_3$ , and  $m_1$  (more rarely traceable also in  $p^3$  and  $p_3$ ) behind main cusp of teeth; the notch is sometimes deep and acute, sometimes a shallow and flatly rounded depression, rarely entirely absent; a second notch not infrequently present behind the former, making (in extreme cases) the profile of the longitudinal ridge of  $m^1$  and  $m_1$  peculiarly crenulate or serrate. Cheek-teeth rather more crowded than in foregoing species, and upper canine and  $p^3$  more narrowly spaced.  $i_2$  somewhat reduced and, at least in some individuals, deciduous; in nine adult skulls examined  $i_2$ — $i_2$  are present in five, absent (and their alveoli filled out) in four. Lower canines more narrowly spaced than in foregoing species, sometimes practically in contact.

*Colour*.—♂ ad. skin, teeth nearly unworn, Ceram, undated, 61.12.11.4: Back of neck light tawny-olive, shading to bistre thinly sprinkled with tawny-olive on head. Underparts pale drab, thickly mixed with very light golden tawny-olive on foreneck, sides of breast, and belly, and with raw-umber on middle of breast. This is the palest-coloured individual of the Ceram series, but an adult male and female from the Key Islands (al., Berlin, 4792) would seem to be paler still; it was no doubt specimens of

\* Figs. 25 A', B', C', D', p. 451.

similar colours which suggested to Heude the name "*viridis*"; there is, in fact, in all the golden and tawny-olive tinges an indefinite hue of greenish.

Four other skins from Ceram (two yg. ad. ♂, one ♀ ad., one ad., 7.1.1.258-261) are of the usual sombre *Dobsonia* colour: Back of neck varying from dark raw-umber to bistre or brownish bistre; head shiny blackish bistre; underparts drab or drab-brown, thickly mixed with raw-umber on breast and belly.

*Measurements.* On pp. 478, 480, 482.

*Specimens examined.* Fifteen, in the collections of the Leyden (seven), Berlin (two), and British Museums, from the following localities:—Amboina (four, skulls of three), Ceram (five, with skulls), Banda Is. (two), and Key Is. (four, skulls of three).

*Range.* Amboina group (known from Amboina and Ceram); Banda Islands; Key Islands.

*Cotypes* presumably in the Zi-ka-wei Museum, near Shanghai. Species based on "un bon nombre de sujets pris dans les grottes madréporiques des Iles de Key. Je l'ai nommée pour nom [mon] usage *C. viridis*, parceque c'est la couleur du ventre et de la partie dégagée du dos. Un seul spécimen était brun." This is the whole of the original description; but Heude's figures of the tooth-rows, though in several respects unsatisfactory, show clearly the structure of  $m_1$  and  $n_1$  characteristic of this section of the genus, in contradistinction to *D. moluccensis* (which may also occur in the Key Is., since inhabiting both Amboina and the Aru Is.), so that there is no doubt as to the identification of the species he had before him.

*Remarks.*—*D. viridis* is at once distinguished from all the foregoing species by the dental and cranial characters summed up in the diagnosis. It is represented by closely related forms in the Gilolo group (*D. crenulata*), Bismarck Archipelago (*D. predatrix*), and Solomon Islands (*D. inermis* and *nesia*). No species with similar dental characters is known from New Guinea.

- a. ♀ imm. al.; skull. Amboina (Voy. Sir E. Belcher [P.]. Not reg.  
'Sulphur').  
b. ♂ ad. sk.; skull. Ceram. Dr. A. R. Wallace 61.12.11.4.  
[C].  
c-f. 2 ♂ yg. ad., 1 ♀ Ceram; 1859 (Dr. Tonies Coll. 7.1.1.258-261.  
ad., 1 ad. sks.; A. R. Wallace).  
skulls.

## 9. *Dobsonia crenulata*, K. Aud.

*Cephalotes peroni* (pt.), Dobson, Cat. Chir. B. M. p. 91.

*Cephalotes peroni* (pt., nec E. Geoff.), *Fisch, Neu-Guinea*, p. 150 (1865: Gilolo; Ternate); *Peters, MB. Akad. Berlin*, 1867, p. 871 (Ternate; Batchian); *Dobson, Cat. Chir. B. M.* p. 91 (1878: Ternate); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 208, n. 330 (1879); *Jentink, Cat. Ost. Mamm.* p. 267 (pt.) (1887: Rau; Morotai; Batchian); *id., Cat. Syst. Mamm.* p. 156 (pt.) (1888: Rau; Morotai; Batchian); *Trouessart, Cat. Mamm.* i. p. 87, n. 470 (1897).  
*Dobsonia peroni* (pt.), *Trouessart, Cat. Mamm.* ii. p. 1278 (1899).

- Cephalotes palliatus*, *Matschie*, *Abh. Senck. nat. Ges.* xxv. Heft 2, p. 272 (1900: Patani, S.W. Gilolo).  
*Dobsonia paliata* (pt.), *Jentink*, *Notes Leyd. Mus.* xxviii. p. 166 (1906: Rau: Morotai; Ternate; Batchian).  
*Dobsonia crenulata*, *K. Andersen*, *Ann. & Mag. N. H.* (8) iv. pp. 532, 533 (1 Dec. 1909: characters; affinities).

*Diagnosis*.—Similar to *D. viridis*, but larger and with conspicuously heavier dentition. Maxillary tooth-row (c-m<sup>2</sup>, crowns) 20-21 mm., forearm 125-128.5. *Hab.* Gilolo group.

*Skull and dentition*.—Skull as in *D. viridis*, but distinctly larger and more heavily built. Structure of premolars and molars quite as in the allied species, but individual teeth on the whole noticeably heavier (see measurements, p. 482). Lower incisors present in three adult skulls, absent in one.

*Colour* (type).—Similar to that of dark-coloured individuals of *D. viridis* (antea, p. 473, specimens 7.1.1.258-261).

*Measurements*. On pp. 478, 480, 482.

*Specimens examined*. Eleven, in the collections of the Leyden (ten) and British Museums, from the following localities:—Rau (four immatures, with skulls), Morotai (two, with skulls), Ternate (type, with skull), and Batchian (four, skulls of two).

*Range*. Gilolo group, generally distributed. So far known from the islands of Rau, Morotai, Gilolo, Ternate, and Batchian.

*Type* in collection.

a. ♀ subad. sk.; skull. Ternate. Dr. A. R. Wallace [C.]. 60.8.26.2.  
 (Type of species.)

#### 10. *Dobsonia prædatrix*, *K. And.*

*Cephalotes peroni* (pt.), Dobson, *Cat. Chir. B. M.* p. 91.

*Cephalotes peroni* (nec *E. Geoff.*), *Dobson*, *P. Z. S.* 1877, p. 118 (Duke of York I.); *id.*, *P. Z. S.* 1878, p. 316 (Duke of York I.); *id.*, *Cat. Chir. B. M.* p. 91 (pt.) (1878: Duke of York I.); *Trouessart*, *Rev. & Mag. Zool.* (3) vi. p. 208, n. 330 (pt.) (1879); *Jentink*, *Cat. Syst. Mamm.* p. 156 (pt.) (1888: Duke of York I.); *Trouessart*, *Cat. Mamm.* i. p. 87, n. 470 (pt.) (1897).

*Dobsonia peroni* (pt.), *Trouessart*, *Cat. Mamm.* ii. p. 1278 (1899).

*Cephalotes palliatus* (pt., nec *E. Geoff.*), *Matschie*, *Megachir.* p. 87 (1899: New Britain); *Trouessart*, *Cat. Mamm., Suppl.* p. 64, n. 555 (1904).

*Dobsonia paliata* (pt.), *Jentink*, *Notes Leyd. Mus.* xxviii. p. 166 (1906: Duke of York I.).

*Dobsonia prædatrix*, *K. Andersen*, *Ann. & Mag. N. H.* (8) iv. pp. 532, 533 (1 Dec. 1909: characters; affinities).

*Diagnosis*.—Allied to *D. viridis* and *crenulata*, but cranial rostrum considerably heavier. General size very nearly as *D. viridis*, smaller than *D. crenulata*; forearm 111.5-121.5 mm. *Hab.* Bismarck Archipelago.

*Skull and dentition*.—Skull heavily built; rostrum unusually broad and deep at base, breadth across lower edges of lacrymal foramina 12.8-13.8 mm. in three adult skulls, against 11.5-12.8 in twelve adult skulls of *D. viridis* and *crenulata*; interorbital region

broader. Structure of premolars and molars as in the allied species; size of teeth on the whole decidedly smaller than in *D. crenulata* and very nearly as in *D. viridis*, except  $p^3$  and  $p_3$ , which are practically as large as in *D. crenulata* (compare measurements, p. 482). Lower incisors present in all adult skulls (three) examined.

*Colour*.—Type: Back of neck brownish bistre distinctly washed with raw-umber; head shiny blackish bistre. Underparts drab, tinged with broccoli-brown and mixed with light golden tawny-olive on middle of breast and belly.—Two mounted specimens from New Britain (♂ ad., ♀ ad., Berlin Museum, Finsch, 6043, 6044) are rather closely similar in colour to the type, though on the whole somewhat darker.

*Measurements*. On pp. 478, 480, 482.

*Specimens examined*. Five, in the collections of the Berlin (three) and British Museums.

*Range*. New Britain, New Ireland, Duke of York Island.

*Type* in collection.

- a. Imm. sk.; skull. Duke of York group. Rev. G. Brown [C.]. 77.7.18.5.  
(Type of species.)  
b. Juv. al. (milk dentition, see *antæ*, p. 452, footnote). Duke of York group. Rev. G. Brown [C.]. 77.7.18.14.

### 11. *Dobsonia inermis*, K. And.

*Cephalotes peroni* (pt.), Dobson, Cat. Chir. B. M. p. 91.

*Cephalotes peroni* (pt., nec B. Geoff.), Dobson, l. c. (1878: San Christoval); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 208, n. 330 (1879); Thomas, *P. Z. S.* 1887, p. 323 (Ugi; San Christoval); Trouessart, *Cat. Mamm.* i. p. 87, n. 470 (1897).

*Dobsonia peroni* (pt.), Trouessart, *Cat. Mamm.* ii. p. 1278 (1899).

*Dobsonia inermis*, K. Andersen, *Ann. & Mag. N. H.* (8) iv. pp. 532, 533 (1 Dec. 1909: differential characters).

*Diagnosis*.—Similar to *D. viridis*, but in every respect smaller. Forearm 105.5–109 mm. *Hab.* East Solomon Islands: San Christoval and Ugi.

*Colour*.—Type (San Christoval): Back of neck dark hair-brown with scarcely any olive tinge, shading into blackish brown on head. Underparts warm drab (a tinge of drab with a faint hue of dark fawn), distinctly though rather inconspicuously mixed with raw-umber and tawny-olive along middle of breast and belly.

*Measurements*. On pp. 478, 480, 482.

*Specimens examined*. Two, as registered below: these and a specimen from Ugi in the Stockholm Museum appear to be the only specimens so far obtained.

*Type* in collection.

*Remarks*.—This, the extreme eastern representative of the genus, differs only in rather trivial characters from the species inhabiting the Amboina group and Key Islands (*D. viridis*), viz. the smaller general size and correspondingly smaller and more delicate-looking skull, slenderer rostrum, and markedly (perhaps also relatively)

smaller teeth; but the structure of the premolars and molars is precisely the same in both species. Compare *D. nesea*, from the West and Central Solomon Islands, with its more peculiarity modified rostrum.

- a. ♀ ad. sk.; skull. San Christoval, Dec. 1854 Lords of the Admi- 56.7.7.5.  
(Voy. 'Herald'; Dr. F. ralty [P.]. (*Type of species.*)  
M. Rayner).  
b. ♀ ad. al.; skull. Ugi (H.M.S. 'Lark'). Dr. H. B. Guppy [C.]. 83.8.18.7.

## 12. *Dobsonia nesea*, K. And.

*Cephalotes peroni* (nec E. Geoff.), Thomas, P. Z. S. 1887, p. 323 (pt.)  
(Alu, Shortland); *id.*, P. Z. S. 1888, p. 476 (1889: Rubiana).

*Dobsonia nesea*, K. Andersen, Ann. & Mag. N. H. (8) iv. pp. 532,  
533 (1 Dec. 1909: differential characters).

*Diagnosis*.—Allied to *D. inermis* and very nearly of the same general size, but premaxillæ and upper canines slanted peculiarly forward, premolars and molars distinctly larger but not differing in structure. Forearm about 109.5 mm. *Hab.* West and Central Solomon Islands; Shortland and Rubiana (off New Georgia).



Fig. 27.—B, rostrum of *Dobsonia nesea* (type skull), to show proclivous premaxillæ and canines, as compared with A, *D. inermis* (type skull).  
 $\frac{3}{2}$  (linear).

*Skull*.—The cranial character given in the above diagnosis is very conspicuous in the profile (fig. 27) and upper view of the rostrum; in the profile of *D. inermis* (as generally in *Dobsonia*) the tip of the nasals is vertically above the middle or front half, in *D. nesea* vertically above the hinder edge, of the alveole of the canine.

*Colour*.—Type (Shortland): Rather similar in colour to the type of *D. inermis*, but with a distinct olive tinge on back of neck, and the general colour of the underparts paler drab.—A young adult male (al.) from Rubiana is very nearly identical in colour.

*Measurements*. On pp. 478, 480, 482.

*Specimens examined*. Those registered below.

*Type* in collection.

- a. ♂ ad. sk.; skull. Alu, Shortland; C. M. Woodford, Esq. 87.1.18.8.  
Ap. 1886. [C.]. (*Type of species.*)  
b. ♂ yg. ad. al.; Rubiana. C. M. Woodford, Esq. 88.1.5.12.  
skull. [C.].  
c. Head of yg. ad. Rubiana. C. M. Woodford, Esq. 88.1.5.12 bis.  
al.; skull. [C.].



	<i>D. minor</i> , 2 ex., incl. type, Amberbaki; uncertain loc.	<i>D. exoleta</i> , 3 ad., incl. type, Celebes.	<i>D. paucidentensis</i> , 2 ad. Kiriwina.	<i>D. malaccensis</i> , 10 ad. Buru; Amboina; Ceram; Aru.	<i>D. magna</i> , 9 ad., incl. type, New Guinea.*	<i>D. peroni</i> , 8 ad., incl. cotypes, Timor; Alor.
	♀ imm. ♂ ad. Type. Leyden.	MIN. MAX.	MIN. MAX.	MIN. MAX.	MIN. MAX.	MIN. MAX.
Forearm .....	mm. mm.	mm. mm.	mm. mm.	mm. mm.	mm. mm.	mm. mm.
Pollex, total length, c. u. ....	80.5 ...	112.5 116	109 112	133.5 141	146 152.5	108.5 117
" metacarpal .....	34 ...	47 48	40.5 42	51.5 51.5	56 58.5	43.5 43.5
" 1st phalanx ...	10.5 ...	12.5 14.5	13 13	16 16	16 18.5	12 14
" 2nd phalanx ...	17 ...	23 25	17.5 19	22.5 24.5	25.5 28.5	20.5 23
2nd digit, metacarpal .....	39 ...	44.5 52	44 47	55.5 59	62 65.5	45 49.5
" 1st phalanx .....	9 ...	12.5 14	11 12	14 16.5	15.5 17	12.5 14
" 2nd phalanx .....	6 ...	6.5 8	5.5 6	6.5 8	7.5 9.5	6 7.5
" 3rd phalanx .....	1.5 ...	1.5 1.5	1 1.5	1.5 2	2 2.5	1.5 2
3rd digit, metacarpal .....	54 ...	68.5 73.5	66 68	78.5 87	91 95.5	68 73
" 1st phalanx .....	36.5 ...	49.5 55	47 50	59.5 66	67.5 70.5	48 52
" 2nd phalanx .....	47.5 ...	72.5 77	69.5 74	84 99	95 102	72 81.5
4th digit, metacarpal .....	48 ...	65 68	60 62.5	71.5 80	82 87.5	63 69
" 1st phalanx .....	31 ...	41 44.5	40 40	51.5 58	60 61.5	39.5 44.5
" 2nd phalanx .....	31 ...	48 51	... 45	57.5 63	62 66.5	45 50.5
" 3rd phalanx .....	51 ...	66 70	61.5 63	75 82.5	83 89	65 71
5th digit, metacarpal .....	26.5 ...	33.5 36	32 32.5	41 45.5	45.5 47.5	32.5 35.5
" 1st phalanx .....	28.5 ...	42 42	37.5 38.5	45.5 51	52.5 56	36.5 41
" 2nd phalanx .....	16.5 ...	24 25.5	25.5 25.5	32 32	32 33	
Ear, length from orifice .....	11 ...	14.5 15.5	13.5 13.5	16 16	16 17.5	
" greatest breadth, flattened ...	13 ...	24 26	21.5 21.5	26 26	34 40	
Tail .....	28.5 ...	32 34.5	47.5 51	60.5 63	65.5 71.5	? 49.5 ? 52.5
Tibia .....	22.5 ...	33 36	26 27	36 39	41 42.5	? 28
Foot, c. u. ....	6.5 ...	11.5 13	11.5 11.5	12 12	15 15.5	
Calcus .....						

\* Andai; Ottilien R.; Stephansort; Tananta; Kokoda; Aroa R.; Iguibirei.

## Dobsonia: External measurements (II.).

	<i>D. sabana</i> . Ad., type. Sumba.	<i>D. viridis</i> . 10 ad. Amboina; Ceram; Banda; Key.	<i>D. crenulata</i> . 5 ad. Morotai; Batchian.	<i>D. praedicta</i> . 3 ad. Bismarek Arch.	<i>D. luernis</i> . 2 ad., incl. type. San Christoval; Ugi.	<i>D. aesea</i> . ♂ ad., type. Shorland.
	mm.	Min. mm. Max. mm.	Min. mm. Max. mm.	Min. mm. Max. mm.	♂ ad. Type. mm. ♀ ad. Type. mm.	mm.
Forearm .....	106	111 38.5 43	125 44.5 128.5	111.5 43 121.5	105.5 38 109	103.5
Pollex, total length, c. u. ....	40	38.5 43			37 39.5	39.5
" metacarpal .....	11	11.5 13.5	13.5 21	13 23	11 11.5	12
" 1st phalanx .....	21	17.5 22.5			17 17	18
2nd digit, metacarpal .....	44.5	47 52.5	53 58	48 51.5	43.5 42.5	45
" 1st phalanx .....	11	10.5 13	12 14	11.5 12	10.5 11	11
" 2nd phalanx .....	6.5	5 7.5	6.5 7.5	6 7	6 6.5	6.5
" 3rd phalanx .....	2	1.5 2	1.5 1.5	1.5 1.5	1.5 1.5	...
3rd digit, metacarpal .....	67.5	67 73.5	77 80.5	71 75	63 64	63.5
" 1st phalanx .....	47.5	49.5 54.5	55.5 62	53 57	47 40.5	48
" 2nd phalanx .....	70.5	70 79.5	75 83	75.5 78.5	69 68	64
4th digit, metacarpal .....	60.5	62 68	68.5 73	65 68.5	58.5 58	59
" 1st phalanx .....	40	41.5 46	48 54.5	45.5 46	39 40	40
" 2nd phalanx .....	43	44.5 48.5	49 56	45.5 51	43 43.5	...
5th digit, metacarpal .....	63	64.5 70	71.5 75.5	66.5 70.5	59.5 61.5	62
" 1st phalanx .....	32.5	33.5 38	38 42.5	35 36.5	31.5 31.5	31
" 2nd phalanx .....	36.5	38.5 43.5	43 49	44.5 44.5	37.5 40	38.5
Ear, length from orifice .....	21	22.5 26	27.5 27.5	25 25	...	...
" greatest breadth, flattened .....	13	12.5 14	16.5 16.5	13.5 13.5	...	...
Tail .....	20	18.5 22	28.5 28.5	28.5 28.5	...	...
Tibia .....	50	44 51	56.5 56.5	48.5 48.5	47 47	47
Foot, c. u. ....	26	27 31	31 31	32 32	...	28
Culcar .....	8	11 11	12.5 12.5	13 13	...	...

## Dobsonia: Measurements of skulls and tooth-rows (I.).

	<i>D. minor</i> , 2 skulls, incl. type, Auerbaki; uncertain loc.	<i>D. exoleta</i> , 3 ad., incl. type, Celebes.	<i>D. pumilipectus</i> , 2 ad. Kiriwina.	<i>D. moluccensis</i> , 7 ad. Buru; Amboina; Aru.	<i>D. magna</i> , 6 ad., incl. type, New Guinea.*	<i>D. peroni</i> , 6 ad., incl. cotype, Timor; Alor.
	♀ imm. ♂ ad. Type, Leyden. mm. 38 ... 17.2 10 ..... 12 ... ? 10.5 7.8 ... 7 7.8 ... 4.7 6.8 3.5 9.8 30.5 14.7 14.5 16	Min. Max. mm. mm. 32 32 23 14.5 20 32 16 17 12.7 13 9.8 10.5 7 7.2 8 8.2 6 7.8 8.8 3.5 4 11 11.3 41 42.5 20 20.5 20.5 21.3 21.5 23	Min. Max. mm. mm. 47 48 21 22.2 12.8 13.2 20 20 28 14.7 14.8 11 12 9.2 9.3 7.7 8 8.7 9.7 6 6.2 6.8 7.7 3.6 3.7 10.8 11 37 37 18.5 18.5 19.8 19.8 21 21.2	Min. Max. mm. mm. ..... 27.8 28.8 15.8 17 22.8 23.5 36 38 17 19.5 12.8 15.2 11.2 12.8 9.5 9.8 10.8 11.7 6.8 7.5 7.8 9.5 4.2 5 12.2 13 46.8 48.8 23 24 24.5 26.3 25.8 27.8	Min. Max. mm. mm. 62 63.8 29 31 17.7 19 23 24.3 36 38 18.5 19.8 14.5 15 12 12.8 8.8 9.2 10.2 11.8 7 8 9 10.2 5 5.5 13.2 13.2 50 51.5 23 25 25.2 27.8 27.2 29	Min. Max. mm. mm. 48.8 51.7 22 23.3 13.7 14.7 19.5 20.8 29.7 32.2 15.8 16 12 12.8 9.8 10.2 7.8 8.8 9 10.2 6 7 7.7 8.2 3.8 5 10.8 11 39 41.2 19.8 21 20 22 21.2 23.2
Skull, total length to gnathion .....						
" palation to incisive foramina .....						
" front of orbit to tip of nasals .....						
" width of brain-case at zygomatica ..						
" zygomatic width .....						
" across crowns of m <sup>1</sup> , externally .....						
" lachrymal width .....						
" across crowns of canines, externally ..						
" postorbital width .....						
" interorbital width .....						
" width of mesopterygoid fossa .....						
" between p <sup>1</sup> -p <sup>4</sup> , internally .....						
" between cingula of canines .....						
" orbital diameter .....						
Mandible, length from condyle .....						
" coronoid height .....						
Upper teeth, c m <sup>2</sup> , crowns .....						
Lower teeth, c-m <sub>3</sub> , crowns .....						

\* Andai; Tamata; Kokoda; Aroa R.; Ighibirei.

## Dobsonia: Measurements of skulls and tooth-rows (II.).

	<i>D. sundana</i> , Ad., type. Sumba.	<i>D. viridis</i> , 8 ad. Amboina; Ceram; Key.	<i>D. crenulata</i> , 4 ad. Morotai; Batchian.	<i>D. procladia</i> , 3 ad. Bismarck Arch.	<i>D. inermis</i> , 2 ad., incl. type. San Christoval; Ugi.	<i>D. nesa</i> , ♂ ad., type. Shortland.
	mm.	Min.    Max.	Min.    Max.	Min.    Max.	♀ ad. Type.    mm.    Ugi.    mm.	mm.
Skull, total length to gnathion .....	46.5	46.5    49	49    51.2	49    51.8	45.5    44.5	...
"    palation to incisive foramina .....	20.2	20.5    21.2	22    23	21.3    21.5	19    19	19.7
"    front of orbit to tip of nasals .....	12.8	11.5    12.2	12.3    13.2	13    14	10.8    11.2	11.8
"    width of brain-case at zygomatica...	19	18.7    19.5	19.7    20	19.8    20.2	19    18.7	19.2
"    zygomatic width .....	28	28.5    31	30.5    50.8	30.2    33	27.8    26.8	...
"    across crowns of m <sup>1</sup> , externally .....	14.7	14.2    15.7	15    16	14.5    15.2	13.2    12.8	13.7
"    lacrimal width .....	11.5	11.5    12.8	11.8    12.8	12.8    13.8	11    11.5	11.7
"    across crowns of canines, externally .....	9	9.2    10.2	9.8    10.2	9.2    10.5	8.8    8.7	9.8
"    postorbital width .....	7.7	7.5    8	7.5    9	8.2    8.5	6.8    6.8	6.8
"    interorbital width .....	8.7	8    9	9    10	10.2    10.5	7.8    7.8	7.5
"    width of mesopterygoid fossa .....	6	6    6	5.2    6.2	6    6.2	4.8    4.8	5
"    between p <sup>4</sup> -p <sup>1</sup> , internally .....	7	7    8.2	7.2    8	7.2    8.2	6.6    6.5	7
"    between cingula of canines .....	4	5    3.5	3.2    4.2	3.2    4.2	3    3	3.2
"    orbital diameter .....	10.7	10.2    11	10.8    11	10.8    11	9.8    9.8	10
"    Mandible, length from condyle .....	36.5	34.5    38	38.2    40	37.2    41	35    34.2	36
"    coronoid height .....	18.5	19.5    21.8	19    20.5	19.8    22.5	19    18	19
"    Upper teeth, c-m <sup>2</sup> , crowns .....	18.8	18.2    19.8	20    21	18.5    20.8	17    17.2	18.5
"    Lower teeth, c-m <sup>3</sup> , crowns .....	20	19.6    21	20.7    22	19.5    22	17.8    18.5	19.8

## Dobsonia: Measurements of teeth (I.).

	<i>D. minor</i> , 2 skulls, incl. type, 3 skulls, incl. type, Amberbaki; uncertain locality.		<i>D. exoleta</i> , 5 skulls, incl. type, Celebes.		<i>D. panaitensis</i> , 5 skulls, Kiriwina; Fergusson I.		<i>D. moluccensis</i> , 9 skulls, incl. type, 10 skulls, incl. type, Bura; Ambolma; Ceram; Aru.		<i>D. magna</i> , 10 skulls, incl. type, 7 skulls, incl. type, New Guinea *; Mysol; Waigeon.		<i>D. peroni</i> , 7 skulls, incl. type, Timor; Alor; Wetter.	
	♂ imm. Type.	♂ ad. Leyden.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
p <sup>3</sup> , length	2.9	3	4.2	4.7	3.8	4.3	4.3	5	4.5	5.3	3.8	4.5
" width	2.2	2.2	3.5	3.8	3	3.8	3.6	4.2	3.7	4.2	3.2	3.7
p <sup>1</sup> , length	2.9	2.9	4.3	4.8	3.8	4.3	4.8	5	4.8	5.7	4.2	4.8
" width	2	2	3.2	3.7	3	3.7	3.6	4.2	3.8	4.2	3.2	3.5
m <sup>1</sup> , length	3.2	3.1	5.7	5.8	4.8	5.2	6	6.8	6	7	5.2	6
" width	1.8	1.8	3	3.3	2.8	3.2	3.1	3.8	3.5	3.9	2.8	3
m <sup>2</sup> , length	1.5	1.5	2.2	2.8	2.2	3.2	2.8	3.5	2.8	3.8	2.1	2.7
" width	1	1	1.5	2	2	2	2	2.5	2.1	2.8	1.8	1.8
p <sub>0</sub> , length	1	1	1.2	1.3	1.7	1.8	1.6	2	1.5	2.2	1	1.7
" width	1.2	1.2	1.8	2	1.8	2	1.8	2.5	1.7	2.8	1.3	1.8
p <sub>2</sub> , length	2.9	3	4	4.5	3.8	4.5	4.4	5	4.5	5.2	3.9	4.6
" width	2	2	2.8	2.8	2.2	2.8	2.6	3.2	2.8	3.2	2.5	2.7
p <sub>0</sub> , length	3	2.9	4.2	4.7	4	4.7	4.8	5.5	4.9	5.5	4.1	4.8
" width	2	2	2.7	3	2.5	2.8	3	3.5	3	3.8	2.5	2.8
m <sub>1</sub> , length	2.9	2.8	4.2	4.5	4	4.5	4.8	5.2	4.8	5.5	3.9	4.5
" width	1.7	1.7	2.5	2.6	2.2	2.5	2.8	3	2.9	3.2	2.1	2.2
m <sub>2</sub> , length	2.2	2.1	3.3	3.8	3.2	3.8	4	4.2	4	4.8	3.2	3.8
" width	1.5	1.5	2.5	2.6	2.2	2.7	2.8	3	2.8	3.2	2.1	2.3
m <sub>3</sub> , length	1.2	1	2	2.2	2	2	2	2.5	2	2.8	1.8	2.2
" width	1	0.8	1.5	1.8	1.8	1.8	1.8	2.2	1.8	2.7	1.3	1.8

\* Andai; Tamata; Kokoda; Arou R.; Ighibirei.

## Dobsonia: Measurements of teeth (II.).

	<i>D. sumbana</i> . Ad., type. Sumba.	<i>D. viridis</i> . 10 skulls. Amboina ; Ceram ; Key.	<i>D. crenulata</i> . 8 skulls, incl. type. Rau ; Morotai ; Ternate ; Batchian.	<i>D. preclatria</i> . 4 skulls, incl. type. Bismarck Arch.	<i>D. inermis</i> . 2 skulls, incl. type. San Christoval ; Ugi.	<i>D. nesca</i> . 2 skulls, incl. type. Shorland ; Rubiana.
	mm.	Min. mm. Max. mm.	Min. mm. Max. mm.	Min. mm. Max. mm.	♀ ad. type. mm. ♂ ad. Ugi. mm.	Min. mm. Max. mm.
p <sup>3</sup> , length .....	38	39 42	41 43	4 45	35 35	37 38
" width .....	3	28 32	31 37	31 37	27 3	32 32
p <sup>3</sup> , length .....	4	38 42	4 45	38 41	32 3	37 38
" width .....	3	29 32	31 37	32 35	28 3	3 3
m <sup>1</sup> , length .....	48	47 51	52 6	48 5	42 4	45 47
" width .....	27	25 28	3 32	3 3	26 2	28 3
m <sup>2</sup> , length .....	22	18 25	2 27	22 27	25 2	22 22
" width .....	18	12 18	16 2	16 18	18 1	18 18
p <sub>1</sub> , length .....	12	1 16	12 15	1 13	12 1	17 17
" width .....	...	18 18	15 18	15 16	15 1	22 22
p <sub>2</sub> , length .....	38	37 4	41 47	4 45	35 37	38 4
" width .....	...	22 26	23 27	25 28	2 2	22 22
p <sub>3</sub> , length .....	4	43 43	45 48	41 45	38 38	38 38
" width .....	...	22 27	27 28	25 28	2 2	27 27
m <sub>1</sub> , length .....	4	4 4	4 47	38 42	33 33	38 38
" width .....	...	2 22	22 28	24 26	2 2	22 22
m <sub>2</sub> , length .....	32	3 32	32 37	3 32	3 3	3 3
" width .....	...	2 22	22 27	21 25	2 2	22 22
m <sub>3</sub> , length .....	18	12 18	18 21	18 2	18 1	2 2
" width .....	...	...	16 18	13 18	12 16	15 18

9. PLEROTES, *K. Andl.*

Type.

1910. Plerotes, *K. Andersen, Ann. & Mag. N. H.* (8) v.  
p. 97 (3 Jan. 1910) ..... *P. auchietæ*.

*Epomophorus* (pt., *nec Bennett*), *Seabra, J. Sci. Math. Lisboa*, (2) vi.  
p. 116 (1900).

*Diagnosis*.—A genus of Epomophorine bats, differing from *Epomops* chiefly in the following characters:—Palate excessively broad, all teeth considerably reduced in size, cheek-teeth  $\frac{4}{5}$  ( $p^1$  and  $m_3$  present), lower incisors simple, not bilobed, surface of molars nearly perfectly flattened, with but slight traces of lateral ridges and median groove, interdental and postdental palate-ridges essentially alike in shape, interfemoral extremely narrow, calcar absent (or rudimentary?), vertical fasciæ of mesopatagium few and broadly spaced. Whitish hair-tufts at anterior and posterior bases of ear-conchs; external tail absent (or rudimentary?). General size small, forearm about 50–60 mm. [One species. Range, Benguela.]

*Skull* (fig. 28).—Essentially the *Epomops* type. Palate unusually broad; breadth across outer surfaces of crowns of  $m^1$ – $m^1$  more than total length of maxillary tooth-row ( $c$ – $m^1$ ); postdental palate flattened as in *Epomops*, not deeply concave posteriorly as in *Epomophorus*. Rostrum low and very broad, dorsal profile conspicuously descending postero-anteriorly; length from front of orbit to tip of nasals more than breadth across lower edges of lachrymal foramina. Premaxillæ similar in general shape to those of *Epomops*, but slanted more strongly anteriorly. Temporal ridges very low down on skull, separated by a space subequal to length of maxillary tooth-row; parietals therefore more domed than in *Epomops*, postorbital much greater than interorbital width, and occipital region more deflected; postorbital processes short and thin. Tympanics not seen. Rami of mandible extremely low and thin, symphysis broad, coronoid low and much sloping, inferior margin of rami deeply concave, condyle below alveolar line.

*Dentition* (fig. 28).— $\frac{i^1 i^2 c p^1 p^3 p^4 m^1}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2 m_3} = 32$ . Dentition unusually weak;  $p^1$ ,  $p_1$ , and  $m_3$  rudimentary; all other cheek-teeth narrow, twice as long (antero-posteriorly) as broad.

Upper incisors extremely small, barely piercing gum, subequal in size, narrowly and equally spaced, crown indistinctly differentiated, blunt (not acutely pointed as in *Epomops*). Lower incisors small, subequal in size, narrowly spaced, forming a curved row in front of (not between) canines, and with relatively wide diastema between  $i_2$  and  $c$ ; cutting-edge simple, obtuse, with scarcely any indication of the bilobate shape of the lower incisors of *Epomops*. Upper canines as in *Epomops*, lower canines slanted conspicuously outward;  $p^1$  subequal in size to an upper incisor, as high as cingulum of canine, crown obtusely triangular;  $p_1$  as in *Epomops*.  $p^3$  and  $p_4$  lower than in *Epomops*, in profile less canine-like, more obliquely

triangular, outer and inner ridges so completely fused as to leave scarcely any trace of a median groove.  $p^1$ ,  $m^1$ ,  $p_1$ ,  $m_1$ , and  $m_2$  very low, crown flattened, with no trace of the usual cusp-like elevations of the outer and inner ridges; upper teeth with a slight but quite

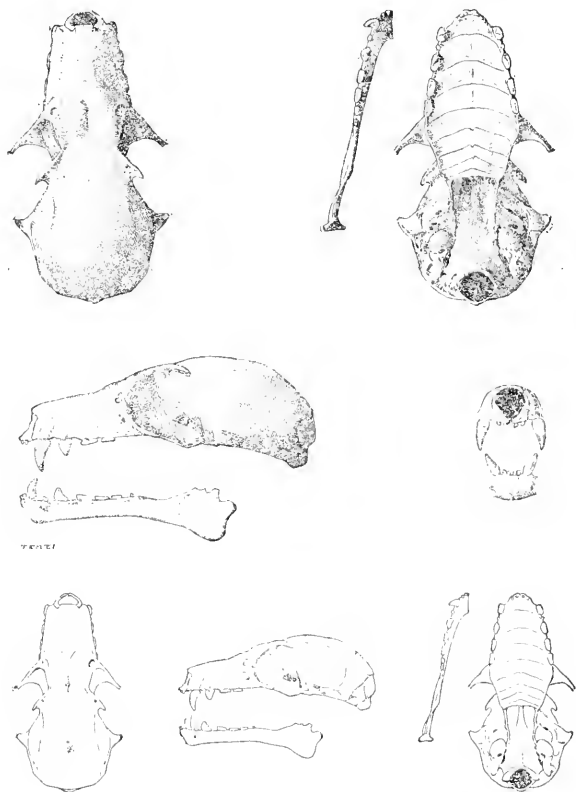


Fig. 28.—*Plerotes anchieta*, ♀ ad., type of species (Lisbon Museum).  
Upper and middle row  $\frac{3}{2}$  (linear), lower row  $\frac{1}{3}$ .

distinct, lower teeth with a scarcely detectable remnant of the median longitudinal groove.  $m_3$  rudimentary, subequal to an upper incisor, situated considerably behind  $m_2$ , and with no upper tooth to act against.

*Palate-ridges* (fig. 29 B).—Palate crossed by eight ridges forming regular curves from side to side (an indistinct trace of a ninth ridge at extreme posterior border of palate); six anterior ridges



almost equidistant, sixth and seventh, and particularly seventh and eighth, more narrowly spaced. Four anterior ridges interdental, though with extremities of fourth ridge behind  $m^1$ : first ridge at level of canines, second at  $p^3$ , third at  $p^4$ , fourth at  $m^1$ . Four post-dental ridges serrate, the first and second (in single individual known) slightly divided in middle.—Fig. 29 shows the probable homologies of the palate-ridges of *Plerotes* (B) as compared with those of *Roussettus* (A); the third interdental ridge of *Plerotes* would seem to correspond to the third and fourth of *Roussettus*; compare also palate-ridges of *Epomops*, p. 489, figs. 31 A, B.

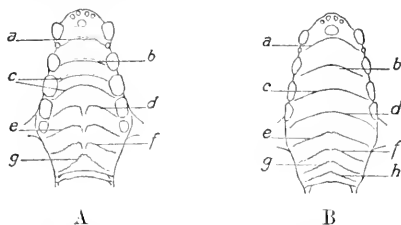


Fig. 29.—Palate-ridges. A, *Roussettus leachi* (6.4.3.126), for comparison with B, *Plerotes anchietae* (type of species). A  $\frac{1}{2}$ , B  $\frac{3}{2}$  (linear).

*External characters*.—Interfemoral greatly reduced, breadth at middle of tibia scarcely more than breadth of tibia bone; calcar absent (or rudimentary). External tail apparently wanting (specimen mounted). Transverse trabeculae of mesopatagium rather broadly spaced (interspaces about 2 mm.); vertical fasciae, as crossed by the main internal cutaneous, few (about seven or eight) and broadly spaced. Membranes from sides of back near flanks and from first phalanx of second toe (as in all Epomophorine bats). Other external characters unmodified Epomophorine.

In the subjoined table the upper row is the wing-indices of *Plerotes* (calculated from measurements of one specimen), the second row those of the Ethiopian species of *Roussettus*, the third those of some typical Oriental species of *Roussettus*. It will be noticed that the pollex, third, fourth, and fifth metacarpals, first and second phalanx of third digit, and first phalanx of fourth and fifth digits are much longer in *Plerotes* than in *Roussettus*.

Forearm.	Pollex. c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	115	443	123	113	679	519	660	698	415	357	689	368	311
1000	361	442	105	105	641	138	604	635	314	379	622	315	286
1000	335	415	93	100	612	108	521	595	313	353	536	291	323

*Sexual differentiation.*—Males of this genus are unknown. Their secondary sexual characters are probably not very different from those developed by males of the related genus *Epomops*.

*Affinities.*—*Plerotes* is the only known genus of Epomophorine bats which has not lost  $p^1$  and  $m_3$ . In so far it is the most primitive genus of this section. But in most of its essential characters it stands decidedly nearest *Epomops*, and it exhibits several of the characters of *Epomops* in an even more extreme phase, namely the broadening of the palate and rostrum, the outward slant of the lower canines, and the broadening of the symphysis menti. A relatively weak dentition is a feature common to all Epomophorine bats, but the reduction of the size of the teeth is in *Plerotes* carried still further than in any of the related genera, and the molars have so far lost nearly every trace of surface structure (lateral ridges, median grooves) as to become similar to the molars of certain highly specialized genera of MacroGLOSSI. In consequence of the degeneration of the dentition, the temporal ridges remain low down on the sides of the skull, the deflection of the brain-case is greater than in other Epomophorine genera, the mandible very weak, the coronoid process still lower and more sloping backward than usual (for parallels compare *Rousettus lanosus* with typical species of *Rousettus*, *Pteropus scapulatus* and *woodfordi* with typical species of *Pteropus*, *MacroGLOSSINÆ* with *Pteropodinae*). In the narrowness of the inter-femoral and absence (or rudimentary condition) of the calcar, *Plerotes* is unique in the Epomophorine section, but there are analogies in the Cynopterine (*Sphærias*) and MacroGLOSSINE sections (*Syconycteris*). Despite its many peculiarities *Plerotes* has preserved one character which, though seemingly rather insignificant, is curiously persistent in all genera of Epomophori, viz. the small whitish hair-tufts at the base of the ears.

### 1. *Plerotes anchietæ*, *Seabra*.

*Epomophorus* n. sp., *Seabra, J. Sci. Math. Lisboa*, (2) v. p. 166, pl. i. fig. 3 (palate-ridges) (1898; Galanga).

*Epomophorus anchietæ*, *Seabra, J. Sci. Math. Lisboa*, (2) vi. p. 116 (Aug. 1900: same specimen).

*Plerotes anchietæ*, *K. Andersen, Ann. & Mag. N. II.* (8) v. p. 97 (1910: same specimen).

Forearm of an adult female 53 mm.

Ears similar in form and size to those of *Micropteropus pusillus*; tip rounded off. Fur of back rather long and silky (approximate length 12 mm.), extending on proximal half of forearm, on tibia to ankle, and forming a long fringe overhanging posterior edge of narrow interfemoral; fur of underparts shorter (about 9–10 mm.) and somewhat harsher, extending on proximal third of forearm and half of tibia. Colour of fur: back brownish isabella with greyish-white or creamy-white bases to the hairs; underparts much lighter, greyish drab; a small tuft of cream-white hair at anterior and posterior base of ear-conch.

*Measurements.* On pp. 510, 512, 513.

*Range.* So far known only from Galanga, Benguela.

*Type*, in the Lisbon Museum, an adult female, mounted, skull extracted, obtained by Sr. Anchieta. No other specimen is known to exist in collections (March, 1910). For the loan of the type the writer is indebted to Sr. A. F. de Seabra.

*Remarks.*—Though widely different in skull and dentition this species bears externally much resemblance to *Micropteropus pusillus*. It may be safely distinguished from that and any other Epomophorino bat by the narrowness of the lateral interfemoral and the absence (or rudimentary condition) of the calcar; and the following two characters taken together, viz., absence of a calcar and presence of whitish hair-tufts at the base of the ears, are, quite apart from cranial and dental peculiarities, sufficient to distinguish it from any other known Fruit-bat.

# 10. EPOMOPS, Gray.

*Epomophorus* (pt.), Dobson, Cat. Chir. B. M. p. 4.

Type.

1866. *Epomops*, Gray, P. Z. S. 1866, p. 65 ..... E. f. franqueti.

*Epomophorus* (pt.), Tomes, P. Z. S. 1860, p. 44; *Peters, MB. Akad. Berlin*, 1867, p. 869; *Dobson, l. s. c.* (1878); *Miller, Fam. & Gen. Bats*, p. 65 (1907).

*Epomops*, Gray, Cat. Monk. &c. p. 125 (1870); *Matschie, Megachir.* p. 56 (1899: subgenus of *Epomophorus*); *K. Andersen, Ann. & Mag. N. H.* (8) v. p. 99, footnote (1910: differential characters).

*Summary of characters.*—Epomophorine section. Length of rostrum much greater than lachrymal breadth; rostrum tapering anteriorly; palate broad, never deeply depressed posteriorly. Incisors  $\frac{2-2}{2-2}$  or,  $i^2$  being often deciduous,  $\frac{1-1}{2-2}$ ; cheek-teeth  $\frac{3}{5}$  ( $p^1$  and  $m_3$  absent); lower incisors bilobed; longitudinal ridges of cheek-teeth simple, prominent; interdental conspicuously different from postdental palate-ridges; thirteen dorsal, four lumbar, two caudal vertebrae. Lips greatly expansible, without prominent cutaneous folds in front; interfemoral and calcar well-developed; external tail rudimentary; vertical fasciae of mesopatagium numerous, crowded; whitish hair-tufts at base of ears. Males larger than females, with two pairs of pharyngeal sacs, and large shoulder pouches and epaulette-like hair-tufts. Forearm 82–100.5 mm. [Three species, four recognizable forms. Range, the western Ethiopian forest region.]

*Skull* (fig. 30).—Palate broader than in *Rousettus* (p. 17, fig. 2), particularly in its postdental portion, but not broadened to the same degree as in *Plerotes* (p. 484, fig. 28), breadth across outer surfaces of crowns of  $m^1$ – $m^1$  less than total length of maxillary tooth-row; postdental palate flattened as in *Plerotes* and *Hypsignathus* (and Fruit-bats generally), not deeply hollowed out

posteriorly as in *Epomophorus*; mesopterygoid fossa broad. Rostrum long, broad across alveolar margins, gradually tapering anteriorly; upper profile line distinctly descending postero-anteriorly (compare *Hypsignathus*); length from front of orbit to tip of nasals much more than breadth across lower edges of lachrymal foramina; nasals shorter than in *Rousettus*, anterior extremity vertically above canine (in *Rousettus* in front of canine).

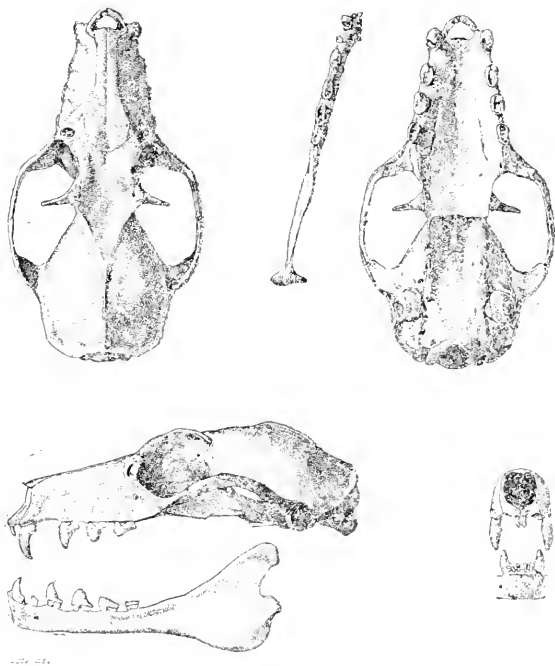


Fig. 30.—*Epomops franqueti franqueti*, ♂. Semliki River. No. 6.12.4.59.  
(Teeth rather more worn than represented in the figure.)  $\frac{1}{4}$ .

Lower half of premaxillæ directed much more obliquely anteriorly than in *Rousettus*, upper half narrow, almost tapering to a point; premaxillæ in simple contact anteriorly. Brain-case more flattened than in *Rousettus*, occipital region directed more straightly backward, alveolar margin if projected posteriorly therefore passing through lower edges of auditory meatus and occipital condyles. Temporal ridges usually (perhaps always) separated in females, in males often (at least in *E. buettikoferi* and the larger race of *E. franqueti*) fused

to form a low sagittal crest; postorbital processes short and thin, as in *Rousettus*. Tympanic ring relatively broad, as in *Rousettus*. Rami of mandible very low, coronoid process low and much sloping, angular process broadly rounded off, lower margin of rami deeply concave in front of angular process, condyle nearly at level of (in *E. dobsoni* even slightly below) alveolar margin.

*Dentition* (fig. 30). —  $\frac{i^1(i^2)c}{i_1 i_2} \frac{p^3 p^4 m^1}{c p_1 p_3 p_4 m_1 m_2} = 28$ .  $p_1$  reduced,

$i^2$  often deciduous, dentition on the whole weak.

Upper incisors small, terete, generally narrowly spaced, and with wide diastema between  $i^2$  and canine; crown barely differentiated from shaft, acutely pointed at tip, and often slightly recurved;  $i^2$  usually a little shorter and thinner than  $i^1$ , very often deciduous\*. Lower incisors crowded or very narrowly spaced, forming a nearly

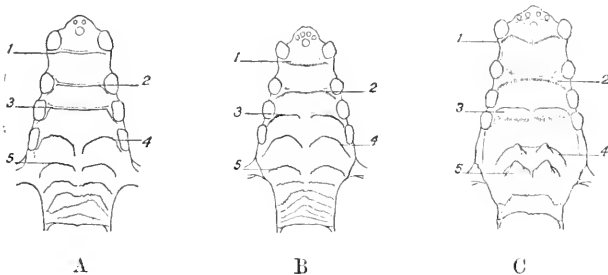


Fig. 31.—Palate-ridges. A, *Epomops franqueti* (♂, 80.7.21.1.); B, *E. buettikoferi* (♀, 66.2.2.1); C, *E. dobsoni* (♂, 5.5.9.3). 1.

*E. franqueti* and *E. buettikoferi*: Four interdentary and about five to seven postdentary ridges. Three anterior interdentary ridges thick and prominent, quite or approximately straight; fourth interdentary and all postdentary ridges thinner and serrate, more or less arcuate or triangular; fourth interdentary and anterior postdentary ridges divided at middle, posterior postdentary ridges often conspicuously asymmetric. Third interdentary ridge in *E. franqueti* (A) nearly always undivided at middle, though often with a distinct median depression indicating a tendency to splitting; in *E. buettikoferi* (B) broadly divided at middle.

*E. dobsoni*: Three thick and prominent interdentary ridges, the second very distinctly bifurcate at either extremity; fourth and fifth ridges postdentary, thick and triangularly prominent; one or two thin and serrate ridges near posterior edge of palate.

\* Details from 30 fully adult skulls of *E. franqueti* and *buettikoferi*:—In 11,  $i^2$  present on both sides; in 5, present on one side only; in 14, absent on both sides. The presence or absence of  $i^2$  is independent of the age of the adult individuals; of the eleven adult skulls with  $i^2$  present on both sides, eight have the teeth conspicuously or even much worn; of the fourteen with

straight line between fronts of canines, cutting-edges bilobed. Upper canines thin, distinctly recurved, anterior surface of crown perfectly smooth or with a scarcely detectable trace of a vertical groove antero-internally; cingulum narrow; lower canines similar to upper but shorter and slenderer, crown often (particularly in *E. dobsoni*) slanted distinctly outward. Diastema c-p<sup>3</sup> wide, all cheek-teeth spaced. p<sub>1</sub>, though small, with distinct remnants of typical structure; outer ridge raised as a small acutely pointed cusp. p<sup>3</sup> and p<sub>3</sub> canine-like in profile, but outer and inner ridge never so completely fused as to obliterate the median groove. p<sup>4</sup>, m<sup>1</sup>, p<sub>4</sub>, and m<sub>1</sub> simple, narrow, with distinct median groove and prominent lateral ridges. m<sub>2</sub> generally about half the bulk of m<sub>1</sub>.

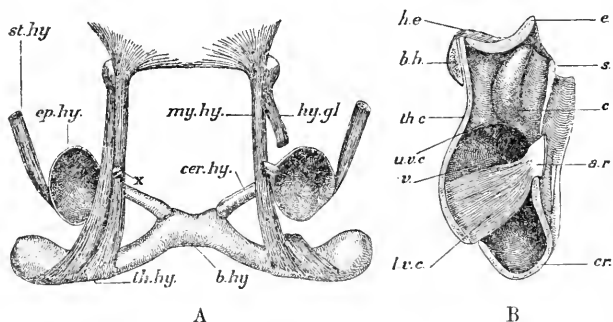


Fig. 32.—A, hyoid bones and muscles of *Epomops buettikoferi* (enlarged). *b.hy*, basihyal, *th.hy*, thyrohyals (shown diagrammatically, in their natural position curved round the thyroid cartilage of the larynx); *cer.hy*, ceratohyals; *ep.hy*, epihyals; *x*, prominent articular process of epihyal, separating and acting as a pulley for the fleshy tendons of the mylohyoid (*my.hy*) and hyoglossus muscles (*hy.gl*); *st.hy*, tendon of stylohyoid muscle attached to upper margin of epihyals.

B, sagittal section through larynx of *Epomops buettikoferi* (enlarged). *e*, epiglottis; *h.e*, hyo-epiglottideus muscle; *b.h.*, basihyal; *th.c.*, thyroid cartilage; *u.v.c.*, upper vocal cord; *v.*, ventricle, leading anteriorly into the long sacculus laryngis, extending almost as far as the base of the epiglottis, and posteriorly continued backward behind *l.v.c.*, the lower vocal cord; *s.*, apex of Santorinian cartilage; *c.*, crescentic fibro-cartilaginous cushion extending forward from *a.r.*, the arytenoid cartilage; *cr.*, cricoid cartilage.

From P. Z. S. 1881, pp. 686, 690 (reduced and slightly altered).

i<sup>2</sup> absent on both sides, four have the teeth quite or nearly unworn; the tooth is sometimes absent on both sides even in slightly immature skulls. So far as the available material goes, i<sup>2</sup> appears to be much more frequently lost in *E. f. franqueti* than in *E. f. strepitans* and in *E. buettikoferi*. (For further details see Ann. & Mag. N. H. (8) v. pp. 103, 104; 1910.)—The single adult individual examined of *E. dobsoni* has i<sup>2</sup> present on both sides.

*Palate-ridges*.—See fig. 31 (p. 489) and synopsis of species (p. 494).

*Lips, pharynx, larynx, hyoid bones* (fig. 32).—Lips full, pendulous, and highly expansible, transverse diameter of mouth with expanded lips about four or five times that of palatal breadth (character conspicuous in both sexes, but most highly developed in males). Oral cavity communicating by a very restricted aperture with the unusually long, wide, and greatly extensible pharynx. Larynx (fig. 32 B) spacious, with ossified walls, large epiglottis, and well-developed lower vocal chords. Hyoid bones (fig. 32 A) peculiarly modified: thyrohyals long and spatulate, ceratohyals articulating by a synovial joint (permitting a very free rotatory motion) with basihyal, and at their upper extremity with the cartilaginous epihyals; these latter subcircular in outline, with the inner side flat or slightly convex, the outer side deeply concave. (For further details see Dobson, l. c. For anatomy of alimentary, respiratory, renal, and reproductive organs see Robin, Ann. Sci. Nat. (6) Zool. xii. Art. 2, 1881.)

*Ears*.—Simple, outer margin flatly concave in upper third, tip rounded off (compare *Hypsignathus*). Antitragal lobe small, triangular.

*Wings*.—Membranes from upper part of flanks (therefore separated at origin by nearly the whole breadth of the dorsum), and inserted on first phalanx of second toe. Antebrachial membrane broad, including basal third of first phalanx of pollex. Vertical fasciæ of mesopatagium very numerous (36–47), crowded, interspaces scarcely more than one millimetre; transverse trabeculi extremely numerous and crowded. Metacarpal of index much longer than in *Plerotes*; third metacarpal generally a little longer than fifth, fourth a little shorter than both; first phalanx of third and fourth digits considerably shorter than in *Plerotes*, the former being about two-thirds (in *Plerotes* three-fourths), the latter one-half (in *Plerotes* much more than one-half) of the metacarpals of the same digits: second phalanx of third digit considerably shorter than (in *Plerotes* nearly equal to) metacarpal; second phalanx of fourth digit always, that of fifth digit generally longer (in *Plerotes* shorter) than first phalanx of same digits. Subjoined, the wing-indices of *Epomops* (upper row), calculated from measurements of 30 adult specimens representing all forms known, and those of *Plerotes* (lower row) for comparison.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	434	538	107	128	728	466	630	699	346	388	715	351	362
1000	415	443	123	113	679	519	660	698	415	387	689	363	311

*Tail and interfemoral*.—Tail rudimentary, in some individuals

about one millimetre, in others not appearing externally, but even in the latter case generally perceptible to the touch as a small pointed knob beneath the integument. Caudal vertebrae two, the posterior a mere nodule (two skeletons of *E. f. buettikoferi* examined). Interfemoral unmodified, breadth at middle of tibia about four to five times that of tibia.

*Sexual differentiation*.—(1) Adult males with a pair of large shoulder pouches, lined with a glandular membrane, and from which long, somewhat rigid, orange or yellowish-white hairs arise, projecting by their extremities from the aperture of the pouches, and when these are everted forming large epaulette-like shoulder tufts (pouches and tufts larger than in *Epomophorus*); in females and immature males absent or quite rudimentary. (2) Males with two pairs of pharyngeal sacs; either anterior sac opening into pharynx by a large oval aperture immediately behind oral cavity, and extending outward under cover of the integument beneath and behind the ears; either posterior sac supported by the deeply concave outer surface of the epihyal, thence extending outward and backward beneath the integument and sterno-mastoid muscle, across the clavicle, to the antero-inferior part of the thorax (see Dobson, P. Z. S. 1881, pp. 688, 689, fig. 4); pharyngeal sacs absent in females. (3) Males averaging considerably larger than females.

*Range*. From Sierra Leone (perhaps Senegambia) in the west, along the Guinea coast, eastward to Niam-Niam, the western bank of Victoria Nyanza, and Semliki River, southward through Gaboon to Benguela and Katanga. The range of the genus almost exactly covers the western Ethiopian forest region.

*Habits*.—The “bindem,” as these bats are called by the natives of Southern Cameroons, probably make more noise at night than any other creature of that country (G. L. Bates writes, P. Z. S. 1905, i. p. 72). “Their monotonous croaking racket may be heard in the bush-growth about villages any night—at least if any of the wild trees growing in such places are in fruit. They were especially abundant about my house when an ‘Udika’ tree near by was bearing. Their noise, consisting of a sort of croaking bark repeated many times in a monotone, was generally heard coming from a thicket where the bat seemed to be hanging. But sometimes, at dead of night, the sound was heard passing overhead, from a bat flying. Whenever a bunch of ripe bananas was hanging on my porch, it was visited by the bats at night. When the bananas got very soft, the bats would eat several of them in a night and bite many more. They took their bites on the wing while flying to and fro. Boys would sometimes find these bats hanging on bushes in the daytime. On the last day of August and the first of September two females were brought to me, each with a half-grown young one, which had been found clinging to the mother.”

*Affinities*.—*Epomops* is in no single character more primitive than *Rousettus* (except perhaps in having the membranes inserted rather lower down on the flanks), but in several respects much more highly specialized. The bats of this genus subsist chiefly,



perhaps entirely, on soft fruits, such as figs and bananas, the contents of which they draw out less by real mastication than by suction; and their muzzle, pharynx, cranial rostrum, dentition, and palate-ridges are modified accordingly. The rostrum and palate are increased in length and particularly in breadth, the lips so expansible as to be capable of completely encircling a fruit three or four times the transverse diameter of the mouth in unexpanded condition; the thin and somewhat hook-like canines and the sharply pointed anterior premolars pierce the rind of the fruit and keep it in position, while it is squeezed between the jaws and pressed upward by the tongue against the thick and prominent interdental palate-ridges; for the action of suction the spacious pharynx, shut off as it is from the posterior nares by its constrictors, communicating in front with the mouth by a small valvular opening, and having its sides supported behind by the expanded hyoid bones, constitutes a most perfect exhauster (see Dobson, P. Z. S. 1881, p. 692). The food of these bats requires but little mastication; hence the dentition is on the whole feeble, and those cheek-teeth which already in *Rousettus* are considerably reduced in size, viz.  $p^1$ ,  $m_3$ , and  $m^2$ , have completely disappeared: the mandible is weakened almost to the same degree as in the *Macroglossi* (to the mandible of which it bears much general resemblance); the temporal muscles extend chiefly upward, less upward-and-backward, the sagittal crest, if present, is therefore developed chiefly in the fronto-parietal, less in the occipital region, and the occiput not deflected downward but directed almost straightly backward. The development of large pharyngeal sacs in the males is probably connected with the peculiar croaking voice and unusually noisy habits of these animals. Externally, apart from minor modifications, *Epomops* differs from *Rousettus* chiefly in the almost complete disappearance of the tail and the very high differentiation of the secondary sexual characters.

*Remarks.*—The present genus has generally not been kept separate from *Epomophorus*, probably owing to its almost perfect resemblance to the latter genus in the tooth-formula and structure of the teeth, and its almost completely similar external characters. Both *Epomops* and *Epomophorus* subsist on soft fruits, but in having adapted themselves to this diet they have, in certain respects, followed essentially different lines of development. In *Epomops* the rostrum and palate are broadened, in *Epomophorus* on the contrary unusually narrow; in *Epomops* the postdental palate has preserved the common "Rousettine" shape, in *Epomophorus* it is deeply hollowed out posteriorly, and the palate-ridges are more peculiarly modified; also the hyoid bones and pharyngeal sacs are different in the two genera. Externally the present genus may be distinguished from *Epomophorus* by the greater number and more crowded arrangement of the vertical fasciæ of the mesopatagium. *Epomops* is in fact more closely related to *Myotis* and *Pteropus* than it is to *Epomophorus*.

*Synopsis of the Species.*

- a. Four interdental and about five to seven postdental palate-ridges; three anterior interdental ridges thick, prominent, quite or nearly straight, the first and second always undivided in middle; fourth interdental and all postdental ridges thinner, serrate, more or less arcuate or angular (figs. 31 A, B).
- a'. Third interdental palate-ridge nearly always undivided in middle (fig. 31 A); bony palate flatter; zygomatic breadth about three-fifths of total length of skull; skull, total length 46.8-53 mm. (males) and 41.8-47 (females), forearm 88-96 (males) and 82-93 (females). (Gold Coast to Victoria Nyanza, and Loanda) ..... [p. 494.  
1. *E. franqueti*,
- b'. Third interdental palate-ridge broadly divided in middle (fig. 31 B); palate conspicuously domed; zygomatic breadth only about one-half of total length of skull; skull, total length 54.5-59.5 mm. (males) and 49.5-51.5 (females), forearm 92.5-100.5 (males) and 88-92.5 (females). (Sierra Leone; Liberia) ..... [p. 499.  
2. *E. buettikoferi*,
- b. Three thick and prominent interdental palate-ridges; postdental palate with two pairs of prominent, triangular ridges at middle and one or a few thin and serrate ridges at palation border (fig. 31 C). Forearm of males about 88 mm. (Benguela; Katanga)..... [p. 500.  
3. *E. dobsoni*,

1. *Epomops franqueti*, *Tomes*.

*Epomophorus franqueti* (pt.), Dobson, Cat. Chir. B. M. p. 12.  
*Epomophorus comptus*, Dobson, *op. cit.* p. 13.

(Synonyms under the subspecies.)

*Characters*.—Palate-ridges as described and figured p. 489, fig. 31 A. The ridges have been examined in 24 individuals representing both subspecies and from the following localities:—Gold Coast (two), Togo (one), Lagos (one), South Nigeria (four), Cameroons (nine), Spanish Guinea (one), Gaboon (two), Malandje (one), Tingasi (one), uncertain localities (two). In 23 of these the third interdental ridge is practically undivided in the middle, either absolutely continuous or, not infrequently, with a distinct notch at the middle suggesting an initial stage toward a splitting of the ridge; in one single individual the ridge is distinctly divided in the middle, by a space about equal to the breadth of p<sup>4</sup> (Kradji, Togo, collected by Count Zech, Berlin Museum 8945, with skull 10037); the latter specimen is in every other respect a typical *E. f. strepitans*. Bony palate more flatly concave from side to side and antero-posteriorly than in *E. buettikoferi*; rostrum and palate relatively shorter; zygomatic breadth about three-fifths of total length of skull. Size smaller than *E. buettikoferi*, a difference much

better pronounced in the skull than in the external dimensions, as shown in the subjoined table; in the size of the skull there is perhaps an absolute difference between the two species, in the external dimensions decidedly only an average difference:—

	<i>franqueti</i> . 14 males.	<i>buettikoferi</i> . 4 males.	<i>franqueti</i> . 10 females.	<i>buettikoferi</i> . 2 females.
Skull, total length ...	46.8-53	54.5-59.5	41.8-47	49.5-51.5 mm.
Zygomatic breadth...	26.8-30	? - 29	? -26.5	? -26 "
Mandible.....	36 -43	43 - 49	33.8-38	39.5-41 "
c-m <sup>1</sup> , crowns .....	14.5-18	18.8- 20	14.5-16.7	16.7-17.8 "
Forearm .....	88 -96	92.5-100.5	82 -93	88 -92.5 "
3rd metacarpal .....	62.5-70	69 - 75	60 -66	66.5-68 "
Ear, length.....	22 -25	23.5- 27	21.5-25.5	22.5-25.5 "
Tibia .....	31.5-37.5	37 - 43.5	? -34.5	? -37.5 "

*Fur*.—Soft and silky, moderately long (12-14 mm.) on back, short (6-8 mm.) and closely adpressed on breast and belly. Fur of back extending on basal half of forearm and on tibia to ankle.

*Colour*.—♂ ad. skin, teeth well-worn, Abonnema, S. Nigeria, 25 Feb., 2.11.2.4: Back and rump deep Prout's brown tinged with dark fawn, this colour passing gradually into brownish fawn on nape of neck, and into dark wood-brown on head; base of hairs not differing; underparts essentially similar to back, but with a large and very sharply defined whitish patch covering the whole of the belly; epaulettes deep buff; tufts at base of ears whitish.—An adult female from same locality (skin, 21 March, 2.11.2.6) is similar in colour but distinctly paler: Back deep brownish fawn, shading to light wood-brown on nape of neck and head; underparts somewhat paler than back, whitish patch extending over belly and posterior part of breast; sides of neck and foreneck cream-white.—An immature male, same place (skin, 21 March, 2.11.2.5), is perfectly similar to the adult female, but with the whitish abdominal patch scarcely indicated.—An adult male from Asaba, S. Nigeria (skin, teeth worn, no date, 95.5.3.7), is similar to the first described adult male (2.11.2.4), but on the whole darker, more approaching vandyck-brown.

The above four skins of *E. f. strepitans* have been selected for description to illustrate the amount of colour variation within one geographical race of the species; but inasmuch as the various forms of the present genus differ very little (if at all) in colour, they may be taken as fairly illustrative of the colour variation in the whole genus. The first specimen (2.11.2.4) represents the average colour, the second and third a rather paler, the fourth an unusually dark pattern. The difference (which even between the extremes is by no means very great) is evidently partly quite individual, partly due to a natural bleaching of an originally darker into a paler tinge. The sexes are alike in colour. A sharply defined abdominal patch seems to be fully developed only in adult individuals, but, apart from this, there appears to be no appreciable age difference in colour.

*Range*. From the Gold Coast eastward, through Togo, Lagos, S. Nigeria, and Cameroons, to Niam-Niam, the western bank of

Victoria Nyanza, and Semliki River, and from Cameroons southward, through Spanish Guinea and Gaboon, to Loanda.

*Subspecies*.—Two, a smaller western (*E. f. strepitans*), ranging from the Gold Coast to Old Calabar, and a larger eastern and southern (*E. f. franqueti*), ranging from Old Calabar, east to Victoria Nyanza, and south to Angola. The subspecies differ in size only, and, as shown by the subjoined comparative measurements, this difference is much better pronounced in the skull than in the external dimensions, and much better so in the males than in the females; the latter are sometimes difficult to discriminate:—

	<i>strepitans</i> . 5 males.	<i>franqueti</i> . 9 males.	<i>strepitans</i> . 2 females.	<i>franqueti</i> . 8 females.
Skull, total length ...	46·8-48	49 -53	41·8-43·5	43 -47 mm.
Mandible .....	36 -39	40 -43	? - ?	33·8-38 „
c-m <sup>1</sup> , crowns .....	14·5-16·2	16·5-18	14·5-14·8	14·8-16·7 „
Forearm .....	88 -89·5	90·5-96	84·5-85	82 -93 „
3rd metacarpal .....	62·5-65·5	67 -70	60 -60·5	60 -66 „
Ear, length .....	22 -24	23 -25	21·5- ?	23·5-25·5 „
Tibia .....	31·5-35	33·5-37·5	? - ?	32 -34·5 „

#### 1 a. *Epomops franqueti strepitans*, K. Aud.

*Epomophorus franqueti*, Peters, *MB. Ak. Berlin*, 1867, p. 869 (pt.) (Lagos); *Jentink, Cat. Syst. Mamm.* p. 137, specimens a-e, h (1888: Gold Coast); *Matschie, Mitth. D. Schutzgeb.* vi. II. iii. p. 7 (1893: Gold Coast: Lagos); *id., Mitth. Geogr. Ges. Lübeck*, (2) II. vii.-viii. p. 133 (1894: Accra; Fanti); *Trouessart, Cat. Mamm.* i. p. 89, n. 478 (pt.) (1897).

*Epomophorus* (*Epomops*) *franqueti* (pt.), *Matschie, Megachir.* p. 56 (1899: Accra; Fanti: Christiansborg; Kradji); *Trouessart, Cat. Mamm., Suppl.* p. 58, n. 523 (1904).

*Epomophorus comptus* (pt.), *Matschie, Mitth. Geogr. Ges. Lübeck*, (2) II. vii.-viii. p. 132 (1894: Gold Coast; Lagos); *Trouessart, Cat. Mamm.* i. p. 89, n. 479 (1897).

*Epomophorus* (*Epomops*) *comptus* (pt.), *Matschie, Megachir.* p. 57 (1899: Accra; Lagos); *Trouessart, Cat. Mamm., Suppl.* p. 58, n. 524 (1904).

*Epomophorus macrocephalus* (*nec Ogilby*), *Jentink, Cat. Ost. Mamm.* p. 251, skeleton a (1887: Gold Coast).

*Epomops franqueti strepitans*, K. Andersen, *Ann. & Mag. N. II.* (8) v. p. 106 (3 Jan. 1910: differential characters).

*Characters*.—See above, and detailed measurements on pp. 509-513.

*Specimens examined*. Nineteen, in the collections of the Leyden (eight), Berlin (four), and British Museums, from the following localities:—Gold Coast (eleven, skulls of four), Togo (one, with skull), Lagos (one, with skull), S. Nigeria (six, with skulls).

*Range*. Gold Coast (Accra, Elmina, Fanti); Togo (Kradji); Lagos; S. Nigeria (Abonnema, Asaba, Oban). In the region of Old Calabar it probably meets the eastern and southern form of the species, *E. f. franqueti*.

*Type* in collection.

a. ♀ imm. sk.; skull.	Gold Coast.	A. M. Mackilligin, Esq. [C. & P.].	8.8.6.11.
b-d. ♂ ad., ♂ imm., ♀ ad. sks.; skulls.	Abonnema, S. Nigeria; 25 Feb., 21 March, 1902.	Dr. W. J. Ausorge [C.].	2.11.2.1-6.
e. ♂ ad. al.; skull.	Asaba, S. Nigeria.	Dr. W. H. Crosse [P.].	95.5.3.6.
f. ♂ ad. sk.; skull.	Asaba.	Dr. W. H. Crosse [P.]. ( <i>Type of subspecies.</i> )	95.5.3.7.
g. ♂ imm. sk.; skull.	Oban, S. Nigeria, 600'; 7 Sept. 1909.	P. A. Talbot, Esq. [C.].	Orig. no. 13.

### 1 b. *Epomops franqueti franqueti*, *Tomes*.

*Epomophorus franqueti*, *Tomes*, *P. Z. S.* 1860, p. 54, pl. lxxv. (col. fig. of type) (Gaboony); *id.*, *op. cit.* 1861, pl. i. figs. 3, 3a, 3b (skull of type); *Peters*, *MB. Ak. Berlin*, 1867, p. 869 (pt.) (Gaboony); *Dobson*, *P. Z. S.* 1873, p. 247 (secondary sexual characters); *Peters*, *MB. Ak. Berlin*, 1876, p. 474 (Aqua Town, Cameroon); *Dobson*, *Cat. Chir. B. M.* p. 12 (pt.) (1878: Gaboony); *Trouessart*, *Rev. & Mag. Zool.* (3) vi. p. 208, n. 335 (pt.) (1879); *Thomas*, *P. Z. S.* 1888, pp. 7, 16 (Tingasi); *Trouessart*, *Cat. Mamm.* i. p. 89, n. 478 (pt.) (1897); *Cabrera*, *Mem. Soc. Esp. H. N.* i. Mem. i. p. 6 (1903); *Bates*, *P. Z. S.* 1905, i. p. 72 (S. Cameroon; habits); *Miller*, *Fam. & Gen. Bats*, p. 67 (pt.) (1907).

*Epomops franqueti*, *Gray*, *P. Z. S.* 1866, p. 65; *id.*, *Cat. Monk. &c.* p. 126 (1870).

*Epomophorus* (*Epomops*) *franqueti* (pt.), *Matschie*, *Megachir.* p. 56 (1899: Bukoba); *Trouessart*, *Cat. Mamm., Suppl.* p. 58, n. 523 (1904).

*Epomops franqueti franqueti*, *K. Andersen*, *Ann. & Mag. N. H.* (8) v. pp. 102-104 (1910: palate-ridges; i<sup>2</sup>).

*Epomophorus comptus*, *H. Allen*, *Proc. Ac. N. Sci. Philad.* 1861 ("July"), p. 158 ("W. Africa," i. e. Gaboony); *Peters*, *MB. Ak. Berlin*, 1867, p. 870; *id.*, *op. cit.* 1876, p. 474 (Mungo, Cameroon); *Dobson*, *Cat. Chir. B. M.* p. 13, pl. ii. fig. 5 (palate-ridges) (1878: Elloby); *Trouessart*, *Rev. & Mag. Zool.* (3) vi. p. 208, n. 336 (1879); *Dobson*, *P. Z. S.* 1878, p. 879 (1879: Ogowe); *J. A. Smith*, *Proc. R. Phys. Soc. Edinb.* v. p. 362, figs. (head and neck; palate-ridges) (1880: Old Calabar); *Thomas*, *Ann. & Mag. N. H.* (5) vi. p. 164 (1880: Old Calabar); *Dobson*, *Rep. Brit. Assoc.* 1880, p. 171 (Old Calabar); *id.*, *P. Z. S.* 1881, p. 690 (pharynx; larynx; hyoid bones); *Robin*, *Ann. Sci. Nat.* (6) *Zool.* xii. Art. 2, p. 4 & seq. pl. ii. fig. 2, pl. iv. figs. 25, 26 (1881: anatomy); *Dobson*, *Trans. Linn. Soc.* (2) *H. Zool.* ii. pt. 5, pp. 260, 261 (1882: digastric); *Jentink*, *Notes Leyd. Mus.* vii. p. 35 (1885: Semio, Niam-Niam); *id.*, *Cat. Ost. Mamm.* p. 252 (1887: same specimen); *id.*, *Cat. Syst. Mamm.* p. 734 (1888: same specimen); *Matschie*, *Arch. Naturg.* 1891, i. p. 353 (Kribi, Cameroon); *id.*, *Mitth. Geogr. Ges. Lübeck*, (2) *H. vii.-viii.* p. 132 (pt.) (1894: Cameroon; Gaboony; Bukoba); *id.*, *Säug. D. Ost-Afr.* p. 16 (1895: Bukoba); *Pousargues*, *Ann. Sci. Nat.* (7) *Zool.* iii. p. 254 (1896: San Benito); *Matschie*, *Deutschl. u. seine Kolonien*, *Zool.* p. 9 (1897: Kagera region); *Trouessart*, *Cat. Mamm.* i. p. 89, n. 479 (pt.) (1897); *Sjöstedt*, *Mitth. D. Schutzgeb.* x. p. 31 (1897: Itoki, Cameroon); *id.*, *Bih. K. Sv. Vet.-Ak. Handl.*

xxiii. Afd. iv. n. 1, p. 15 (1898: Itoki); *Cabrera, Mem. Soc. Esp. H. N.* i. Mem. i. p. 6 (1903); *Miller, Fam. & Gen. Bats*, p. 67 (1907); *K. Andersen, Ann. & Mag. N. H.* (8) v. p. 100 (1910: synonymous with *E. franqueti*).

*Epomophorus* (*Epomops*) *comptus* (pt.), *Matschie, Megachir.* p. 57 (1899: Aqua Town, Victoria, Mungo, Kribi, Yaunde, in Cameroon; Dongila, Gaboon; Malange, Loanda); *Trouessart, Cat. Mamm., Suppl.* p. 58, n. 524 (1904).

*Epomophorus gambianus* (*nec Ogilby*), *Peters, MB. Ak. Berlin*, 1876, p. 474 (Dongila, Gaboon).

*Characters.* See p. 496, and detailed measurements on pp. 509–513.

*Specimens examined.* Twenty-seven, in the collections of the Leyden (one), Berlin (fourteen), Paris (one), and British Museums. from:—Old Calabar (three, with skulls); Cameroons (Bitye; Victoria; Kribi; Yaunde; Aqua Town; Mungo; Bipindi; Klein Batanga: twelve, skulls of nine); Spanish Guinea (Benito R.: one, with skull); Gaboon (Dongila; Elloby; Como R.: four, with skulls, incl. type); Loanda (Malange: one, with skull); Niam-Niam (Semio: one, with skull); Tingasi (one, with skull); Semliki R. (one, with skull); Bukoba (one, with skull); uncertain localities (two).

*Range.* From Old Calabar (where it probably meets the smaller western race, *E. f. strepitans*), south to Loanda (Malange), east to Niam-Niam, Semliki River, and Bukoba.

*Type*, in the Paris Museum, a mounted adult male; fur somewhat faded, collected by Franquet in "Gaboon," register number A 107; skull separate, register number A 6767 (Mus. d'anat. comp.), figured by Tomes (*l. c.*), now less complete than represented in the figure, but all dimensions precisely agree; teeth worn, i<sup>2</sup> present on both sides, palate-ridges destroyed.

*Epomophorus comptus*, H. Allen; 1861.—Type locality, "W. Africa"; as having been collected by Du Chaillu the specimen is no doubt from Gaboon. Type in the collection of the Academy of Natural Sciences, Philadelphia, an unmounted skin, skull extracted, soft palate destroyed, i<sup>2</sup>–i<sup>3</sup> absent, forearms broken. Is the female of the present species (see Ann. & Mag. N. H. (8) v. p. 100).

a. ♀ ad. al.		Lidith de Jende Coll.	67.4.12.324.
b. Ad. al.	W. Africa.	A. Murray, Esq. [P.]	70.3.29.14.
c-e. ♂ ad., ♀ ad., ♂ juv. al.; skulls of c, d.	Old Calabar ( <i>Dr.</i> <i>Robb</i> ).	Dr. J. A. Smith [P.]	80.7.21.1, 3, 4.
f. ♂ ad. sk.; skull.	Bitye, R. Ja, Ca- meroons, 2000'; 20 June, 1909.	G. L. Bates [C.]	9.10.2.2.
g. ♀ juv. al.; skull.	Benito R., Spanish Guinea; Jan.-Feb. 1898.	G. L. Bates [C.]	98.5.4.15.
h. ♀ ad. al.; skull.	Elloby, Gaboon.	H. F. Ansell, Esq. [P.]	74.10.6.2.

- i. ♀ ad. sk.; skull. Como R., Gaboon; G. L. Bates [C.]. 97.7.1.3.  
6 March, 1897.  
j. ♂ ad. sk.; skull. Tingasi, Monbuttu; Dr. Emin Pasha 87.12.1.26.  
May, 1882. [C. & P.].  
k. ♂ ad. sk.; skull. 30 mi. N.W. of Ft. Ruwenzori Explo- 6.12.4.59.  
Beni, Semliki R., ration Com-  
3000'; 12 Aug. mittee [P.].  
1906 (R. E. Dent).

## 2. *Epomops buettikoferi*, Matschie.

*Epomophorus franqueti* (pt.), Dobson, Cat. Chir. B. M. p. 12.

*Epomophorus franqueti* (nec *Tomes*), *Dobson, Cat. Chir. B. M.* p. 12 (pt.), pl. ii. fig. 4 (palate-ridges) (1878: Sierra Leone); *id.*, *P. Z. S.* 1881, p. 686, figs. 1-5 (pharynx; larynx; hyoid bones); *id.*, *Proc. R. Soc.* 1881, p. 32 (digastric); *id.*, *Trans. Linn. Soc.* (2) *Zool.* ii. pt. 5, pp. 260, 261, pl. xxv. fig. 7 (1882: digastric); *Jentink, Notes Leyd. Mus.* x. p. 50 (1887: Robertsport; St. Paul's R.; Junk R.; Du Queah R.; palate-ridges; number of vertebrae); *id.*, *Cat. Ost. Mamm.* p. 252 (1887: St. Paul's R.); *id.*, *Cat. Syst. Mamm.* p. 137, specimens *f, g* (1888: St. Paul's R.; Schieffelinville); *Büttikofer, Reischeld. Liberia*, ii. p. 471 (1890); *Flower & Lydekker, Mamm.* p. 648, fig. 299 (pharyngeal sacs, copy from Dobson) (1891); *Trouessart, Cat. Mamm.* i. p. 89, n. 478 (pt.) (1897); *Miller, Proc. Wash. Ae. Sci.* ii. p. 646 (1900: Mt. Collee); *id.*, *Fam. & Gen. Bats*, p. 66, fig. 9 (skull of female) (1907: Cape Palmas, Liberia).

*Epomops franqueti*, *Rochebrune, Faun. Sénégal, Mamm.* p. 44 (1883: "Gambia").

*Epomophorus* (*Epomops*) *franqueti* (pt.), *Matschie, Megachir.* p. 56 (1899); *Trouessart, Cat. Mamm., Suppl.* p. 58, n. 523 (1904).

*Epomophorus gambianus* (nec *Ogilby*), *Jentink, Notes Leyd. Mus.* x. p. 50 (1887: Schieffelinville); *id.*, *Cat. Syst. Mamm.* p. 137, specimen *c* (1888: same specimen).

*Epomophorus buettikoferi*, *Matschie, Megachir.* p. 45 (1899: Schieffelinville); *Trouessart, Cat. Mamm., Suppl.* p. 55, n. 507 (1904).

*Epomops buettikoferi*, *K. Andersen, Ann. & Mag. N. H.* (8) v. pp. 102-104 (1910: palate-ridges; i<sup>2</sup>).

*Characters*.—Palate-ridges as described and figured p. 489, fig. 31 B. The ridges have been examined in three individuals, in all of which the third interdental ridge is broadly divided in the middle. Bony palate considerably more domed from side to side and antero-posteriorly than in *E. franqueti*; rostrum and palate relatively longer, zygomatic arches less flaring, zygomatic breadth of skull only about half its total length. Size larger than *E. franqueti*, a difference much more pronounced in the skulls of the two species than in the external dimensions, as shown in the table p. 495; in the size of the skull there seems to be an absolute difference between the two species, female skulls of *E. buettikoferi* being about equal in general size to male skulls of *E. franqueti*, but externally the difference is decidedly only one of average. Colour of fur scarcely differing from that of *E. franqueti*.

*Measurements*. On pp. 509-513.

*Specimens examined.* Eight, in the collections of the Leyden and British Museums, viz. six (incl. type) from Liberia, two from Sierra Leone.

*Range.* Known with certainty only from Sierra Leone and Liberia, but probably of wider distribution along the Guinea coast.

*Type*, in the Leyden Museum, an adult male, preserved in alcohol, collected by Stampfli at Schieffelsville, Junk River, Liberia (Cat. Syst. Mamm. p. 137, *Epomophorus gambianus*, specimen c); total length of skull 59.5 mm., forearm 100.5. The characters given above are entirely different from those on which the species was based by Matschie, who believed it to be a Liberian representative of *Epomophorus* "*macrocephalus*."

a. ♀ ad. al.; skull.	Sierra Leone.	Purchased (Stevens).	66.2.2.1.*
b. ♂ ad. al.; skull.	Sierra Leone.	R. Army Medical College [P].	9.1.4.4.†
c. ♂ ad. al.; skull.	Grand Bassa, Li- beria.	Dr. A. McCloy [P.].	8.7.27.1.

### 3. *Epomops dobsoni*, Bocage.

*Epomophorus dobsoni*, Bocage, *J. Sci. Math. Lisboa*, (2) i. p. 1, fig. 1 (palate-ridges), p. 14 (March, 1889: Quindumbo); Matschie, *Mitth. Geogr. Ges. Lübeck*, (2) H. vii.-viii. p. 133 (1894); Trouessart, *Cat. Mamm.* i. p. 88, n. 474 (1897); Bocage, *J. Sci. Math. Lisboa*, (2) v. p. 136, fig. 2 (palate-ridges) (1898: Quindumbo; Galanga; Hanha); Seabra, *t. c.* p. 165 (1898); Thomas & Wroughton, *Ann. & Mag. N. H.* (7) xvi. p. 170 (1905: Kalonga, Bihe, 6200'); Miller, *Fam. & Gen. Bats*, p. 67 (1907). *Epomophorus* (*Epomops*) *dobsoni*, Matschie, *Megachir.* p. 57 (1899); Trouessart, *Cat. Mamm., Suppl.* p. 58, n. 525 (1904).

*Epomophorus zenkeri* (*nec Matschie*), Dollman, *Ann. & Mag. N. H.* (8) iii. p. 349 (male, no. 1) (1909: Kambove, Katanga).

*Characters.*—Palate-ridges as described and figured p. 489, fig. 31 C. Cranial characters essentially as in *E. buettikoferi*; rostrum and palate very long, skull even narrower across zygomatic than in *E. buettikoferi*, its zygomatic breadth (in single adult male skull available) not quite equal to half its total length, mandible still weaker, its condyles rather lower down as compared with alveolar line. Teeth relatively smaller, lower canines slanted more conspicuously outward. General size of animal (forearm of male about 88 mm.) smaller than *E. buettikoferi*, scarcely exceeding *E. f. strepitans*, but skull nearly equal in length to that of *E. buettikoferi*.

*Colour.*—♂ ad. skin, teeth almost unworn, specimen a, *infra* (fur probably considerably bleached during life of specimen): Upperside approximately wood-brown, palest on nape of neck; breast and flanks brownish fawn; colour of centre of breast and belly conspicuously paler but not forming a well-defined abdominal patch; epaulettes and tufts at bases of ears whitish. Two immature

\* Palate-ridges figured by Dobson (*l. c.*; figure in certain respects inaccurate).

† Specimen on which Dobson based his anatomical notes on "*Epomophorus franqueti*" (*ll. cc.*).



individuals (specimens *b* and *c*, *infra*) are similar to pale-coloured specimens of *E. franqueti*.

*Measurements.* On pp. 509, 511, 513.

*Specimens examined.* Those catalogued below.

*Range.* Benguela, east to Katanga.

*Type*, an adult male from Quindumbo, Benguela, in the Lisbon Museum. Palate-ridges figured by Bocage, *l. c.*

*Remarks.*—This species is probably a southern representative of *E. buettikoferi*, with peculiarly modified palate-ridges and somewhat weaker dentition. In the cranial characters, at any rate, it more closely approaches *E. buettikoferi* than it does *E. franqueti*.

a. ♂ ad. sk.; skull.	Kalunga, Bihé R., Benguela, 6200'; 30 Sept. 1904.	Dr. W. J. Ansorge [C.].	5.5.9.3.
b. Juv. sk.; skull.	Nr. Bailundo, Benguela, 1366 m.; 30 Dec. 1907.	Dr. F. C. Wellman [C. & P.].	8.2.12.2.
c. ♂ imm. sk.; skull.	Kambove, Katanga, 4400'; 6 Feb. 1907.	S. A. Neave, Esq. [C.].	7.12.13.1.

## 11. HYPSIGNATHUS, *H. Allen*.

*Epomophorus* (pt.), Dobson, Cat. Chir. B. M. p. 4.

Type.

1861. *Hypsignathus*, *H. Allen*, *Proc. Ac. Nat. Sci. Philad.* 1861 (July), p. 156 ..... H. monstrosus.  
 1862. *Zyganocephalus*, *A. Murray*, *P. Z. S.* 1862, pl. i. \* (June, 1862) ..... II. monstrosus.  
 1862. *Sphyrocephalus*, *A. Murray*, *P. Z. S.* 1862, p. 8 (June, 1862) ..... II. monstrosus.

*Hypsignathus*, *Peters*, *MB. Ak. Berlin*, 1865, p. 256; *Gray*, *P. Z. S.* 1866, p. 65; *Peters*, *MB. Ak. Berlin*, 1867, p. 870; *Gray*, *Cat. Monk. &c.* p. 124 (1870); *Dobson*, *Cat. Chir. B. M.* p. 6 (1878: subgenus of *Epomophorus*); *Matschie*, *Megachir.* p. 42 (1899: subgenus of *Epomophorus*); *Miller*, *Fam. & Gen. Bats*, p. 67 (1907: generic characters).

*Sphyrocephalus*, *Gray*, *P. Z. S.* 1864, p. 55.

*Differential characters.*—Allied to *Epomops*, but cranial rostrum greatly enlarged, particularly in depth (dorsal and ventral profiles subparallel in adult males), extremity of rostrum, premaxillæ, and mandibular symphysis much broader, postdental palate narrower; lower incisors not (or indistinctly) bilobed and closing in front of upper incisors, lower canines slanted considerably outward and closing some distance in front of upper canines, p<sub>1</sub> rudimentary, outer ridge of lower molars bilobed or trilobed; 15 thoracic, 3 lumbar, no postsacral vertebræ; upper lip with conspicuous integumentary folds, ears pointed. Males larger than females,

\* Murray probably originally intended to name this genus *Zyganocephalus* in allusion to the Hammer-headed Sharks (*Zygæna*), and had that name printed on the plate, but for some reason or other changed it in the text to *Sphyrocephalus*.

with two pairs of pharyngeal air-sacs and a paired maxillary air-sac; no shoulder-tufts in either sex. Size large: forearm 118-137 mm. (One species. Range, the western Ethiopian forest region.)

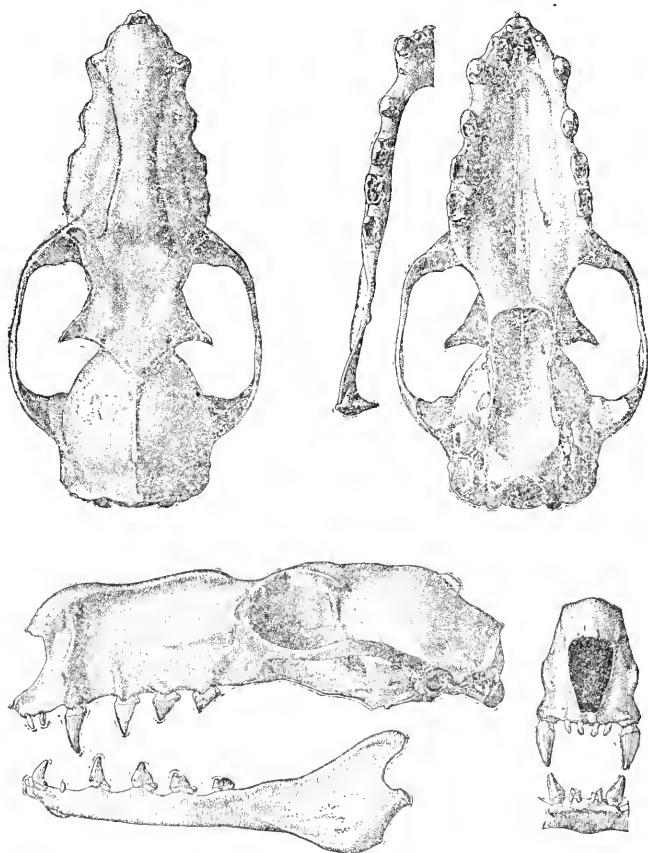


Fig. 33.—*Hypsignathus monstrosus*, ♂. Benito River, Spanish Guinea.  
No. 98.10.7.2. ♀.

Skull (fig. 33).—Rostrum of adult males highly peculiar (*"Sphyrocephalus,"* Hammer-headed Bat), long and excessively deep (*"Hypsignathus,"* with deep jaws), broad across alveolar margins, strongly compressed laterally (a large air-sac present on either side of rostrum), dorsal and ventral profiles subparallel; length from front

of orbit to gnathion subequal to (in *Epomops* only two-thirds of) distance from former point to lambdoid crest; height above canine subequal to height above  $m^1$ ; dorsal surface of rostrum broad and convex, marked off from lateral surfaces by a prominent longitudinal ridge; a strong vertical crest from nasals to alveole of canine (supporting cutaneous fold of upper lip). Rostrum of adult female similarly, but much less excessively, modified; length from front of orbit to gnathion about four-fifths of distance from former point to lambdoid crest; dorsal profile distinctly descending anteriorly, height above canine less than above  $m^1$ ; horizontal ridge of rostrum undeveloped, vertical crest barely indicated (cutaneous folds of upper lip much smaller in females). Nasals longer than in *Epomops*, in adult males very strongly, in females only slightly, bent downward anteriorly; tip of nasals in front of canines. Premaxillæ much broader than in *Epomops*, in adult individuals ankylosed with each other anteriorly and with maxillaries laterally and ventrally, half as broad at upper extremity as along alveolar margin. Interdental palate fully as broad as in *Epomops*, postdental palate considerably narrower, particularly behind zygomatic processes of maxillary bones; breadth of mesopterygoid fossa much less than (in *Epomops* subequal to or even rather more than) palatal breadth between  $p^3$ - $p^3$ . Sagittal crest well developed in fronto-parietal region, undeveloped or very low along interparietal. Symphysis menti unusually broad, long, and much sloping. Other cranial characters essentially as in *Epomops*.

Dentition (fig. 33).— $\frac{i^1 i^2 c \quad p^3 p^4 m^1}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2} = 28$ .  $p_1$  rudimentary, dentition on the whole weak.

Incisors more broadly spaced than in *Epomops*; lower incisors closing in front of (nearly completely covering) upper, crowns not or only obscurely bilobed. Lower canines shorter, scarcely higher than  $p_3$ , directed obliquely backward and outward, and closing some distance (in adult males about 2 mm.) in front of upper\*. Diastema  $c$ - $p_3$  unusually wide, all cheek-teeth spaced.  $p_1$  quite rudimentary, styliform, scarcely piercing gum, rather smaller in cross-section even than a lower incisor. Outer and inner ridge of  $p^3$  and  $p_3$  more completely fused than in *Epomops*; outer and inner ridge of  $p^4$ ,  $m^1$ ,  $p_4$ ,  $m_1$ , and  $m_2$  higher and their cusps more narrowly pointed; outer ridge of  $p_1$  more or less obscurely, that of  $m_1$  always distinctly trilobed or bilobed, that of  $m_2$  always bilobed.

Palate-ridges (fig. 34 C).—Very similar to those of *Epomops* (figs. 34 A, B), but first ridge moved backward to front of  $p^3$  (in *Epomops* situated at back of canines); second and third ridges more posterior in position than in *E. franqueti* (fig. 34 A), but *E. dobsoni* (fig. 34 B) exhibits a transitional stage toward *Hypsignathus*. Three interdental ridges thick, prominent, straight,

\* Also in the milk dentition of *Hypsignathus* the incisors are widely spaced, the lower incisors "bite" in front of the upper, and the lower canines a good distance (1.5 mm.) in front of the upper; see ♀ pull., n. 61.1.25.1 (forearm 76 mm., as against 118-127 in adult females; all milk teeth present  $p_3$  on the point of piercing the jaw, no other permanent teeth out).

undivided, like corresponding ridges of *Epomops*; all postdental ridges thin, serrate, often conspicuously asymmetric (see figure), either all undivided or a few of them slightly divided at middle.

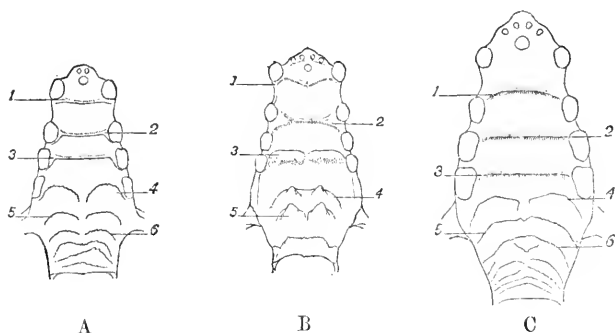


Fig. 34.—Palate-ridges. A, *Epomops franqueti* (80.7.21.1); B, *Epomops dobsoni* (5.5.9.3); C, *Hypsignathus monstrosus* (62.1.23.1). †. See text.

*External characters.*—Head large, anterior extremity of muzzle thick and truncate (hammer-shaped) in males, considerably lower in females; dorsal surface of muzzle in males enormously, in females much less, elevated above the nasal apertures; on either

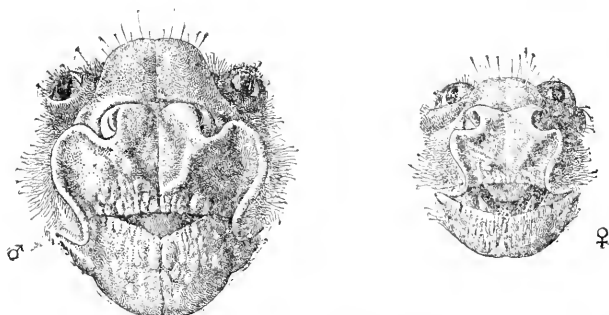


Fig. 35.—Extremity of muzzle of *Hypsignathus monstrosus*, male (62.1.23.1) and female (4.8.28.1), to show sexual difference. †. See text.

side of extremity of muzzle a prominent vertical cutaneous fold, continuous above with inferior margin of nostril and below with horizontal margin of upper lip, this fold large and leaf-like in adult males (fig. 35 ♂), much less developed in females (fig. 35 ♀); front face of upper lip, between cutaneous folds, and corresponding face of lower lip greatly expanded both transversely and vertically, and densely papillate. Ears more abruptly attenuated above than in

*Epomops*, tip more narrowly pointed; small whitish tufts at base of eonch anteriorly and posteriorly (as in all *Epomophorine* bats). No external tail (and no tail vertebrae). Interfemoral and calcar as in *Epomops*.

Membranes inserted posteriorly on middle or proximal half of second (in *Epomops* on first) phalanx of second toe. Vertical fasciae of mesopatagium fewer (26-34) and less crowded. Pollex and terminal phalanx of fourth and fifth digits distinctly shorter than in *Epomops*. Subjoined the wing-indices of *Hypsignathus* (upper row), calculated from measurements of seven adult individuals, and, for comparison, those of *Epomops* (lower row).

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	335	536	99	117	711	475	620	698	334	350	688	328	307
1000	434	538	107	128	728	466	630	699	346	388	715	351	262

*Sexual differentiation.*—(1) Hammer-shaped form of muzzle and cranial rostrum much more pronounced, cutaneous leaves at extremity of muzzle and corresponding vertical ridge of cranial rostrum much larger, and occipito-pollicalis muscle (one of the supporters of the head, visible externally as a strong subcutaneous band from point of origin of antebrachial membrane, along either side of neck, to sides of occiput) much stronger in males than in females. (2) Males with two pairs of pharyngeal sacs, homologous with those of *Epomops*, and with a paired sac communicating with mouth beneath upper lip and extending from extremity of muzzle on either side of rostrum to halfway between eyes and ears; larynx much larger in males. (3) General size of males considerably larger.—No shoulder pouches or epaulette-like hair-tufts in either sex.

*Habits.*—Hammer-headed Bats are particularly abundant in the mangroves and palms along the banks of the rivers, more rarely seen in the forest (except at swampy places), but not infrequently visiting the clearings of the human settlements at night in search of ripe bananas, mango plums, and soursops (*Anona muricata*). The voice is a loud croaking, recalling that of the Ethiopian Giant Frog, *Rana occipitalis* (Büttikofer, Reisebild. Liberia, ii. p. 362, 1890; Bates, P. Z. S. 1905, i. p. 72).

*Affinities.*—*Hypsignathus* has probably originated from a bat which in all important characters was similar to *Epomops* (but with the postdental palate not broadened quite to the same extent as in *Epomops*). The only very essential cranial peculiarity of *Hypsignathus* is the great enlargement of the rostrum, but this modification is much more pronounced in males than in females, and is in reality scarcely more than an excessive development of a tendency already present in *Epomops*. The two genera, *Epomops* and *Hypsignathus*, exhibit the following four principal stages of enlargement of the rostrum: females of *Epomops*, males of *Epomops*,

females of *Hypsignathus*, males of *Hypsignathus*. The development of a large air-sac on either side of the rostrum may be peculiar to *Hypsignathus*, but judging from the shape of the lateral surfaces of the rostrum in male skulls of *Epomops buettikoferi* and *dobsoni*, it appears probable that similar, though undoubtedly much smaller, air-sacs are present also in those species. The mandibular symphysis of *Epomops dobsoni* is (at least in males) broader than in the other species of the same genus, and the lower canines slant distinctly outward: these characters are excessively developed in *Hypsignathus*; one of the male skulls examined of *Epomops buettikoferi* (B.M. 8.7.27.1) is conspicuously asymmetric, the lower canine of the left side closing along the front face of the upper canine, as always in normal skulls of *Epomops*, that of the right side some distance in front of the upper canine, as in *Hypsignathus*. The splitting of the longitudinal ridges of certain cheek-teeth into more or less distinct cusps is a character developed independently in totally different sections of Megachiroptera, e. g., *Pteralopex*, *Dobsonia*, *Hypsignathus*, *Nyctimene* (compare also footnote p. 516 on certain dental anomalies in *Epomophorus*). The vertebral column of *Hypsignathus* exhibits a slight increase in the number of thoracic (15, as against 13 in *Epomops*) and decrease of the lumbar vertebræ (3, as against 4), and the postsacral vertebræ (two in *Epomops*) have entirely disappeared. Externally (apart from the modifications of the head) *Hypsignathus* differs chiefly in the absence of shoulder-pouches and tufts.—The affinities of this genus to *Epomophorus* are much more remote.

### 1. *Hypsignathus monstrosus*, H. Allen.

*Epomophorus monstrosus*, Dobson, Cat. Chir. B. M. p. 6.

*Hypsignathus monstrosus*, H. Allen, *Proc. Ac. Nat. Sci. Philad.* 1861 (July), p. 157 ("W. Africa," i. e. Gaboon); Gray, *P. Z. S.* 1866, p. 65; Peters, *MB. Ak. Berlin*, 1867, p. 870 (Calabar; Gaboon); Gray, *Cat. Monck. Sc.* p. 124 (1870: Old Calabar; Gaboon); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 208, n. 232 (1879); Robin, *Ann. Sci. Nat.* (6) Zool. xii. Art. 2, p. 4 & seq., pl. iii. fig. 7 (1881: anatomy); Rochebrune, *Faune Sénégal. Mamm.* p. 43 (1883: Gambia); Trouessart, *Cat. Mamm.* i. p. 89, n. 482 (1897); Cabrera, *Mem. Soc. Esp. H. N.* i. Mem. i. pp. 6, 11, 21 (1903: Cape S. John, Spanish Guinea); Bates, *P. Z. S.* 1905, i. p. 72 (Benito R.; Bulu country; habits); Miller, *Fam. & Gen. Bats*, p. 67 (1907).

*Pteropus monstrosus*, Schlegel, *Dierent., Zoogd.* p. 66 (1872).

*Epomophorus monstrosus*, Dobson, *Cat. Chir. B. M.* p. 6, pl. i. (whole fig. of ♂, muzzle of ♂ and ♀; two of these figures slightly altered copies from *P. Z. S.* 1862, pl. i.), pl. ii. fig. 1 (palate-ridges) (1878: Gambia; Old Calabar; Gaboon); *id.*, *P. Z. S.* 1878, p. 879 (1879: Ogowe); *id.*, *Rep. Brit. Assoc.* 1880, p. 170; *id.*, *P. Z. S.* 1881, p. 680 (pharyngeal sacs); Jentink, *Notes Leyd. Mus.* x. p. 49 (1887: Junk R.; Du Queah R.; habits; number of vertebræ); *id.*, *Cat. Syst. Mamm.* p. 136 (1888: Liberia; Gold Coast); Büttikofer, *Reisebild. Liberia*, i. pp. 261, 320, 343, ii. p. 362, fig. (animal, copy from *P. Z. S.* 1862, pl. i.), p. 471 (1890: habits); Matschie, *Müth. D. Schutzgeb.*

vi. II. 3, p. 6 (1893: Liberia; Cameroon); *Lydekker, R. Nat. Hist.* i. p. 258 (1893 94); *Matschie, Mitth. Geogr. Ges. Lübeck*, (2) II. vii.-viii. p. 133 (1894: Togo; Cameroon; Gaboon); *Bocage, J. Sci. Math. Lisboa*, (2) iv. p. 4 (1895: Mongola, Fernando Po); *Sjöstedt, K. Sv. Vet.-Ak. Handl.* xxvii. n. 1, pp. 13, 18, 119 (1895: Cameroon); *id.*, *Mitth. D. Schutzgeb.* x. p. 31 (1897: Borge; Bibundi; N'dian; Itoki); *id.*, *Bih. K. Sv. Vet.-Ak. Handl.* xxiii. Afd. iv. n. 1, p. 11 (1898: habits); *Bocage, J. Sci. Math. Lisboa*, (2) v. p. 135 (1898: Fernando Po); *Seabra, t. c.* p. 165 (1898: Fernando Po); *Bocage, op. cit.* (2) vii. p. 27 (1903: Fernando Po).

*Epomophorus* (*Hypsignathus*) *monstrosus*, *Thomas, P. Z. S.* 1888, pp. 7, 16 (Tingasi); *Ponsargues, Ann. Sci. Nat.* (7) Zool. iii. p. 250 (1896: Orowe; Bangui); *Trouessart, Cat. Mamm., Suppl.* p. 55, n. 505 (1904).

*Zygaenocephalus labrosus*, *A. Murray, P. Z. S.* 1862, pl. i. (whole fig. of ♂; front view of muzzle of ♂) (June, 1862: Old Calabar).

*Sphyrocephalus labrosus*, *A. Murray, P. Z. S.* 1862, p. 8 (June, 1862: Old Calabar); *Gray, P. Z. S.* 1864, p. 55 (specimen 64.1.25.1: "W. Africa").

*Epomophorus macrocephalus* (*nec Ogilby*), *Peters, MB. Ak. Berlin*, 1876, p. 474 (Dongila, Gaboon).

*Epomophorus franqueti* (*nec Tomes*), *Sjöstedt, K. Sv. Vet.-Ak. Handl.* xxvii. n. 1, pp. 15, 119 (1895: Cameroon).

*Hypsignathus haldemani* (*nec Epomophorus haldemani*, *Hallonell*, vide *Rehn, Am. Nat.* xxxvi. p. 202, 1902), *Matschie, SB. Ges. nat. Fr.* 1899, p. 29, fig. (larynx, hyoid bones, pharyngeal sacs).

*Epomophorus* (*Hypsignathus*) *haldemani*, *Matschie, Megachir.* p. 42, pl. x. figs. 1 a-d (skulls) (1899: Togo; Cameroon; Gaboon).

*Fur*.—Short, dense, silky, closely adpressed on breast and belly; approximate length, back 9–10, belly 6–7 mm. Throat so thinly haired as to appear seminaked; dorsal surface of muzzle and sides of same immediately behind the cutaneous folds covered with very short and tightly adpressed velvety hair, forming a sharply defined area contrasting with ordinary fur of head. Distribution of fur on forearm and tibia as in *Epomops*.

*Colour*.—General aspect rather similar to that of *Epomops*, but often (particularly in males) of a darker, more plumbeous or slate-brown tinge, with the nape of the neck and foreneck paler, forming a more or less well-defined collar, and with the abdominal patch much less distinct or entirely absent.

♂ ad. skin, teeth almost unworn, Benito R., 14 April: Back dark plumbeous brown distinctly tinged with a very dark shade of fawn and passing posteriorly, on rump, femur, and tibia, gradually into a purer brown; nape of neck light isabella, approaching dull wood-brown, much paler than and somewhat contrasting with back; crown distinctly darker; hair-tufts at base of ears whitish; breast, sides of belly, and flanks very nearly similar to back; centre of belly conspicuously washed with light greyish drab, but not marked off as a sharply defined abdominal patch; foreneck greyish white, forming a transverse band contrasting with dark breast.

An adult male from Fernan Vaz, Gaboon (skin, teeth almost unworn, 29 Jan.) is similar in colour, but with a conspicuous admixture of greyish hairs on breast, belly, and flanks, and with

the dark back "frosted" with the same tinge, owing to the presence of short greyish tips to the hairs; abdominal patch scarcely indicated.

In the whole series examined the general colour of the back varies from the darkest extremes described above, through various brighter tinges, to warm brownish fawn (the latter practically identical with the average colour of *Epomops*); pale collar generally distinct, sometimes obsolescent; abdominal patch sometimes conspicuous, though never as strongly pronounced as in *Epomops*, often ill-defined or indicated by a slightly paler tinge of the centre of the belly, sometimes quite obsolete. The darker (plumbeous) tinges appear to be predominant in adult males, the purer brownish or brownish fawn in females.

*Measurements.* On pp. 509-513.

*Specimens examined.* Those catalogued below.

*Range.* From Gambia, along the Guinea coast (including the island of Fernando Po), east at least as far as Monbuttu (Tingasi), south at least to the coast regions of French Congo (Ogowe; Fernan Vaz).

*Type*, in the collection of the Academy of Natural Sciences, Philadelphia, skin and skull of an adult male, Gaboon (DuChaillu), Reg. no. 969. Skull, total length 72, mandible (from condyle) 59, c-m<sup>1</sup> (crowns) 24.2, forearm 128 mm. (James A. G. Rehn, *in litt.*)

a. ♀ pull. al.	West Africa.	Purchased (Dalton).	64.1.25.1.
b. ♀ imm. sk.; skull.	Gambia.	Purchased (Ger-rard).	76.7.21.1.
c, d. ♀ yg. ad., ♀ imm. al.; skull of c.	Benin.	H. H. Squire, Esq. [P.].	4.8.28.1, 2.
e. ♂ ad. sk.; skull.	Kwa R., S. Nigeria, 200'; 17 Aug. 1909.	P. A. Talbot, Esq. [C.].	Orig. no. 8.
f. ♂ juv. sk.; skull.	Oban, S. Nigeria, 500'; 3 Oct. 1909.	P. A. Talbot, Esq. [C.].	Orig. no. 18.
g. ♂ ad. al.; skull.	Old Calabar ( <i>Rev. Wm. C. Thomson</i> ).	A. Murray, Esq. [P.].	62.1.23.1.
<i>(Type of Zygocephalus (and Sphyrocephalus) labrosus, Murray.)</i>			
h. ♂ imm. al.	Near Cameroons.	Purchased (Cutter).	71.7.10.1.
i-k. 2 ♂ ad., ♀ imm. sks.; skulls.	Benito R., Spanish Guinea; 14 Apr. 1898, 13, 20 Mar. 1899.	G. L. Bates [C.].	98.10.7.2. 99.7.22.1, 2.
l. ♂ ad. al.	Benito R.	G. L. Bates [C.].	99.7.22.6.
m. ♀ imm. al.; skull.	Elloby district, Gaboon.	H. F. Ansell, Esq. [P.].	74.10.6.4.
n. ♂ ad. sk.; skull.	Nehali (Lake Asebbe), Fernan Vaz, Gaboon; 29 Jan. 1908.	Dr. W. J. Ansorge [C.].	8.6.14.6.
o, p. ♂ ad., ♀ imm. sks.; skull of o.	Lobi, nr. Angu, about 3° 30' N., 24° 30' E.; 19 Feb. 1906.	Alexander - Gosling Expedition [P.].	7.7.8.21, 22.
q. ♀ imm. sk.; skull.	R. Welle, above Bam-bili, about 3° 40' N., 26° E.; 22 Apr. 1906.	Alexander - Gosling Expedition [P.].	7.7.8.23.
r, s. ♀ ad., ♀ imm. sks.; skulls.	Tingasi, Monbuttu; 29 Oct. 1883.	Dr. Emin Pasha [C. & P.].	87.12.1.24, 25.



*Epomops and Hypsignathus: External measurements of males.*

	<i>E. f. strepitans.</i> 5 ♂ ad., incl. type. Gold Coast; Lagos; Abonnema; Asaba.		<i>E. f. franqueti.</i> 9 ♂ ad.; incl. type. Old Calabar; Cameroons; Gaboon; Angola; Tingasi; Semliki.		<i>E. buettikoferi.</i> 4 ♂ ad., incl. type. Sierra Leone; Liberia.		<i>E. dobsoni.</i> ♂ ad. Kalonga, Benguela.	<i>H. monstrosus.</i> 6 ♂ ad. S. Nigeria; Old Calabar; Benito R.; Angola; Welle R.	
	Min.	Max.	Min.	Max.	Min.	Max.	mm.	Min.	Max.
Forearm .....	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Pollex, total length, c. u. ....	88	89.5	90.5	96	92.5	100.5	137	128	157
" metacarpal .....	34	37	41	44	39	43.5	40	51	55
" 1st phalanx .....	12.5	14	14	15.5	12.5	16.5	13.5	19.5	21
2nd digit, metacarpal .....	17	17.5	19	21	19.5	22	20	23	26.5
" 1st phalanx .....	47	49	50.5	52	50	55	42	67.5	75.5
" 2nd phalanx .....	8	8.5	9.5	10	10	10.5	11	13	14.5
" 2nd-3rd phalanx, c. u. ....	10.5	11	11	13	11.5	12.5	12.5	15	16.5
3rd digit, metacarpal .....	62.5	65.5	67	70	68.5	75	61	94	101
" 1st phalanx .....	37.5	42	42.5	45	43	47.5	40.5	62	66.5
" 2nd phalanx .....	52	57.5	57	60	56.5	63	55.5	81	85
4th digit, metacarpal .....	59.5	62.5	64	67.5	64.5	72	54.5	92	98.5
" 1st phalanx .....	29	31	32.5	33	30.5	34	32	43.5	46
" 2nd phalanx .....	32	33	36.5	38	35	39.5	37	45.5	47.5
5th digit, metacarpal .....	61	63.5	65	69.5	64.5	72.5	59	92	95
" 1st phalanx .....	29.5	31.5	32.5	34	31	34.5	31	41	46
" 2nd phalanx .....	29.5	31.5	34	36.5	32	34.5	33.5	40.5	42.5
Ear, length from orifice .....	22	24	23	25	24.5	27	...	30.5	31
" greatest breadth, flattened ..	18	18	19	19	17.5	18	...	21	21
Tail .....	0	0	0	0	0	1	...	0	0
Interfemoral in centre, depth ..	7.5	7.5	10	10	8	9.5	...	12.5	12.5
Tibia .....	31.5	35	33.5	37.5	38	43.5	30	55	59.5
Foot, c. u. ....	22	24.5	24.5	25.5	23	26	24.5	35	38
Calcaneal .....	...	...	...	8.5	8	9	...	13.5	13.5

\* Forearm of type of *E. dobsoni* (♂ ad.) according to Bocage 88 mm.

## Plerotes, Epomops, and Hypsignathus: External measurements of females.

	<i>P. anchietae</i> . ♀ ad. Type.	<i>E. f. strepitans</i> . 2 ♀ ad. Togo; Abouneima.		<i>E. f. franqueti</i> . 9 ♀ ad. Old Calabar; Cameroons; Gaboon; Bukoba.		<i>E. buettikoferi</i> . 2 ♀ ad. Sierra Leone; Liberia.		<i>H. monstrosus</i> . 2 ♀ ad. Benin; Tingasi.	
		Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Forearm .....	53	84.5	85	82	93	88	92.5	118	127
Pollex, total length, c. u. ....	22	35	...	36	39	39.5	39.5	50	51
" " metacarpal .....	...	12.5	...	13	13.5	13	13.5	18	18.5
" " 1st phalanx .....	23.5	17.5	...	17.5	19.5	19.5	20	24	25.5
2nd digit, metacarpal .....	23.5	43	...	43.5	46	47.5	48.5	66	66.5
" " 1st phalanx .....	6.5	8	...	9	10	9.5	11	12	12
" " 2nd-3rd phalanx, c. u. ....	6	10.5	...	9.5	12	12	12	13.5	16
3rd digit, metacarpal .....	36	60	60.5	60	66	66.5	68	85.5	88.5
" " 1st phalanx .....	27.5	38	...	39	41	42	42.5	58	60
" " 2nd phalanx .....	35	50.5	...	52.5	59	57	57.5	77	80
4th digit, metacarpal .....	27	58	...	57.5	60.5	64.5	65	84	87.5
" " 1st phalanx .....	22	28	...	28	30.5	31.5	32	40.5	43
" " 2nd phalanx .....	20.5	33	...	32	34.5	34	36	...	45
5th digit, metacarpal .....	36.5	60	...	58	62	65	66	82.5	87.5
" " 1st phalanx .....	19.5	...	...	29.5	32	31	31.5	40.5	42.5
" " 2nd phalanx .....	16.5	...	...	29.5	33	31	32.5	37	39.5
Ear, length from orifice .....	...	21.5	...	23.5	25.5	22.5	25.5	...	32.5
" " greatest breadth, flattened	...	...	...	16	17	17	18	...	22
Tail .....	...	...	...	0	0	0	...	...	0
Interfemoral in centre, depth .....	...	...	...	8	...	9.5	...	...	14.5
Tibia .....	...	...	...	32	34.5	37	37.5	...	54
Foot, c. u. ....	...	23	...	22	24.5	24.5	...	33.5	35.5
Calcaneal .....	...	...	...	...	...	7	...	...	11.5

## Epomops and Hypsignathus: Measurements of male skulls.

	<i>E. f. strepitans</i> , 5 ♂ ad., incl. type. Gold Coast; Lagos; S. Nigeria.		<i>E. f. franqueti</i> , 9 ♂ ad., incl. type. Old Calabar; Cameroons; (Taboom); Angola; (Tingasi); Senliski.		<i>P. bottikoferi</i> , 4 ♂ ad., incl. type. Sierra Leone; Liberia.		<i>E. dabsoni</i> , ♂ ad. Kalonga, Benguela.		<i>H. monstrosus</i> , 6 ♂ ad. S. Nigeria: Old Calabar; Benito R.; Angola; Welle R.	
	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.
Skull, total length to gnathion .....	46.8	48	49	53	54.5*	59.5	53.8	73	69.5	73
" palation to incisive foramina .....	22	23.5	25	26.7	27*	30	26.2*	37.5	26.3	37.5
" palation to basion .....	18	18.2	18	19.8	20.5	...	20	26.2	22.5	26.2
" postdentale palate .....	9.2	10.7	10.5	11.7	11.7	14.2	14.5	15.8	14.8	15.8
" front of orbit to tip of nasals .....	16	17.2	17.2	19.5	20	22	22	35.7	33	35.7
" height of rostrum at m <sup>1</sup> .....	10.5	11	11	12.7	12	13	11.2	20	19.5	20
" height of rostrum at canine .....	6.8	7.8	7.8	8.8	7.2	8	8.7	20	18	20
" width of brain-case at zygomatica .....	17	18.8	18.8	20	18.8	19	19.2	23.7	22.5	23.7
" zygomatic width .....	26.8	28	28	30	...	29	26.2	37.2	35.5	37.2
" across crowns of m <sup>1</sup> , externally .....	14	15	15	16	17	17.2	15.7	22.8	21.8	22.8
" lachrymal width .....	13	13.7	13	14.2	13.2	15	13.3	22	20.7	22
" across crowns of canines, externally .....	9.2	10	10	10.7	10.5	10.7	11	16	15	16
" postorbital width .....	9	9.8	8.2	9	9.8	...	10.5	12.5	11.7	12.5
" interorbital width .....	7.8	8.5	7.7	8.2	8	9	7.2	14	13.2	14
" width of mesopterygoid fossa .....	7.2	8	8.5	9.5	7.8	8.5	7.8	9.8	8.5	9.8
" between p <sup>4</sup> -p <sup>1</sup> , internally .....	8.3	9.7	9	9.7	10.8	11	10.7	15.2	13.5	15.2
" between cingula of canines .....	5.2	6	5.5	5.8	5.8	6	6.5	10.2	9.5	10.2
" orbital diameter .....	10.3	11.2	11	11.8	11.8	12	11	15	14.8	15
" Mandible, length from condyle .....	36	39	40	43	43	49.2	43	62	57.2	62
" " depth at diastema p <sup>4</sup> -m <sup>1</sup> .....	3.5	4	3.7	4	3.8	4	...	4.7	4	4.7
" " coronoid height .....	13.5	16	16	17.2	16.5	18.8	14.5	21	19	21
" Upper teeth, c-m <sup>1</sup> , crowns .....	14.5	16.2	16.5	18	18.8	20	16.5	24.2	23	24.2
" Lower teeth, o-m <sup>2</sup> , crowns .....	16.2	18.2	18.5	20	21	21.5	18.5	32	28.8	32

\* Estimate.

## Plerotes, Epomops, and Hypsignathus: Measurements of female skulls.

	<i>P. anchietae</i> , ♀ ad. Type.	<i>E. f. strepitans</i> , 2 ♀ ad. Toga; Abonnema.		<i>E. f. franqueti</i> , 8 ♀ ad. Old Calabar; Cameroons; Gaboon; Bukoba.		<i>E. buettikoferi</i> , 2 ♀ ad. Sierra Leone; Liberia.		<i>H. monstrosus</i> , 2 ♀ ad. Benin; Tingsasi.	
		MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.
Skull, total length to gnathion .....	mm.	41.8	43.5	43	47	49.5	51.5	...	65
" palation to incisive foramina .....	14.5	20.5	...	20.5	21.8	25	...	20.2	32
" palation to basion .....	10	...	...	16.8	...	17.8	...	21.2	22.5
" postdental palate .....	7.4	8.7	...	8.3	8.7	10.8	...	12	13.8
" front of orbit to tip of nasals .....	9.7	14.5	15.7	14.5	16.5	17.8	...	23.2	28
" height of rostrum at m <sup>1</sup> .....	6.6	9.5	...	9	10	12	...	16.8	17
" height of rostrum at canine .....	4.8	6.2	...	6	6.8	7.2	...	13	13.2
" width of brain-case at zygomatic .....	12.6	...	...	17	18	18	...	22	22
" zygomatic width .....	...	...	...	25.2	26.5	26	...	34.8	...
" across crowns of m <sup>1</sup> , externally .....	9.2	13.5	...	13.2	13.5	15	16	19	...
" lachrymal width .....	7.8	12.8	...	12	13	13	...	18.7	19.8
" across crowns of canines, externally .....	6.8	...	...	8.8	9	9.5	...	12.2	13.7
" postorbital width .....	8.5	9	...	8.8	10.5	9.8	...	11	...
" interorbital width .....	5.2	7	...	6.8	7.8	8	...	12	12.5
" width of mesopterygoid fossa .....	?	...	...	7	7.8	7.5	...	7.7	8
" between p <sup>1</sup> -p <sup>1</sup> , internally .....	6.8	8	...	7.5	8.7	9	...	11.5	12
" between cingula of canines .....	4.5	4.5	...	4.7	4.8	4.8	...	7	8.7
" orbital diameter .....	7.5	10.2	...	10.3	10.8	11	...	13.8	14
Mandible, length from condyle .....	22.2	...	...	33.8	38	39.5	41*	48.8	53
" depth at diastema P <sub>4</sub> -m <sub>1</sub> .....	...	3	...	2.8	3.2	3.2	...	3.8	4
" coronoid height .....	...	...	...	12.7	14.5	16.5	...	16.8	18.2
Upper teeth, c-m <sup>1</sup> , crowns .....	8.3	14.5	14.8	14.8	16.7	16.7	...	20.7	21.5
Lower teeth, excl. incisors, crowns .....	10.8	...	16.8	16.8	18.2	18	19.8	25.3	27.8

\* Estimate.

## Plerotes, Epomops, and Hypsignathus: Measurements of teeth.

	<i>P. anchietae</i> , Type.	<i>E. f. strepitans</i> , 6 skulls, incl. type. Gold Coast; Aboumema; Asaba.		<i>E. f. franqueti</i> , 10 skulls, incl. type. Old Calabar; Cameroons; Benito R.; Gaboon; Niam-Niam; Tingasi; Senlikli.		<i>E. buettikoferi</i> , 6 skulls, incl. type. Sierra Leone; Liberia.		<i>E. dobsoni</i> , 3 skulls, Benguela; Katanga.		<i>H. monstrosus</i> , 14 skulls, Gambia; Benin; S. Nigeria; Old Calabar; Benito R.; Fernan Vaz; R. Welle; Tingasi.	
		Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
p <sup>1</sup> , length .....	mm. 0.4	...	...	...	...	...	...	...	...	...	...
" width .....	0.4	...	...	...	...	...	...	...	...	...	...
p <sup>2</sup> , length .....	1.5	2.5	3	2.5	3.2	2.8	3	2.7	2.8	3.7	4.2
" width .....	0.8	2	2.2	2	2.5	2	2.2	1.9	2.1	2.2	2.8
p <sup>3</sup> , length .....	1.6	2.8	3.1	3	3.7	3	3.2	2.7	2.9	3.9	4.7
" width .....	0.8	2	2.2	2.1	2.5	2	2	1.9	2	2.7	3.2
m <sup>1</sup> , length .....	1.4	2.8	3.2	3.1	3.8	3.5	3.8	2.8	2.8	4.1	4.7
" width .....	0.7	1.7	1.9	1.8	2.1	1.8	1.9	1.9	2	2.7	3.3
p <sup>1</sup> , length .....	0.5	0.8	1.1	0.8	1.2	1	1.2	1	1	0.5	0.7
" width .....	0.5	0.8	1.3	0.8	1.2	1	1.5	1	1	0.5	0.6
p <sup>2</sup> , length .....	1.4	2.3	2.8	2.6	2.8	2.3	2.9	2.2	2.2	2.7	3.1
" width .....	0.7	1.8	1.9	1.8	2.1	2	2	1.8	1.8	2	2.2
p <sup>3</sup> , length .....	1.5	2.8	3.1	2.9	3.7	3	3.2	2.4	2.7	3.2	4.3
" width .....	0.7	1.8	2	2	2.1	2	2	1.8	1.9	2.5	3
m <sup>1</sup> , length .....	1.6	2.8	3.2	3	3.5	3.2	3.3	2.8	2.9	4	4.9
" width .....	0.6	1.7	1.8	1.8	2	1.8	1.9	1.8	1.9	2.7	3
m <sup>2</sup> , length .....	1.1	2	2	1.9	2.1	1.9	2.2	2	2	3.1	4
" width .....	0.5	1.5	1.8	1.5	1.8	1.7	1.8	1.3	1.8	2.5	3
m <sup>3</sup> , length .....	0.4	...	...	...	...	...	...	...	...	...	...
" width .....	0.3	...	...	...	...	...	...	...	...	...	...

## 12. EPOMOPHORUS, Bennett.

*Epomophorus* (pt.), Dobson, Cat. Chir. B. M. p. 4.

Type.

1836. *Epomophorus*, Bennett, P. Z. S. 1835, p. 149  
(12 Feb. 1836) ..... *E. gambianus*.

*Pteropus* (pt.), Ogilby, P. Z. S. 1835, p. 100 (9 Oct. 1835); *Temminck, Mon. Mamm.* ii. pp. 49, 58 (1837: genus *Pteropus*, part of section A, "Roussettes sans queue"); *Wagner, Schreber's Säug., Suppl.* i. p. 366 (1839: genus *Pteropus*, section c, species "sedis incertae").

*Epomophorus*, Bennett, Trans. Z. S. ii. pt. i. p. 33 (1836); *Gray, Mag. Zool. & Bot.* ii. p. 504 (1838); *Temminck, Mon. Mamm.* ii. p. 360\* (1841: characters); *Gray, List Mamm. B. M.* pp. xix, 38 (1843); *id.*, *Voy. 'Sulphur,' Zool.* i. p. 29 (1844); *Peters, Reise Mossamb., Säug.* p. 26 (1852: characters); *Tomes, P. Z. S.* 1860, p. 42 (pt.) (revision); *id.*, P. Z. S. 1861, p. 11 (additions and corrections); *Peters, MB. Ak. Berlin*, 1865, p. 256 (pt.); *Gray, P. Z. S.* 1866, p. 65; *Peters, MB. Ak. Berlin*, 1867, p. 869 (pt.) (revision); *Gray, Cat. Monk. &c.* p. 125 (1870); *Dobson, Ann. & Mag. N. H.* (4) xvi. p. 354 (pt.) (1875); *id.*, *Cat. Chir. B. M.* p. 4<sub>o</sub> (genus), pp. 6, 7 (subgenus) (pt.) (1878); *Leche, Lunds Univ. Arsskr.* xiv. pp. 21 & seq. (1878: dental formula; milk dentition); *Dobson, P. Z. S.* 1881, p. 685 (anatomy); *Floer & Lydekker, Mamm.* p. 650 (pt.) (1891); *Winge, E. Mus. Lundii*, ii. pt. i. pp. 24, 27, 28, 56 (1892: affinities; dental formula); *Matschie, Megachir.* p. 34 (genus), p. 43 (subgenus) (1899); *Miller, Fam. & Gen. Bats*, p. 65 (pt.) (1907).

*Pachysoma* (pt.), *Temminck, Esq. Zool.* p. 64 (1853: *Epomophorus* + *Cynopterus*); *Wagner, Schreber's Säug., Suppl.* v. p. 605 (1853-55: genus *Pteropus*, subgenus *Pachysoma*, section a; section b = *Cynopterus* + *Chironax*).

*Diagnosis*.—Length of rostrum much more than lachrymal breadth, postdental palate deeply depressed posteriorly, premolars and molars  $\frac{3}{5}$ . Ceratohyals extremely short, a single small pharyngeal sac in males. Externally similar to *Epomops*, but metacarpals and phalanges shorter, and vertical fasciæ of mesopatagium fewer. Forearm 60-93 mm. [Eight species, nine recognizable forms. Range, the Ethiopian region, north to Senegal and Erythrea, south to Damaraland and East Cape Colony.]

*Skull* (fig. 36).—Rostrum and palate long and narrow, breadth across external surfaces of  $m^1$ - $m^1$  varying according to species from somewhat more than  $\frac{1}{2}$  to only  $\frac{2}{5}$  (in *Epomops* from  $\frac{3}{4}$  to  $\frac{2}{3}$ ) of total length of bony palate, from incisive foramina to palation. Palate deeply depressed in front of the high and prominent palation border. Ascending branches of premaxillæ of equal breadth throughout (in *Epomops* tapering almost to a point superiorly).

\* Miswritten *Emomophorus*.

Zygomatic arches stronger than in *Epomops*, vertically expanded at middle, often twice as high at middle as anteriorly and posteriorly. Brain-case flattened, occiput in smaller species only slightly deflected against facial axis, in larger species directed straightly posteriorly.

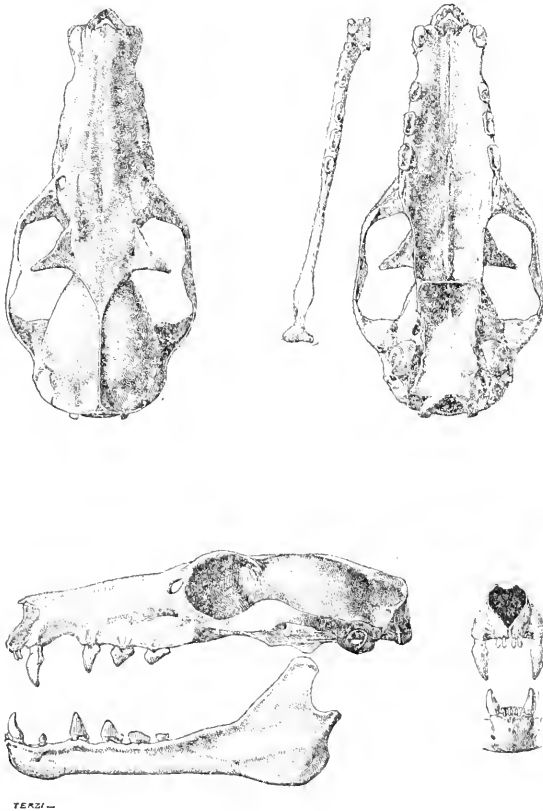


Fig. 36.—*Epomophorus gambianus*, ♂. Benin, Nigeria. No. 94.7.25.9. †.

Sagittal crest fully developed, but always low, in smaller species barely raised above surface of skull. Coronoid process low and sloping backward, but less so than in *Epomops*; condyle of mandible above level of alveolar line.

*Dentition* (fig. 36).— $\frac{i^1 i^2 c p^3 p^4 m^1}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2} = 28^*$ . Characters of teeth as in *Epomops*, but  $i^2$  never deciduous.

*Palate-ridges* (fig. 37).—Six thick prominent ridges across interdental and postdental palate, and two or three thin and serrate ridges close together at extreme posterior edge (very inconspicuous and easily overlooked). Four anterior ridges undivided (second to fourth often notched at middle), fifth and sixth distinctly separated at middle. The arrangement of the postdental and posterior interdental ridges is of primary taxonomic importance, no specimen of

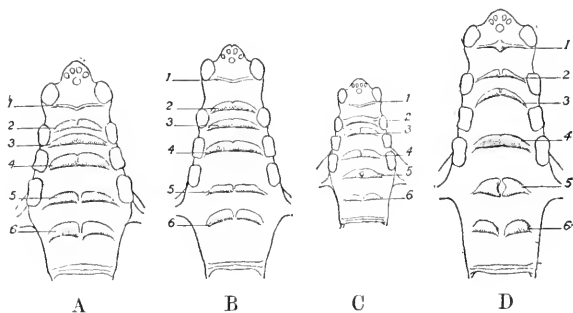


Fig. 37.—Palate-ridges. A, *Epomophorus w. wahlbergi* (♂, 64.1.9.35); B, *E. angolensis* (♂, 64.8.16.1, type of species); C, *E. minor* (♂, 79.9.12.4, type of species); D, *E. gambianus* (♂, 83.4.24.2). All figures  $\frac{1}{2}$ .

*Epomophorus* ought to be named without an examination of the soft palate. Fig. A shows the arrangement of the ridges characteristic of *E. wahlbergi* only, fig. B that of *E. angolensis* and *pousarguesi*, figs. C and D the type of palate-ridges found with but little specific variation in *E. labiatus*, *minor*, *crypturus*, *anurus*, and *gambianus*. For details see Synopsis, p. 520, and descriptions of species.

\* The following dental anomalies have been observed in a series of much more than 150 skulls representing all forms known:—A “ $p_2$ ” present on both sides, closely wedged in between  $p_1$  and  $p_3$ , small, about equal in cross-section and height to a lower incisor, and similar in general shape and structure to  $p_1$  of a *Rousettus* and *Pteropus* (*E. gambianus* juv., 99.6.15.3); a “ $p_2$ ” present on left side, situated about midway between  $p_1$  and  $p_3$ , in bulk subequal to  $\frac{1}{3}$  of  $p_1$  (*E. gambianus* ad., Berlin Museum 10171, type of *E. zechi*); a small supplementary premolar between  $p^3$  and  $p^4$ , equal in size to a lower incisor (*E. gambianus* yg. ad., 99.6.15.2). Not one of the skulls exhibits a  $p^1$ ,  $m^2$ , or  $m_3$ , teeth comparatively recently lost in this group of bats (compare *Pterotes*, in which  $p^1$  and  $m_3$  are present).—An initial stage of a splitting of the outer ridge of  $m_1$ , or both  $m_1$  and  $m^1$ , into two cusps, is seen in a few individuals (*E. gambianus* yg. ad., 74c; *E. anurus* ad. and imm., 6.12.4.8 and 6.3.8.2); compare *Hypsignathus*.



*Hyoid bones*.—In general characters not unlike those of *Epomops*, but differing in many details. Thyrohyals very long, their broad extremities bent inward above so as nearly to meet in the middle line above the aperture of the larynx; basihyal much expanded in postero-anterior direction; ceratohyals extremely short; epihyals expanded, lozenge-shaped, in general outline recalling those of *Epomops*, but quite flat and without prominent pulley-like cornua ( $x$  in fig. 32 A, p. 490). Also the arrangement of the muscles connected with the hyoid apparatus is conspicuously different (for details see Dobson, P. Z. S. 1881, pp. 691-692).

*Wings*.—Vertical fasciæ of mesopatagium (those crossing in vertical direction the main internal cutaneous line) fewer in number and less crowded than in *Epomops*, 11-33 as against 36-47 in *Epomops*. All digits noticeably shorter than in *Epomops*, but not all shortened quite to the same degree (the term "shortened" here used for convenience, not implying that the wing-structure of *Epomophorus* is considered phylogenetically derivable from that of *Epomops*); if compared with corresponding portions of the *Epomops* wing, the pollex and metacarpals and phalanges of the third and fourth digits are shortened by 5-7 p. et., the second metacarpal and the metacarpal and phalanges of the fifth digit by 10-12 p. et. Subjoined the wing-indices of *Epomophorus* (upper row), calculated from measurements of 125 adult individuals of all forms known, and for comparison those of *Epomops* (lower row):—

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	411	471	109	127	680	436	591	647	320	358	641	309	316
1000	434	538	107	128	728	466	630	699	346	388	715	351	362

*Sexual differentiation*.—(1) Adult males with shoulder-pouches and erectable epanulette-like hair-tufts similar to those of *Epomops* (as a rare exception present in females: seen in one female of *E. anurus*). (2) Males with a single small central pharyngeal sac, opening near the commencement of the oesophagus, opposite the aperture of the larynx, and situated between the spine and the middle constrictor of the pharynx, fibres from that muscle forming a sphincter round the neck of the sac; cavity of sac in *E. gambianus* as a small bean, in *E. minor* scarcely larger than a pea. (3) Males of all species, except *E. labiatus* and *minor*, averaging considerably larger than females.

*Range*.—The table of distribution of the species and subspecies (p. 518) is based entirely on specimens identified by the writer.

	<i>E. wahlbergi</i> group.	<i>E. gambianus</i> group.		
		<i>labiatus</i> , <i>minor</i> .	<i>anurus</i> , <i>crypturus</i> , <i>gambianus</i> .	<i>angolensis</i> , <i>pousarguesi</i> .
Senegal to Nigeria .....	.....	.....	<i>gambianus</i>	<i>pousarguesi</i>
Shari R. ....	.....	.....	.....	
Sennaar .....	.....	<i>labiatus</i>	<i>gambianus</i>	
Omo R. ....	.....	.....	<i>gambianus</i>	
Shoa; Abyssinia .....	.....	{ <i>labiatus</i> <i>minor</i>	<i>anurus</i>	<i>angolensis</i> <i>angolensis</i>
Erythrea .....	.....		<i>anurus</i>	
Cameroons to Angola ...	<i>w. haldemani</i>	.....	<i>anurus</i>	
Benguela .....	<i>w. haldemani</i>	.....	.....	
Damaraland .....	.....	.....	.....	<i>angolensis</i> <i>angolensis</i>
Welle R. ....	<i>w. haldemani</i>	.....	<i>anurus</i>	
Bahr-el-Ghazal .....	.....	.....	<i>anurus</i>	
Uganda .....	.....	.....	<i>anurus</i>	
British E. Africa .....	{ <i>w. haldemani</i> <i>w. wahlbergi</i>	[ <i>minor</i> *]	<i>anurus</i>	<i>angolensis</i> <i>angolensis</i>
German E. Africa .....	{ <i>w. haldemani</i> <i>w. wahlbergi</i>	<i>minor</i>	<i>anurus</i>	
Zambesia .....	<i>w. wahlbergi</i>	.....	<i>crypturus</i>	
Limpopo .....	<i>w. wahlbergi</i>	.....	<i>crypturus</i>	
E. Cape Colony .....	<i>w. wahlbergi</i>	.....	.....	

*Affinities*.—A well-defined genus of the Epomophorine section, similar in the tooth-formula (loss of  $p^1$ ,  $m^2$ , and  $m_3$ ) to *Epomops*, *Hypsognathus*, *Micropteropus*, and *Nanonycteris*, but peculiar in the lengthening and narrowing of the rostrum and palate and the deeply depressed postdental palate. In the latter character it is approached only by *Micropteropus*.

*Chronology and revisions*.—The earliest species of *Epomophorus* known to zoologists was one of those which exhibit the characters of the genus in their extreme phase; examples of this large bat obtained by Lieut. Rendall at the River Gambia were in 1835 and 1836 described under five different names, *Pteropus gambianus* (Ogilby), *macrocephalus* (Ogilby), *megacephalus* (Swainson), *epomophorus* (Bennett), and *whitei* (Bennett). Botta's collections from Sennaar added a second species described by Temminck in 1837, the small *Pteropus labiatus*; Rüppell's *Pteropus schöensis* (1842) is synonymous with this. Next in order came one of the species inhabiting the eastern and south-eastern regions of the continent, *Pteropus wahlbergi*, described by Sundevall in 1846 from Natal.

\* As *E. minor* is known with certainty from Shoa and German E. Africa, there can be no doubt, of course, that it occurs also in British E. Africa, but so far specimens have not been examined by the present writer.

Hallowell's *Pteropus hablemani*, 1846, from "W. Africa" is a tolerably well-marked western and northern race of *E. wahlbergi*. A fifth form was discovered by Peters at Tette, Zambesi, and made known by him in 1852 as *E. crypturus*. The above, ten nominal (but, as we now know, five really distinguishable) forms, was the material which the first reviser of the genus, Tomes (1860 and 1861), had to work upon; he recognized four species, *E. macrocephalus*, *gambianus*, *labiatus*, and *crypturus* (his *E. franqueti* is an *Epomops*, and the specimens identified by him with *E. schoënsis*, Rüppell, are *Micropteropus pusillus*); like all subsequent writers he failed to see that *macrocephalus* is the male, *gambianus* the female of one species, and the name *crypturus* in his monograph covered both that species and *wahlbergi*. A few years later (1864) a sixth form was brought home by Heuglin from Bahr-el-Ghazal and described as *E. anurus*. Peters's revision in 1867 differed from that of Tomes in no noteworthy respect except the recognition of *E. crypturus* and *wahlbergi* as distinct species, but the characterization of all the species admitted was still exceedingly vague. Gray's *E. macrocephalus* var. *angolensis* (1870), based on one of Monteiro's specimens from Benguela, is a distinct (seventh) form, his *E. macrocephalus* var. *unicolor*, from Shupanga, synonymous with *E. wahlbergi*. The first important step toward a better understanding of the species and their differential characters was made by Dobson's revision (1878); he erred in recognizing only three forms, *E. macrocephalus* [= *gambianus*], *gambianus* [roughly = *wahlbergi*], and *labiatus* (considered only a local form of his "*gambianus*," in which respect he was in so far right as the two specimens catalogued by him as *labiatus* are in reality the smaller race of *wahlbergi*), but he was the first to point out the fundamental importance of the arrangement of the palate-ridges as a taxonomic character in this genus. Two years later he added a new (eighth) form, the small *E. minor*, discovered by Dr. Robb in Zanzibar. Bocage's *E. guineensis* (1898), from Bolama, is apparently synonymous with *gambianus*. Decidedly a retrograde step was Matschie's revision in 1899; it was based chiefly on that author's peculiar zoogeographical ideas, with the inevitable result that the safe ground laid by Dobson was abandoned, doubt thrown on any previous record which did not fit in with the reviser's own theories, the distribution and characters of the already described species to a large extent obscured and confused, and a series of untenable "Gebiet"-species created; so far from acting as a stimulus to further studies this revision rendered thenceforth the identification of specimens an almost hopeless task and thus very nearly stopped, for more than ten years, all sound systematic work on this genus. Since then one name has been added to the list, Trouessart's *E. pousarguesi* (1904), known from a single female from the Shari River, apparently a distinct (ninth) form.

*Synopsis of the Species.*

- A. One postdental palate-ridge\* (fig. 37 A, p. 516); vertical fasciæ of mesopatagium 22-33 ..... A. E. WAHLBERGI GROUP.
- α. Skull, total length 47-55.5 (males) and 44-50.5 (females), forearm 77-89 (males) and 72-86 mm. (females). (Ethiopian region, north to Cameroons and B. E. Africa, south to Benguela and E. Cape Colony) . . . [p. 521.
1. *E. wahlbergi*,
- B. Two postdental palate-ridges\* (figs. 37 B-D, p. 516); vertical fasciæ of mesopatagium 11-24 ..... B. E. GAMBIANUS GROUP.
- a. Fourth palate-ridge situated midway between third and fifth (figs. 37 C, D, p. 516).
- a'. Small species; sexual difference in size none or inconspicuous. Skull, total length 35.8-39.7, forearm 60-66.5 mm.
- a<sup>2</sup>. Premolars and molars heavier (measurements p. 552). (Sennaar; Abyssinia; Shoa) ..... 2. *E. labiatus*, p. 529.
- b<sup>2</sup>. Premolars and molars weaker (measurements p. 552). (Shoa to G. E. Africa) ..... 3. *E. minor*, p. 531.
- b'. Larger; males conspicuously larger than females.
- c<sup>2</sup>. Size medium: skull, total length 46-48.8 (males) and 40-45 (females), forearm 71.5-78 (males) and 66.5-74 mm. (females). (Erythrea to G. E. Africa) ..... 4. *E. anurus*, p. 532.
- d<sup>2</sup>. Larger: skull, total length 52-55 (males) and 46-49.7 (females), forearm about 81-85.5 (males) and 79-80 mm. (females). (Zambesi and Limpopo valleys) ..... [p. 535.
5. *E. crypturus*,
- e<sup>2</sup>. Largest; rostrum and palate extremely long and narrow: skull, total length 59.7-62 (males) and 52-55 (females), forearm 87-93 (males) and 81-86.5 mm. (females). (Senegal, east along Guinea coast, to Sennaar and Omo R.) ..... [p. 538.
6. *E. gambianus*,
- b. Fourth palate-ridge much nearer third than fifth (fig. 37 B, p. 516).
- c' Size as *E. gambianus*: skull, total length 58.5-61.5 (males), forearm about 87.5-91 (males) and 82.5 mm. (one female). (Benguela; Damaraland) ..... [p. 542.
7. *E. angolensis*,
- d'. Size probably larger (known from one adult female): skull, total length 55.5, forearm 91 mm. (Shari R.) ..... [p. 543.
8. *E. pousarguesi*,

\* Apart from some (two or three) inconspicuous, thin and serrate ridges situated close together at extreme posterior border of palate.—The fifth and sixth (often also the fourth) ridges produce a distinct transverse elevation on the bony palate, so that, even if the soft palate has been destroyed, it is generally easy to see whether there has been one or two postdental ridges.

1. *Epomophorus wahlbergi*, *Sund.*

*Epomophorus gambianus* (pt.), Dobson, Cat. Chir. B. M. p. 10.

*Epomophorus labiatus* (pt.), Dobson, op. c. p. 11.

(Synonyms under the subspecies.)

*Diagnosis*.—One postdental palate-ridge; 22–33 vertical fasciæ in mesopatagium; light abdominal patch none or obsolescent. Forearm 77–89 (males) and 72–86 mm. (females). *Hab.* From Cameroons and British East Africa in the north, to Benguela and Grahamstown in the south; absent from the whole of the Guinea coast west of Cameroons.

*Skull*.—Rostrum and palate relatively considerably longer and narrower than in *Rousettus*, but less lengthened and narrowed than in other species of *Epomophorus* of approximately similar size (c. g. *E. crypturus* and *anurus*); skull on the whole more heavily built, and broader across zygomata. Median palatal length (incisive foramina to palation) less than twice the breadth across external surfaces of  $m^1$ – $m^1$ ; postdental palate (hinder edge of  $m^1$  to postero-external corner of bony palate) only about  $\frac{3}{4}$ , in females often only  $\frac{2}{3}$ , of same breadth; rostrum, from front of orbit to tip of nasals, generally distinctly shorter than, sometimes subequal to, maxillary tooth-row ( $c$ – $m^1$ ); front of orbit vertically above middle, or some point of posterior half, of  $m^1$ , never behind  $m^1$ ; zygomatic breadth much more than half the total length of the skull.

*Palate-ridges* (fig. 37 A, p. 516).—Five interdental ridges, one postdental (and two or three thin and serrate ridges close together at extreme hinder edge of palate); four anterior ridges approximately straight, undivided, fifth and sixth arcuate, divided. First ridge at hinder edges of canines; second and third between  $p^3$ – $p^3$  (second at front, third at back of these teeth); fourth between  $p^4$ – $p^4$ , individually varying in position from level of middle to level of hinder edges of these teeth; fifth between  $m^1$ – $m^1$ , quite similarly varying in position; sixth situated toward (generally a little in front of) middle of postdental palate.

*Fur*.—Soft, silky, slightly adpressed on back, more so on underparts; foreneck much more thinly haired than breast and belly. Fur of upperside extending on proximal half or two-thirds of forearm and on tibia quite or nearly to ankle, in some individuals even in a thin line along metatarsus to base of toes. Small tufts of closely adpressed hairs thinly scattered over the whole of the upper surface of the mesopatagium. Interfemoral, except region above calcar which is practically naked, covered with rather long hair overhanging posterior free margin. Beneath, femur, tibia immediately below knee, and proximal half of forearm clothed; thinly spread woolly hair on lateral membrane along flanks and outer side of forearm. Length of hair, back 14–17 (longest hairs) and 10·5–11 (shortest), nape of neck 13–14·5 and 9–10·5, belly 11–14 and 7–8 mm. Neither in the length nor in the distribution of the fur is there any difference between the subspecies of *E. wahlbergi*.

*Colour*.—Upperside brownish fawn, somewhat varying in tinge; in its darkest extreme the general colour approaches fawn Prout's brown, in its palest extreme fawn wood-brown, but the large majority are intermediate (café-au-lait); colour of upperside sometimes practically uniform from crown to interfemoral, sometimes slightly lighter on nape of neck and head; individual hairs generally uniform from base to tip. Underparts paler than back, generally some tinge of isabella or drab, more rarely wood-brown, and in any case with a distinct touch of fawn; never any trace of a light abdominal patch; foreneck rather often slightly paler than breast and belly, but never forming a well-defined transverse band.

The variations described above are perfectly individual, a sufficiently large series from any region showing any "phase," from the darkest to the lightest extreme. The two subspecies are alike in colour, nor is there any colour difference between individuals of the same subspecies from widely separated localities (e.g. *E. w. haldemani* from Angola and British East Africa), nor any sexual colour difference. Quite young individuals differ from adults only in the rather duller (less shiny) colour of the upperside.

*Subspecies*.—Two, *E. w. haldemani* and *wahlbergi*. The former is essentially western (Cameroons to Benguela), but extends through the Congo Valley east to British and northern German East Africa, where it meets *E. w. wahlbergi*, which ranges from southern British East Africa to eastern Cape Colony. The two subspecies differ apparently only in size, and, as shown in the subjoined comparative table, this difference is much better pronounced in the skull than in the external dimensions, and much better so in males than in females:—

	<i>haldemani</i> . Males.	<i>wahlbergi</i> . Males.	<i>haldemani</i> . Females.	<i>wahlbergi</i> . Females.
Skull, total length...	47-51	52-55.5	43-49	45-50.5 mm.
Mandible .....	38.8-41.5	41.8-45	34.8-38.5	37-41 „
c-m <sup>1</sup> , crowns .....	16.6-18	18-19.2	15-17.2	16.5-18 „
m <sup>1</sup> , length .....	3.2-3.8	3.7-4.3	3.2-3.8	3.7-4.2 „
m <sub>1</sub> , length .....	3.2-3.7	3.5-4.1	3-3.6	3.5-4 „
Forearm .....	77-87	81.5-89	72-81.5	78-86 „
3rd metacarpal .....	54.5-61	57.5-64.5	50-59	54-61 „
Tibia .....	29.5-35	31.5-35	28.5-32	30-34 „

1 a. *Epomophorus wahlbergi haldemani*, Hallowell.

*Pteropus haldemani*, Hallowell, *Proc. Ac. N. Sci. Philad.* iii. p. 52\*, (1846†: W. Africa); *Rehn*, *Am. Nat.* xxxvi. p. 201 (1902: type re-examined).

*Pteropus* [*Pachysoma*] *haldemani*, *Wagner*, *Schreber's Säug., Suppl.* v. p. 609 (1853-55).

\* Name of the author misprinted Hallowell.

† See footnote, p. 526.

- Epomophorus haldemanni* (sic), *Fitzinger, SB. Ak. Wien*, lx. Abth. i. p. 597 (1870).
- Epomophorus whitei* (nec Bennett), *Gerrard, Cat. Bones Mamm. B. M.* p. 59 (1862: "Abyssinia").
- Epomophorus gambianus* (nec Ogilby), *Peters, P. Z. S.* 1865, p. 400 (Loanda); *Gray, Cat. Monk. &c.* p. 126 (pt.) (Angola; "Abyssinia"); *Peters, P. Z. S.* 1872, p. 364 (Benguela); *Dobson, Cat. Chir. B. M.* p. 10 (pt.) (1878: Gaboon; Angola; Dar-es-Salam); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 208, n. 334 (pt.) (1879); *Jentink, Notes Leyd. Mus.* vii. p. 35 (1885: Semio, Niam-Niam); *id., Cat. Ost. Mamm.* p. 251 (pt.) (1887: Semio); *id., Cat. Syst. Mamm.* p. 137 (1888: Semio); *Bocage, J. Sci. Lisboa*, (2) i. pp. 4, 14 (1889: Ambaca; Pungo Andongo; R. Cuillo; Quindumbo; Caconda); *Noack, Zool. Jahrb., Syst.* iv. p. 203, pl. v. figs. 52-53 (skull; palate-ridges) (1889: Netonna, Congo); *Matschie, SB. Ges. nat. Fr.* 1893, p. 257 (Chinchoxo; Angola); *id., Mitth. Geogr. Ges. Lübeck*, (2) H. vii.-viii. p. 133 (pt.) (1894: Cameroon; Gaboon; Chinchoxo; Angola; Dar-es-Salam: Mombasa; Malindi; Kitui); *Pousargues, Ann. Sci. Nat.* (7) *Zool.* iii. p. 251 (1896: Franceville); *Trouessart, Cat. Mamm.* i. p. 88, n. 476 (pt.) (1897); *Bocage, J. Sci. Lisboa*, (2) v. p. 136 (1898: Quissanga; Ambaca; Pungo Andongo; R. Cuillo; Quindumbo; Caconda); *Seabra, t. c.* p. 165, pl. i. fig. 1 (palate-ridges) (1898); *Cabrera, Mem. Soc. Esp. H. N.* i. Mem. 1, p. 6 (1903: Spanish Guinea); *Seabra, J. Sci. Lisboa*, (2) vii. p. 104 (1904: Cubicula, Cazengo; Serra de Selles, Novo Redondo); *Trouessart, Cat. Mamm., Suppl.* p. 56, n. 509 (pt.) (1904); ? *Elliot, Cat. Mamm. Field Col. Mus.* p. 490, n. 854 (1907: W. Africa).
- Epomophorus macrocephalus* (nec Ogilby), ? *Peters, J. Sci. Lisboa*, iii. p. 123 (1871: Angola; Benguela); ? *id., MB. Ak. Berlin*, 1876, p. 474 (Dongila, Gaboon); *Noack, Zool. Jahrb., Syst.* iv. p. 200, pl. v. figs. 50, 51 (skull; palate-ridges) (1889: P. da Lenha, Congo).
- Epomophorus crypturus* (nec Peters, 1852), *Peters, MB. Ak. Berlin*, 1876, p. 913 (Mombasa); *id., op. cit.* 1878, p. 195 (Taita; Kitui).
- Epomophorus labiatus* (nec Temm.), *Dobson, Cat. Chir. B. M.* p. 11 (1878: "Abyssinia"); *Peters, MB. Ak. Berlin*, 1879, p. 831 (Malindi); *Dobson, P. Z. S.* 1879, p. 716 (1880: Zanzibar); *id., Rep. Brit. Assoc.* 1880, p. 171 (Zanzibar); *id., P. Z. S.* 1881, p. 690 (pharynx; larynx; hyoid bones); *id., Trans. Linn. Soc.* (2) *Zool.* ii. pt. v. p. 260 (1882: digastric); *Trouessart, Cat. Mamm.* i. p. 88, n. 477 (pt.) (1897).
- Epomophorus zenkeri*, *Matschie, Megachir.* p. 46 (1899: Cameroon; Gaboon; Chinchoxo; Angola); *Trouessart, Cat. Mamm., Suppl.* p. 56, n. 511 (1904).
- Epomophorus angolensis* (pt.), *Matschie, Megachir.* p. 47 (1899: Caconda, Benguela); *Trouessart, Cat. Mamm., Suppl.* p. 56, n. 512 (pt.) (1904).
- Epomophorus spec. nov.*?, *Matschie, Megachir.* p. 48 (1899: "Angola," Monteiro coll.); *Trouessart, Cat. Mamm., Suppl.* p. 56, n. 513 (1904).
- Epomophorus neumanni* (pt.), *Matschie, Megachir.* p. 50 (1899: Mombasa; Malindi; Takaungu); *Trouessart, Cat. Mamm., Suppl.* p. 57, n. 517 (1904); *Miller, Fam. & Gen. Bats*, p. 67 (1907).
- Epomophorus* sp., *Thomas, Ann. & Mag. N. H.* (7) xiii. p. 406 (1904: Bragança; Pungo Andongo).

*Characters*.—Skull, teeth, and external dimensions averaging conspicuously smaller; see p. 522 and detailed measurements pp. 544, 546, 548, 550, 552.

*Specimens examined*. Fifty-five, in the collections of the Leyden (one), Berlin (twenty-seven), and British Museums, from the following localities:—

Cameroons:—One (♂ imm.).

Gaboon:—Three, skulls of two.

Cabinda:—Chinchoxo: four, including type (with skull) of *E. zenkeri*.

Loanda:—Duque de Bragança: two, with skulls; Pungo Andongo: four, skulls of three; Dondo: six, with skulls; Malange: three; “Angola,” Monteiro and Welwitsch coll.: four, skulls of two, including the specimen (with skull) catalogued by Matschie as “*E. spec. nov.*?” (l. c.).

Benguela:—Caconda: one (♂ imm.).

Welle R.:—Semio: one.

British East Africa:—Kitui: four, skulls of three; Malindi: four, skulls of three (all well-pronounced *haldemani*); Takaungu: ten, skulls of two (all *haldemani*); Mombasa: three, with skulls, including type of *E. neumanni* (all *haldemani*).

German East Africa:—Dar-es-Salam: one adult, with skull (in every respect a well-pronounced *haldemani*), one young (too immature for allocation to subspecies); Zanzibar: one adult, with skull (in every respect a *haldemani*).

Uncertain localities:—Two, with skulls.

*Range*. From the Cameroons south to Benguela, east through the Welle River district (Niam-Niam) to British and German East Africa (Kitui, Malindi, Takaungu, Mombasa, Dar-es-Salam, Zanzibar). In British and German East Africa it meets and occurs together with the larger eastern and south-eastern race of the species, *E. w. wahlbergi*. [Compare *Hipposideros caffer centralis* and *caffer*, the former ranging from the west coast of Africa through the Congo valley to British and German East Africa, where it meets and occurs together with the dominant race of the eastern side of the continent, *H. c. caffer*.]

*Type*, in the collection of the Academy of Natural Sciences, Philadelphia, Penn., an adult female preserved in alcohol, skull extracted, soft palate intact, ticketed “W. Africa,” obtained from “Dr. Goheen, Physician to the American Colonization Society” (from this it might be supposed that the specimen came from Liberia; there can be little doubt, however, that it was obtained elsewhere in W. Africa; no form of *Epomophorus* with the palatridges of the *wahlbergi* type is known to inhabit the Guinea coast west of the Cameroons). Wrongly identified by Matschie (1899), on the basis of the original description, with the female of *Hypsignathus monstrosus*, an error corrected by James A. G. Rehn in 1902 (l. c.). Re-examined for the present writer by Rehn in 1909: palate “exactly as in Dobson’s figure of *E. gambianus*,” skull, total length 49, mandible 38, c-m<sup>1</sup> (crowns) 17.2, forearm 81.5 mm. (in litt.).

*Epomophorus zenkeri*, Matschie; 1899.—Lectotype, ♀ ad. skin, skull extracted, collected by Falkenstein at Chinchoxo, Cabinda,



Berlin Museum nos. 9974 (specimen) and 9975 (skull). Skull, total length 45.5, mandible 38.5, c-m<sup>1</sup> (crowns) 16.5, m<sup>1</sup>, length (antero-posterior extent of crown) 3.2, m<sub>1</sub>, length 3.1, forearm 78 mm. Type, as well as all other specimens in the Berlin Museum referred by Matschie to *E. zenkeri*, examined by the writer.

*Epomophorus neumanni*, Matschie; 1899.—Lectotype, ♂ ad. al., skull extracted, collected by Hildebrandt at Mombasa, Berlin Museum no. 9967. Skull, total length 50, mandible 39.5, c-m<sup>1</sup> (crowns) 17, m<sup>1</sup>, length 3.6, forearm 81 mm.; vertical fasciæ of mesopatagium (those crossed by the main internal cutaneous line) 23. *E. neumanni* is indistinguishable from *E. w. haldemani*; the type and all other specimens in the Berlin Museum referred by Matschie to *E. neumanni* (as well as several not entered in his list) have been examined. In the original description stated to differ from "*E. zenkeri*" [= *haldemani*] by its smaller size and "zahlreichere Stränge auf der Flughaut." The tables of measurements pp. 544, 546, 548, 550, 552, in which western and eastern examples of *haldemani* have been kept separate for comparison of their measurements, show that the latter ("*neumanni*") do not differ from the former ("*zenkeri*") in size. The number of vertical fasciæ of the mesopatagium of two adult specimens of "*zenkeri*" is, respectively, 24 and 25, of seven adult specimens of "*neumanni*," 22, 23, 23, 24, 24, 26, and 30 (the extremes in specimens from practically the same locality, viz. Takaungu and Mombasa).

a. ♀ yg. ad. al.; skull.	Gaboon.	H. F. Ansell, Esq. [P.].	74.2.19.1.
b. ♀ ad. sk.; skull.	Gaboon; Apr. 1879.	H. L. Laglaize [C.].	80.6.7.4.
c, d. ♀ ad., ♀ juv. sks.; skulls.	Duque de Bragança, Loanda; 29, 31 July, 1903.	Dr. W. J. Ansorge [C.].	44.9.6, 8.
e-h. ♂ yg. ad., ♂ juv., 2 ♀ yg. ad. sks.; skulls of nos. 3, 4, 7.	Pungo Andongo, Lo- anda, 1200 m.; 20 June, 12 July, 1903.	Dr. W. J. Ansorge [C.].	44.9.3-5, 7.
i-n. 3 ♂ yg. ad., 3 ♀ ad. sks.; skulls.	Dondo, Loanda, 93 m.; 20 July, 1903.	Dr. W. J. Ansorge [C.].	9.10.1.3-8.
o. ♀ pull. al.	Angola.	Dr. Welwitsch [P.].	Not reg.
p. ♂ ad. al.; skull.	Angola.	Dr. Welwitsch [P.].	66.1.20.6.
q-s. ♂ ad., ♂ yg. ad., ♀ yg. ad. sks.; skulls.	Malindi, B. E. A.; 22 Feb. 1901.	A. B. Percival, Esq. [C. & P.].	1.5.1.1-3.
t-w. ♀ ad., ♀ yg. ad., 2 juv. sks.; skulls of nos. 4, 6.	Takaungu, B. E. A.; 14 Mar. 1901.	A. B. Percival, Esq. [O. & P.].	1.5.1.4-7.
x. ♀ pull. al.	Dar-es-Salam.	Sir J. Kirk [P.].	74.4.20.6.
y. ♀ ad. al.; skull.	Zanzibar ( <i>Dr. Robb</i> ).	R. Army Medical College [P.].	9.1.4.5.
z. ♀ ad. st.; skull.	[Ticketed "Abys- sinia."]	Purchased (Verreaux).	{ 47.7.8.25. 49.8.16.5.
a <sup>2</sup> . Ad. sk.; skull.			49.8.16.6.

1 b. *Epomophorus wahlbergi wahlbergi*, Sund.

- Pteropus wahlbergi*, *Sunderall, Öfr. Vet.-Ak. Förh.* iii. p. 118 (1846\*: Pt. Natal; "Caffraria interior").
- Pteropus* [*Pachysoma*] *wahlbergi*, *Wagner, Schreber's Säug., Suppl.* v. p. 606 (1853-55).
- Epomophorus wahlbergi*, *Peters, MB. Ak. Berlin*, 1867, p. 869; *Fitzinger, SB. Ak. Wien*, lx. Abth. i. p. 607 (1870); *Matschie, Megachir.* p. 48 (1899: Pt. Natal; Grahamstown); *Trouessart, Cat. Mamm., Suppl.* p. 56, n. 514 (1904); *Thomas & Schwann, P. Z. S.* 1905, i. p. 256 (Ngoye Forest, Zululand; habits); *Miller, Fam. & Gen. Bats*, p. 67 (1907); *Jameson, Ann. & Mag. N. H.* (8) iv. p. 468 (1909: Tzaneen, Zontpansberg; habits).
- Epomophorus crypturus* (*nec Peters*), *Tomes, P. Z. S.* 1861, p. 11 (pt.) (Natal); *Kirk, P. Z. S.* 1864, p. 650 (Shupanga; habits); *Thomas, P. Z. S.* 1894, p. 137 (pt.) (Natal); *Trouessart, Cat. Mamm.* i. p. 88, n. 475 (pt.) (1897); *Thomas & Wroughton, P. Z. S.* 1907, p. 776 (pt.) (1908: Masembeti, Beira, specimens 1685, 1687).
- Epomophorus whitei* (*nec Bennett*), *Gray, P. Z. S.* 1864, p. 56 (Shupanga; habits).
- Epomophorus macrocephalus* *var. unicolor*, *Gray, Cat. Monk. &c.* p. 125 (1870: Shupanga).
- Epomophorus gambianus* (*nec Ogilby*), *Gray, Cat. Monk. &c.* p. 126 (pt.) (1870: Pt. Natal; Caffraria); *Dobson, Cat. Chir. B. M.* p. 10 (pt.), pl. ii. figs. 3, 3 a<sub>c</sub> (head; palate-ridges) (1878: Shupanga); *Leche, Lunds Univ. Arsskr.* xiv. pp. 17 & seq. (1878: milk dentition); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 208, n. 334 (pt.) (1879); *Jentink, Cat. Ost. Mamm.* p. 251 (pt.) (1887: Pt. Natal); *id., Cat. Syst. Mamm.* p. 137 (pt.) (1888: Pt. Natal); *Noack, Jahrb. Hamb. Wiss. Anst.* ix. p. 57 (1891: Zanzibar); *Matschie, Mitth. Geogr. Ges. Lübeck*, (2) H. vii.-viii. p. 133 (pt.) (1894: Zanzibar; Dar-es-Salam; Usaramo; Pt. Natal; Grahamstown); *id., Säug. D. Ost-Afr.* p. 16, fig. 7 (head) (1895: Zanzibar; Dar-es-Salam; Usaramo); *Howard, Scient. Afr.* i. p. 77 (1896: Shiloh, nr. Bulawayo); *Matschie, Deutschl. u. seine Kolon.* p. 9, fig. 9 (head) (1897: G. E. Africa); *Trouessart, Cat. Mamm.* i. p. 88, n. 476 (pt.) (1897); ? *Lorenz-Liburnau, Abh. Senck. nat. Ges.* xxi. H. iii. p. 456 (1898: Kokotoni, N. Zanzibar); *Matschie, Megachir.* p. 55, pl. x. figs. 2 a-c (skull of ♀ ad. without locality) (1899); *W. L. Slater, Mamm. S. Afr.* ii. p. 102, n. 169 (pt.), figs. 116, 117 (head; palate-ridges) (1901: Mashonaland; Matabeleland; Natal; E. Cape Col.); *Trouessart, Cat. Mamm., Suppl.* p. 56, n. 509 (pt.) (1904).
- Epomophorus stuhlmanni*, *Matschie, Megachir.* p. 50 (pt.) (1899: Zanzibar; Dar-es-Salam; Vikindo, Usaramo; Lindi); *Neumann,*

\* Sundevall's paper was read before the Stockholm Academy on May 13th, 1846, and presumably published in the latter half of May or in June (the "Öfversigt" appears to have been issued regularly for every month in which the Academy held a meeting). Hallowell's description of *Pt. haldemani* was passed by the Publication Committee on May 26th, 1846, and printed in the May-June issue of the Proceedings of the Philadelphia Academy, which cannot have come out before, in the earliest, in July, since it contains a report of a meeting held on June 30th. The balance of evidence would seem, therefore, to be in favour of the date priority of *Pt. wahlbergi*.

*Zool. Jahrb., Syst.* xiii. p. 536 (1900: Mojeni, Zanzibar); *Trouessart, Cat. Mamm., Suppl.* p. 57, n. 516 (pt.) (1904).  
*Epomophorus neumanni*, ? Neumann, *Zool. Jahrb., Syst.* xiii. p. 536 (1900: Moshi, Kilimanjaro): ? Lönnberg, *Kilimandjaro-Mernu Exp.* pt. ii. p. 6 (1908: Ngare Nairobi, nr. Kibonoto, Kilimanjaro).

*Characters*.—Skull, teeth, and external dimensions averaging conspicuously larger; see p. 522 and detailed measurements pp. 544, 546, 548, 550, 552.

*Specimens examined*. Fifty-one, in the collections of the Stockholm (one), Leyden (two), Berlin (twenty-three), and British Museums, from the following localities:—

British East Africa:—Mt. Kenya (Smara and Ft. Hall): two, with skulls.  
 German East Africa:—Moshi, Kilimanjaro: two, skull of one; Zanzibar: six, skulls of two; Dar-es-Salam: four; Vikindo, Usaramo: six, with skulls, including type of *E. stuhlmanni*; Lindi: one, with skull.  
 Zambesia:—Zomba: one; Shupanga: three, with skulls, and one odd skull, including type of *E. macrocephalus* var. *unicolor*; Quellimane: one; Maseumbeti, Beira: two, with skulls.  
 Limpopo:—Inhambane: two, with skulls; Zoutpansberg: one, with skull.  
 E. Cape Colony:—Ngoye forest, Zululand: one, with skull; Natal: seven, skulls of three; Tugela R., Natal: type, with skull, of *Pteropus wahlbergi*; Ft. St. John, Pondoland: one, with skull; Grahamstown: eight, skulls of five.  
 Uncertain locality:—One, with skull, Berlin Museum, specimen no. 356, skull no. 10084 (“*E. gambianus*,” Matschie, *Megachir.* p. 55, pl. x. figs. 2 a-c).

*Range*. From British East Africa (Mt. Kenya), south through German East Africa, the Zambesi and Limpopo valleys, to eastern Cape Colony, at least as far as Grahamstown. In the equatorial regions of this area it occurs together with the smaller western and northern race of the species, *E. w. haldemani*.

*Type* (by selection) in the Riksmuseum, Stockholm, a well-preserved mounted adult male, skull separate (nearly perfect), Tugela River, Natal, 27 Nov. 1843, J. Wahlberg coll., Reg. no. 1040. Forwarded for examination by Professor Dr. Einar Lönnberg. Skull, total length 53·8, mandible 43·7, c-m<sup>1</sup> (crowns) 19, m<sup>1</sup>, length 4·2, m<sub>1</sub>, length 4, forearm 88 mm.

*Epomophorus macrocephalus* var. *unicolor*, Gray; 1870.—Type (♀ yg. ad.) in collection. Skull, total length 49, mandible 39, c-m<sup>1</sup> (crowns) 17·2, m<sup>1</sup>, length 4·1, m<sub>1</sub>, length 4, forearm 84 mm.

*Epomophorus stuhlmanni*, Matschie; 1899.—Lectotype, skin and skull of an adult male, Vikindo, Usaramo, German East Africa, Dr. Stuhlmann coll., Berlin Museum, Reg. nos. 9982 (skin) and 9983 (skull). Skull incomplete; mandible 44·8, c-m<sup>1</sup> (crowns) 19·2, m<sup>1</sup>, length 4·1, m<sub>1</sub>, length 3·9, forearms incomplete, third metacarpal 60·5 mm. Stated to differ from *E. wahlbergi* by its smaller size and “ihre gegen die Körperseiten weisslich überflügten Flughäute.” As to the former character, Matschie himself measures the forearms of males of “*wahlbergi*” 85–86 mm., of “*stuhlmanni*” 85–87, and a female of “*stuhlmanni*” in the Berlin Museum from Zanzibar has the forearm 89 mm.; Matschie measures the fore-

arms of females of "*wahlbergi*" 84 mm., of "*stuhlmanni*" 80-81, but an adult female (teeth much worn) of "*wahlbergi*" in the British Museum from Grahamstown has the forearm 80 mm. The colour of the plagiopatagium along the body varies in a series of alcoholic specimens of "*stuhlmanni*" precisely within the same limits (whitish brown to brownish white) as it does in a series of "*wahlbergi*." The colour of the membranes ought, of course, to be described only from freshly killed specimens.

*Remarks.*—Both races of the present species occur in British and German East Africa. Although the only tangible difference is one of size and there even in this respect is no perfectly definite line between the races, the smaller *haldemani* merging gradually into the larger *wahlbergi*, it is nevertheless in most cases possible, by a careful examination and measuring of the skull, teeth, and external dimensions, to class the specimens under subspecies; but there will always, in any large series, remain a small number of individuals which it is impossible to allocate. The forty-five specimens examined from British and German East Africa may be identified as follows:—As to British East Africa, the seventeen specimens from Malindi, Takaungu, and Mombasa (in so far as they are sufficiently mature for identification) are well-pronounced *haldemani*; those from "Kitui" (four) are tolerably well-marked *haldemani*, though with more or less distinct inclinations to *wahlbergi*; one adult male from Ft. Hall, Mt. Kenya, is a *wahlbergi* (skull 53 mm., teeth large, forearm 82), and an immature female from Smara, Mt. Kenya, is, judging from the teeth alone, referable to the same race. In German East Africa the dominant race appears to be *wahlbergi*; all specimens (seven) from Usaramo and Lindi belong to this race; most (seven) of the specimens from Zanzibar and Dar-es-Salam are well-marked *wahlbergi*, but one adult male from Dar-es-Salam and one adult female from Zanzibar are quite unmistakably *haldemani*; of the only two specimens examined from Kilimanjaro, one is rather too young for safe allocation, the other a tolerably well-marked *wahlbergi*, but with leanings to *haldemani*. The available material is far too small for generalizations; this much only is sure, that the larger southern race, *wahlbergi*, extends north to Mt. Kenya, the smaller western and northern race, *haldemani*, south at least to Zanzibar and Dar-es-Salam.

a. ♀ imm. sk.; skull.	Smara, Mt. Kenya, 3700'; 3 Feb. 1900.	Lord Delamere [P.].	0.6.21.1.
b. ♂ ad. sk.; skull.	Ft. Hall, Mt. Kenya, 4000'; 16 June, 1903.	Mrs. S. L. Hinde [P.].	4.2.4.1.
c. ♂ ad. sk.; skull.	Moshi, Kilimanjaro.	E. J. Baxter, Esq. [C.].	94.2.6.1.
d. ♂ imm. al.	Near Zomba ( <i>A. Whyte</i> ).	Sir H. H. Johnston [P.].	95.12.7.1.
e. ♀ yg. ad. sk.; skull.	Shupanga; June.	Sir J. Kirk [P.].	64.1.9.4.
(Type of <i>E. macrocephalus</i> var. <i>unicolor</i> , Gray.)			
f-h. [♂] ad. skull; 2 ♂ ad. al., skulls.	Shupanga.	Sir J. Kirk [P.].	64.1.9.5, 35, 35*.

i, j. ♂ ad., ♀ imm. sks.; skulls.	Masembeti, Beira, 120'; 2. 3 Nov. 1906 (C. H. B. Grant).	C. D. Rudd, Esq. [P.].	7.6.2.9, 11.
k, l. ♀ ad., ♀ imm. sks.; skulls.	Inhlanhlanh; 29 Sept. 1906 (C. H. B. G.).	C. D. Rudd, Esq. [P.].	7.6.2.12, 13.
m. ♀ ad. sk.; skull.	Tzaneen Estate, Zoutpansberg, 2500'; 31 Oct. 1907.	Dr. H. Lyster Jameson [C. & E.].	9.3.2.4.
n. ♂ yg. ad. sk.; skull.	Ngoye Forest, Zululand, 800'; 25 Sept. 1904 (C. H. B. G.).	C. D. Rudd, Esq. [P.].	4.12.3.8.
o. ♀ imm. sk.; skull.	Natal.	Tomes Coll.	7.1.1.232*.
p. ♀ imm. sk.; skull.	Natal.	Capt. Sheiley [P.].	81.3.18.1.
q. ♀ yg. ad. sk.; skull.	Pt. St. John, Pondoland; 11 July, 1902 (Guy C. Skovridge).	S. African Museum [E.].	3.6.2.1.
r-x. 2 ♂ yg. ad., 2 ♀ ad., 1 ♀ juv., 2 pull. ul.; skulls.	Near Grahamstown.	Grahamstown Museum [P.].	97.11.5.36-42.

## 2. *Epomophorus labiatus*, Temm.

*Epomophorus labiatus* (pt.), Dobson, Cat. Chir. B. M. p. 11.

*Pteropus labiatus*, Temminck, *Mon. Mamm.* ii. p. 83, pl. xxxix. (animal; heads of ♂ and ♀) (1837: "Abyssinia," i.e. Sennaar); *Wagner, Schreber's Säug., Suppl.* i. p. 356 (1839); *Schinz, Syst. Verz. Säug.* i. p. 128, n. 22 (1844); *Gervais, Hist. Nat. Mamm.* i. p. 190 (1854); *Schlegel, Dierk.* i. p. 53 (1857); *id., Dierent., Zoogd.* p. 66 (1872).

*Pachysoma labiata* (sic), Temminck, *Esq. Zool.* p. 68 (1853: dentition).

*Pteropus* [*Pachysoma*] *labiatus*, *Wagner, Schreber's Säug., Suppl.* v. p. 608 (1853-55).

*Epomophorus labiatus*, *Tomes, P. Z. S.* 1860, p. 55; *id., op. c.* 1861, p. 11 (type re-examined); *Fitzinger, SB. Ak. Wien*, liv. Abth. i. p. 544 (1866); *Peters, MB. Ak. Berlin*, 1867, p. 869 (pt.); *Fitzinger, SB. Ak. Wien*, lx. Abth. i. p. 602 (1897); *Dobson, P. Z. S.* 1873, p. 247 (secondary sexual characters); *id., Cat. Chir. B. M.* p. 11 (pt.) (1878); *Jentink, Cat. Ost. Mamm.* p. 251 (pt.) (1887: skull of type); *id., Cat. Syst. Mamm.* p. 137 (pt.) (1888: type; and Abyssinia. Rüppell Coll.); *Trouessart, Cat. Mamm.* i. p. 88, n. 477 (pt.) (1897); *Matschie, Megachir.* p. 54 (1899); *Anderson & De Winton, Zool. Egypt, Mamm.* p. 91 (1902); *Trouessart, Cat. Mamm., Suppl.* p. 57, n. 520 (1904); *Miller, Fam. & Gen. Bats*, p. 67 (1907).

♀ *Epomophorus* (*Pteropus*) *labiatus*, *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 518 (1873: structure of hairs).

*Pteropus macrocephalus* (nec Ogilby), *Blainville, Ost. Mamm.* i. *Chéir.* pp. 100, 103. *Atl.* i. *Chéir.* pl. vi. fig. 5 (skull of ♂ ad., Sennaar, Botta Coll.), pl. xiii. fig. 6 (dentition of same) (1840).

*Pteropus schoënsis*, *Rüppell, Mus. Senck. Abh.* iii. H. ii. p. 131 (1842: Shoa); *id., t. c.* p. 154, n. H. A. 13 a (1842: type); *Schinz, Syst. Verz. Säug.* i. p. 129, n. 23 (1844).

*Pteropus* [*Pachysoma*] *schoënsis*, *Wagner, Schreber's Säug., Suppl.* v. p. 608 (1853-55).

- Epomophorus schoënsis*, *Fitzinger, SB. Ak. Wien*, liv. Abth. i. p. 544 (pt.) (1866); *id.*, *op. c.* lx. Abth. i. p. 613 (pt.) (1870).  
 ? *Epomophorus* (*Pteropus*) *schoënsis*, *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 518 (1873: structure of hairs).  
*Epomophorus schovanus*, *Heuglin, Reise N.O.-Afr.* ii. p. 18 (1877: nom. emend.).  
*Pteropus whitei* (pt., *nec Bennett*), *Hartmann, Zeitschr. Ges. Erdk. Berlin*, iii. p. 40 (1868).  
*Epomophorus minor* (pt., *nec Dobson*), *Monticelli, Ann. Mus. Civ. Genova*, (2) v. p. 523 (1887: Let Marefia).

*Diagnosis*.—Four interdental, two postdental palate-ridges. Differing from all other species of the genus, except *E. minor*, by its small size; from *E. minor* by its heavier dentition. Skull, total length 37·2–39·7, mandible 28–31·2, c–m<sup>1</sup> (crowns) 13·2–15: forearm 62–66·5 mm. *Hab.* Sennaar; Abyssinia; Shoa.

*Description*.—Rostrum and palate rather long and narrow, but not lengthened and narrowed to the same degree as in the larger species of the same (the *E. gambianus*) section. Median palatal length (incisive foramina to palation) not quite twice the breadth across external surfaces of m<sup>1</sup>–m<sup>1</sup>; front of orbit above or slightly in front of middle of m<sup>1</sup>. Dentition heavy for the genus and the size of the animal, the individual teeth practically similar in size to those of the considerably larger *E. anurus*. Second palate-ridge between p<sup>3</sup>–p<sup>3</sup>; third between fronts or anterior halves of p<sup>4</sup>–p<sup>4</sup>; fourth between fronts or anterior halves of m<sup>1</sup>–m<sup>1</sup>; fifth thick, with a lozenge-shaped depression at middle, right and left half of ridge only slightly separated, situated closely behind tooth-rows, a line connecting posterior points of m<sup>1</sup>–m<sup>1</sup> touching front of ridge; sixth thick, very slightly divided at middle, situated at middle of postdental palate (compare fig. 37 C, p. 516, palate-ridges of *E. minor*). Vertical fasciæ of mesopatagium (those crossing the main internal cutaneous line) about 14–15. Whitish abdominal patch generally present, sometimes obsolescent. Sexual difference in size none or quite inconspicuous.

*Measurements*. On pp. 544, 546, 548, 552.

*Specimens examined*. Nine, from the following localities:—

- Sennaar, Botta coll.:—Type of species, with skull (Leyden): two mounted specimens (Paris, A 110, A 111): one odd skull (Paris, A 6780).  
 Roseires:—Two, with skulls, as catalogued below.  
 "Abyssinia," Rüppell Collection:—One (Leyden).  
 "Shoa," Rüppell Collection:—Type, with skull, of *Pteropus schoënsis* (Museum Senckenbergi).  
 Let Marefia, Shoa, Antinori coll.:—One, with skull (Paris, 1885, no. 189).

*Type*.—Temminck had two specimens "acquis, l'un à Londres sans indications de patrie, l'autre à Paris, provenant des collections de M. Botta." Only the latter specimen is now in the Leyden Museum (*E. labiatus*, Cat. Syst. specimen c, Cat. Ost. skull b). It is a young individual, mounted, much faded, but otherwise tolerably well preserved: profile of head figured in Mon. Mamm. ii. pl. xxxix. fig. 3 (originals of figs. 1 and 2 of same plate not identified). Of

the type skull only the rostrum and anterior portion of the mandible, including the upper and lower tooth-rows, are preserved. Three topotypes, collected by Botta, viz. a mounted adult male (A 110), a mounted adult female (A 111), both with skulls *in situ*, and an odd skull (A 6780), are in the Paris Museum; the skull was figured by Blainville (*l. c.*) under the name *Pteropus macrocephalus*. Type locality of species, Sennaar, not "Abyssinia" as given by Temminck. The British Museum specimens from Roseires are practically topotypes.

*Pteropus schoënsis*, Rüppell; 1842.—Type, in the collection of the Senckenbergische naturforschende Gesellschaft, Frankfurt-on-M. (no. II. A. 13 a of Rüppell's Catalogue), a mounted specimen of doubtful sex, much faded, but otherwise tolerably well preserved, sent to Rüppell from "dem Reiche Schoa, südlich von Abyssinien." The specimen is not quite fullgrown, forearm 57.5 mm. *E. schoënsis* is undoubtedly a synonym of *E. labiatus*; the dentition of the type is, tooth for tooth, precisely similar to that of the type of *labiatus*, to the Sennaar and Let Marefia skulls in the Paris Museum, and the Roseires skulls in the British Museum, and decidedly different from that of *E. minor*. The Leyden specimen, *E. labiatus* a, ♂ ad., "Abyssinia," Rüppell, belongs here, and is perhaps even a paratype or topotype of *E. schoënsis*.

a, b. ♂ imm., ♂ yg. Roseires, Blue Nile; Egyptian Government 8.4.17.2, 3.  
ad. al.; skulls. Sept. 1907 (*Capt.* Zoological Gardens  
S. S. Flower). [P.]

### 3. *Epomophorus minor*, Dobson.

*Epomophorus minor*, Dobson, *P. Z. S.* 1879, p. 715 (Apr. 1880: Zanzibar); *id.*, *Rep. Brit. Assoc.* 1880, p. 170; *id.*, *P. Z. S.* 1881, p. 333 (digastric); *id.*, *t. c.* p. 690 (pharynx; larynx; hyoid bones); *id.*, *Proc. R. Soc.* 1881, p. 31 (digastric); *id.*, *Trans. Linn. Soc.* (2) *Zool.* ii. pt. v. p. 260 (1882: digastric); *Noack, Zool. Jahrb.* ii. p. 268, pl. x. figs. 28-30 (skull) (1887: Gonda, Uganda); *Monticelli, Ann. Mus. Civ. Genova*, (2) v. p. 523 (pt.) (1887: Farri); *Jentink, Cat. Syst. Mamm.* p. 136 (1888: Shoa); *Thomas, P. Z. S.* 1890, p. 446 (pt.) (Bagamoyo); ? *Noack, Jahrb. Hamb. Wiss. Anst.* ix. p. 58 (1891: Zanzibar); *Matschie, Mitth. Geogr. Ges. Lübeck*, (2) H. vii.-viii. p. 133 (1894: Zanzibar; Bagamoyo; Gonda); *id.*, *Saug. D. Ost-Afr.* p. 16 (1895: Zanzibar; Bagamoyo; Gonda); *id.*, *Deutschl. u. seine Kolon.* p. 9 (1887: G. E. Africa); *Trouessart, Cat. Mamm.* i. p. 88, n. 473 (1897); *Bocage, J. Sci. Lisboa*, (2) v. p. 137 (1898: Zanzibar, cotype); *Seabra, t. c.* p. 166 (1898); *Matschie, Megachir.* p. 51 (pt.), pl. xi. figs. 2 a-c (skull of ♀ ad., Gonda) (1899: Zanzibar; Bagamoyo; Gonda; Ujiji); *Thomas, in Johnston's The Uganda Protectorate*, i. p. 421 (1902); *Trouessart, Cat. Mamm., Suppl.* p. 57, n. 518 (pt.) (1904); *Miller, Fam. & Gen. Bats*, p. 67 (1907); *Lönnerberg, Kilimandjaro-Meru Exp.* pt. ii. p. 6 (1908: Moëmbe, Usambara).

*Diagnosis*.—Closely allied to *E. labiatus*, but dentition remarkably weaker. *Hab.* From Shoa in the north to German East Africa in the south.

*Description*.—The principal differential character of this species is that given in the diagnosis above and shown in the table of measurements of the teeth p. 552; in other respects it is very similar to *E. labiatus*. Rostrum of skull relatively slightly shorter; palato-ridges (fig. 37 C, p. 516) quite as in *labiatus*. Vertical fasciæ of mesopatagium 13–19. Colour as *E. wahlbergi*, but generally with a more or less clearly-defined large whitish abdominal patch. Sexual difference in size none or quite inconspicuous.

*Measurements*. On pp. 544, 546, 548, 550, 552.

*Specimens examined*. Sixteen, in the collections of the Leyden (one), Berlin (eleven), and British Museums, from the following localities:—

Shoa:—Shoa, Robb coll.: one, with skull; Farri, Ragazzi coll.: one, with skull.

German East Africa:—Pangani: one; Zanzibar: two, type (with skull) of species and paratype; Bagamoyo: three, with skulls; Dar-es-Salam: one; Gonda, Uganda: five, skull of one; Ujiji, Tanganyika: one, with skull; Mikindani, Lindi: one.

*Type* in collection. Paratypes were distributed by Dobson to various Museums.

*Remarks*.—There can be little doubt that this is a small-toothed form of *E. labiatus*. So far as the material goes there has been no difficulty in distinguishing the two species, but it must be admitted that in their extremes they come very close indeed to each other. *E. labiatus* appears to be more northern and north-western in distribution, *E. minor* southern, but the two species would seem to meet somewhere in Shoa.

a. ♂ ad. al.; skull.	Shoa (Dr. Robb).	R. Army Medical College [P.].	9.1.4.6.
b. ♂ yg. ad. al.; skull.	Zanzibar.	Surg.-Gen. G. E. Dobson [E.].	79.9.12.4.
		(Type of species.)	
c, d. ♂ yg. ad., ♀ yg. ad. sks.; skulls.	Bagamoyo; 20 Feb. 1890.	Dr. Emin Pasha [C. & P.].	90.6.8.12, 13.

#### 4. *Epomophorus anurus*, Heuglin.

*Epomophorus labiatus* (pt.), Dobson, Cat. Chir. B. M. p. 11.

*Pteropus whitei* (nec Bennett), Rüppell, Mus. Senck. Abh. iii. II. ii. p. 154, specimen II. A. 8 c (1842: Sennaar); Hartmann, Zeitschr. Ges. Erdk. Berlin, iii. p. 40 (pt.) (1868).

*Epomophorus anurus*, Heuglin, N. Act. Ac. Cæs. Leop. xxxi. Abh. viii. p. 12 (1864: Bongo, Bahr-el-Ghazal); Fitzinger, SB. Ak. Wien, lx. Abth. i. p. 599 (1870); Heuglin, Reise N.O.-Afr. ii. p. 16 (1877); Matschie, Megachir. p. 54 (1899: cotypes re-examined); Anderson & De Winton, Zool. Egypt, Mamm. p. 92 (1902); Trouessart, Cat. Mamm., Suppl. p. 58. n. 522 (1904); Wroughton, Ann. & Mag. N. H. (7) xx. p. 500 (1907: Dad Majok, Bahr-el-Ghazal).

*Pteropus* (*Epomophorus*) *anurus*, Hartmann, Zeitschr. Ges. Erdk. Berlin, iii. p. 41 (1868).



*Epomophorus schoënsis* (nec Rüppell), Fitzinger, *SB. Ak. Wien*. liv. Abth. i. p. 544 (pt.) (1866: Bellegas R.); *id.*, *op. c.* lx. Abth. i. p. 613 (pt.) (1870); *Matschie, Megachir.* p. 53 (1899: Kirimba); *Neumann, Zool. Jahrb., Syst.* xiii. p. 536 (1900: ? Ussoga); *Thomas, in Johnston's The Uganda Protectorate*, i. p. 421 (1902); *Trouessart, Cat. Mamm., Suppl.* p. 57. n. 519 (1904); *Festa, Duke of Abruzzi's Il Ruwenzori*, i. p. 75, pl. vi. figs. 1, 4, 7, 8, 9, 10 (skulls of ♂ and ♀) (1909: Ruwenzori).

*Epomophorus labiatus* (nec Temm.), Peters, *MB. Ak. Berlin*, 1867, p. 869 (pt.); *Dobson, Cat. Chir. B. M.* p. 11 (pt.) (1878); ? *Monticelli, Ann. Mus. Civ. Genova*, (2) v. p. 524 (1887: Keren); *Jentink, Cat. Ost. Mamm.* p. 251, skull a (1887); *id.*, *Cat. Syst. Mamm.* p. 137, specimen b (1888: "Abyssinia"); *Trouessart, Cat. Mamm.* i. p. 88, n. 477 (pt.) (1897).

*Pteropus* (*Epomophorus*) *labiatus*, Henglin, *Reise N.O.-Afr.* ii. p. 15 (1877: Bellegas R.; habits).

*Epomophorus minor* (nec Dobson), Thomas, *P. Z. S.* 1890, p. 446 (pt.) (Kirimba); *id.*, *P. Z. S.* 1891, p. 182 (Turquel); *Matschie, Megachir.* p. 51 (pt.) (1899: Uji); *Trouessart, Cat. Mamm., Suppl.* p. 57, n. 518 (pt.) (1904).

*Epomophorus gambianus* (pt., nec Ogilby), Matschie, *Mitth. Geogr. Ges. Lübeck*, (2) H. vii.-viii. p. 133 (1894: Kirimba).

*Epomophorus doriæ*, Matschie, *Megachir.* p. 54 (1899: "Bogos"); *Trouessart, Cat. Mamm., Suppl.* p. 57, n. 521 (1904); *Sennu, Arch. Zool. (Napoli)* ii. p. 356 (1905).

*Diagnosis*.—Four interdental, two postdental palate-ridges. Skull, total length 46–49 (males) and 40–45 mm. (females), mandible 36.8–39 (males) and 31.5–36.5 (females), c-m<sup>1</sup>, crowns 16–17.2 (males) and 14.6–16 (females), forearm 71.5–78 (males) and 66.5–74 (females). *Hab.* From Erythrea, Sennaar and Abyssinia, south through Bahr-el-Ghazal, Uganda, and British East Africa, to Massailand and Tanganyika.

*Description*.—Readily distinguished from *E. wahlbergi* by the different arrangement of the palate-ridges (two, not one, postdental ridges), and from *E. labiatus* and *minor* by its larger size (see "Remarks" below). Skull heavier than in the two latter species, with relatively longer rostrum and palate; median palatal length (incisive foramina to palation) in males slightly more, in females slightly less, than twice the breadth across the external surfaces of m<sup>1</sup>–m<sup>1</sup>; postdental palate (posterior edge of m<sup>1</sup> to postero-external corner of bony palate) in males nearly equal to, in females rather more than  $\frac{3}{4}$ , of same breadth; rostrum (front of orbit to tip of nasals) equal to or more than length of maxillary tooth-row; front of orbit in males above posterior point, in females above posterior half, of m<sup>1</sup>. Size of teeth and arrangement of palate-ridges as in *E. labiatus*. Vertical fasciæ of mesopatagium 15–21. Males much larger than females.

Colour of ♂ ad. (skin), teeth unworn, Ruwenzori S.E., 17 June, 6.12.4.9:—Back uniform dark fawn-brown (a tinge between Prout's brown and vandyek-brown, but warmer than either, and washed with deep fawn), shading into a rather paler fawn-brown on nape of neck and head. Foreneck and flanks much paler than back, deep fawn with a tinge of drab. A large whitish patch

covering centre of breast and belly. Epaulettes and tufts at base of ears whitish, strongly contrasting with surrounding brownish fur.

The above is very nearly the darkest extreme in the series. Similarly coloured specimens appear to occur anywhere within the area of the species. More often, however, the general colour of the upperside is conspicuously paler, between Prout's brown and russet, frequently café-au-lait, sometimes even approaching fawn isabella or wood-brown. Foreneck, flanks and sides of breast and belly similarly varying, from deep fawn tinged with drab, to a more russet tinge of fawn, or to pale fawn. Abdominal patch in adults often ill-defined, in immature individuals generally obsolescent or entirely absent.

*Measurements.* On pp. 545, 547, 549, 551, 553.

*Specimens examined.* Thirty, in the collections of the Leyden (two), Berlin (five), Frankfort-on-Main (one), Stuttgart (three), and British Museums, from:—

Erythrea:—"Bogos": type, with skull, of *E. doriae*.

Abyssinia:—Simen, Rüppell coll.: one, with skull; Bellegas Valley, Heuglin coll.: one, with skull; "Abyssinia," Heuglin coll.: one, with skull; Gofa, O. Neumann coll.: one, with skull.

Bahr-el-Ghazal:—Bongo: two, skull of one, cotypes of species; Dad Majok: two, with skulls.

Uganda and British East Africa:—Turquel: three; Masindi, Unyoro: one, with skull; N.W. bank of Victoria Nyanza (Lubwa, Mengo, Pt. Alice, Entebbe): six, skulls of five; Kiriamo, Semlki R.: one, with skull; Ruwenzori: five, skulls of four; Kirimba, N.W. bank of Albert Edward Nyanza: one, with skull; Kirui, Mt. Elgon: two, with skulls.

German East Africa:—Massailand: one; Ujiji: one, with skull.

*Cotypes* two, in the R. Natural History Museum, Stuttgart, viz. (1) a mounted adult male, Reg. no. 1090, much bleached but otherwise well preserved, white abdominal patch sharply defined, large epaulettes, skull nearly complete, teeth practically unworn, a few of the teeth missing; and (2) a mounted adult female, Reg. no. 1091, same condition as foregoing, white abdominal patch distinct, skull apparently missing: both collected by Heuglin at Bongo, Bahr-el-Ghazal, the male in Nov. 1863, the female undated. A third specimen in the same collection, Reg. no. 609, mounted, skull extracted, Bellegas Valley (between Simen and Wogara, see Heuglin, *Reise nach Abessinien*, p. 196, 1868), Heuglin coll., is evidently the individual recorded by Heuglin in his *Reise N.O.-Afr.* ii. pp. 15-16 (measured p. 17) under the name *Pteropus (Epomophorus) labiatus*; it is a female of *E. anurus*. All three specimens forwarded for examination by Dr. K. Lampert. Measurements of cotypes: male, total length of skull 48.8, mandible 38.7, c-m<sup>1</sup> (crowns, estimate) 17.2, forearm 78; female, forearm 74. Female from Bellegas, total length of skull 43.2, mandible 33.8, c-m<sup>1</sup> 16, forearm 69 mm.

*Epomophorus doriae*, Matschie; 1899.—Type locality, "Bogos"; type, a mounted adult female, dealer's specimen without collector's name, skull separate, teeth well worn, Berlin Museum nos. 5384 (skin) and 10079 (skull). Indistinguishable from a Kirimba

female of *E. anurus* in the same Museum. Skull, total length — 2, mandible 31.8, e-m<sup>1</sup> 14.6, forearm 69 mm.

*Remarks.* — Males of *E. anurus* are easily distinguished from *E. labiatus* by their much larger size, but the smallest females examined are closely similar to the largest individuals of *E. labiatus*; the size of the teeth is practically alike in the two species, and their areas of distribution seem to overlap each other in Abyssinia. Even the smallest female skulls of *anurus* are, however, on the whole distinctly more heavily built than the largest skulls of *labiatus*, the rostrum and postdental palate longer, and the front of the orbit vertically above some point of the posterior half or third of m<sup>1</sup>, in *labiatus* above or slightly in front of the middle of m<sup>1</sup>.

<i>a, b.</i> ♂ yg. ad., ♀ imm. sks.; skulls.	Dad Majok, Bahrel - Ghazal; 29 Mar. 1907.	A. L. Butler, Esq. [C.].	8.4.2.1, 2.
<i>c-c.</i> 2 ♂ ad., 1 ♀ imm. sks.	Turquel; Jan. 1890.	F. J. Jackson, Esq. [C. & P.].	93.2.3.4-6.
<i>f.</i> ♂ imm. sk.; skull.	Masindi, Unvoro; 5 June, 1907.	Dr. W. J. An-sorge [C.].	2.11.1.1.
<i>g.</i> ♀ imm. ad.	Uganda, 4000'.	G. F. Scott Elliot, Esq. [C. & P.].	95.3.5.9.
<i>h.</i> ♂ ad. sk.; skull.	Mengo, Uganda; 10 Dec. 1897.	F. J. Jackson, Esq. [P.].	99.8.4.2.
<i>i.</i> ♀ yg. ad. al.; skull.	Pt. Alice, Uganda.	Sir H. Johnston [P.].	1.8.9.91.
<i>j, k.</i> ♀ imm., ♂ imm. sks.; skulls.	Entebbe, Uganda, 3600'; 26 Apr., 20 Sept. 1905.	E. Degen [C.].	6.3.8.2, 3.
<i>l.</i> ♂ imm. sk.; skull.	Kiriamo, Semliki R., 2900'; 16 May, 1889.	Dr. Emin Pasha [C. & P.].	90.6.8.11.
<i>m, n.</i> ♀ ad. sk., skull; ♀ yg. ad. al.	Ruwenzori E., 5000'; 11 Mar. 1906 ( <i>R. E. Dent</i> ).	Ruwenzori Exploration Comm. [P.].	6.12.4.7, 73.
<i>o-g.</i> 2 ♂ ad., 1 ♀ ad. sks.; skulls.	Ruwenzori S.E., 3400'; 17 June, 1906 ( <i>R. E. D.</i> ).	Ruwenzori Exploration Comm. [P.].	6.12.4.8-10.
<i>r, s.</i> ♂ ad., ♀ imm. sks.; skulls.	Kirui, Mt. Elgon, 6000'; 11, 19 Sept. 1909 ( <i>R. Kemp</i> ).	C. D. Rudd, Esq. [P.].	Coll. nos. 231, 291.

### 5. *Epomophorus crypturus*, *Pet.*

*Epomophorus gambianus* (pt.), Dobson, Cat. Chir. B. M. p. 10.

*Epomophorus crypturus*, *Peters, Reise Mossamb., Säug.* p. 26, pl. v (animal; head; interfemoral), pl. xiii. figs. 1-6 (skull of ♂ imm.) (1852: Tette); *Kirk, P. Z. S.* 1864, p. 650 (pt.) (Shupanga); *Peters, MB. Ak. Berlin*, 1867, p. 869; *Fitzinger, SB. Ak. Wien*, lx. Abth. i. p. 611 (1870); *Bocage, J. Sci. Lisbon*, (2) i. p. 3 (1889: Mozambique); *Thomas, P. Z. S.* 1894, p. 137 (pt.) (1894: Zomba); *Matschie, Mitth. Geogr. Ges. Lübeck*, (2) II. vii.-viii. p. 133 (1894: Tette); *Thomas, P. Z. S.* 1896, p. 790 (1897: Zomba); *Trouessart, Cat. Mamm.* i. p. 88, n. 475 (pt.) (1897); *Bocage, J.*

- Sci. Lisboa*, (2) v. p. 136 (1898: Mozambique); *Seabra, t. c.* p. 166 (1898); *Matschie, Megachir.* p. 49, pl. xi. figs. 3 a-e (skull of ♀ yg. ad.) (1899: Tette); *W. L. Slater, Mamm. S. Afr.* ii. p. 105 (1901); *Trouessart, Cat. Mamm., Suppl.* p. 57, n. 515 (1904); *Miller, Fam. & Gen. Bats.* p. 67 (1907); *Thomas & Wroughton, P. Z. S.* 1907, p. 776, specimen 1686 (1908: Masembeti, Beira); *id.*, *P. Z. S.* 1908, p. 538 (Tette); *Wroughton, Ann. & Mag. N. H.* (8) i. p. 304 (1908: Chirinda, Melssetter, Rhodesia).
- Pteropus* [*Pachysoma*] *crypturus*, *Wagner, Schreber's Säug., Suppl.* v. p. 605 (1853-55).
- Pteropus crypturus*, *Giebel, Säug.* p. 1002 (1855).
- Pteropus gambianus* (*nec Ogilby*), *Dobson, P. Z. S.* 1873, p. 247 (pt.) (secondary sexual characters); *id.*, *Cat. Chir. B. M.* p. 10 (pt.) (1878); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 208, n. 334 (pt.) (1879); *Matschie, Mitth. Geogr. Ges. Lübeck*, (2) H. vii.-viii. p. 133 (pt.) (1894: Tette).
- Epomophorus zenkeri* (*nec Matschie*), *Dollman, Ann. & Mag. N. H.* (8) iii. p. 349 (female, no. 28) (1909: Katanga).
- Epomophorus angolensis* (*nec Gray*), *Jameson, Ann. & Mag. N. H.* (8) iv. p. 468 (1909: Tzaneen, Zontpansberg; Kalomo, N.W. Rhodesia; habits).

*Diagnosis*.—Similar to *E. anurus*, but larger, and with relatively longer rostrum and palate. Skull, total length about 52-55 (males) and 46.2-49.7 mm. (females), mandible 42-44 (males) and 36.3-39.8 (females), c-m<sup>1</sup> 18-19 (males) and 16.2-17.5 (females), forearm 81-85.5 (males) and about 79-80 (females). *Hab.* The Zambesi and Limpopo valleys, north to Nyasa and Katanga, south at least to Transvaal.

*Description*.—Male skulls much, female skulls at least somewhat, larger than those of corresponding sexes of *E. anurus*: postdental palate always relatively longer. Median palatal length in males more than, in females subequal to, twice the breadth across external surfaces of m<sup>1</sup>-m<sup>1</sup>; postdental palate in males subequal to, in females about  $\frac{6}{7}$ , of same breadth; rostrum (front of orbit to tip of nasals) more than length of c-m<sup>1</sup>: front of orbit in males always quite distinctly, though not much, behind, in females vertically above or slightly behind, posterior point of m<sup>1</sup>. Palate-ridges closely similar in arrangement to those of *E. anurus*, but fifth ridge generally situated slightly behind (in *anurus* touched by) a line connecting hinder edges of m<sup>1</sup>-m<sup>1</sup>. Externally in every respect larger than *E. anurus*, females of *crypturus* being equal in size to, or even conspicuously larger than, males of *anurus*. Vertical fasciæ of mesopatagium about 11-18. Light abdominal patch very often entirely absent, not infrequently indicated by a pale greyish or whitish tinge at the centre of the breast and belly, in none of the specimens seen well-defined; colour of fur in other respects not differing from that of *E. wahlbergi*.

*Measurements*. On pp. 545, 547, 549, 551, 553.

*Specimens examined*. Eighteen, viz. those catalogued below and seven specimens in the Berlin Museum collected at Tette by Peters, being the type and six paratypes of the species.

*Type* (by selection) an adult female, preserved in alcohol, skull separate, Berlin Museum no. 553. Skull, total length 47, mandible 38, c-m<sup>1</sup> (crowns) 17.5, forearm 80 mm. Most of the paratypes are immature; no adult male (Peters's "ausgewachsenes Männchen" measured *op. c. p.* 30 is immature).

*Remarks*.—Externally *E. crypturus* is very similar, even in size, to *E. wahlbergi*, with the eastern and south-eastern race (*wahlbergi*) of which it occurs together. A confusion of the two species is, of course, impossible if the skull and palate-ridges are available for examination. Even without these, alcoholic specimens of *crypturus* may be distinguished by the smaller number of vertical fasciæ of the mesopatagium, about 11-18 (or perhaps a little more) as against 22-33 in *wahlbergi*. Dried skins of the two species, with closed wings and without skulls, are scarcely distinguishable (pale abdominal patch occasionally present in *crypturus*, apparently never in *wahlbergi*). The hairing of the femur and tibia is in *wahlbergi* often a little longer and denser, but the difference is sometimes hardly appreciable, for practical purposes therefore of very little value.—Slightly immature females of *crypturus* (e. g. specimens *b-d* in the list below, from Zomba) are sometimes puzzlingly like adult females of *anurus*, even in the size of the skulls and length of the tooth-rows, but generally distinguishable by the rather stouter premolars and molars, and by having the front of the orbit vertically above or slightly behind the posterior edge of m<sup>1</sup> (in *anurus* above some point of posterior half of m<sup>1</sup>).

<i>a.</i> ♀ ad. sk.; skull.	Dikulwe R., Katanga, 4000'; 17 Mar. 1907.	S. A. Neave, Esq. [C.].	7.12.13.2.
<i>b, c.</i> 2 ♀ imm. al.; skulls.	Zomba, Nyasa ( <i>A. Whyte</i> ).	Sir H. H. Johnston [P.].	{ 94.1.25.23. 94.6.7.1.
<i>d.</i> ♀ imm. al.; skull.	Zomba; June-Aug. 1895 ( <i>A. Whyte</i> ).	Sir H. H. Johnston [P.].	95.12.7.2.
<i>e, f.</i> ♂ juv., ♀ juv. sks.; skulls.	30 mi. above Tette; 15 Aug. 1898.	Capt. Boyd Alexander [P.].	99.8.3.1. 2.
<i>g.</i> ♀ juv. sk.; skull.	Tette; 31 Aug. 1907 ( <i>C. H. B. Grant</i> ).	C. D. Rudd, Esq. [P.].	8.4.3.8.
<i>h.</i> [♂] ad. skull.	Shupanga.	Sir J. Kirk [P.].	64.1.9.6.
<i>i.</i> ♀ yg. ad. sk.; skull.	Gwizima, Umfu'i R., Mashonaland, 4200'; 29 Aug. 1895.	G. A. K. Marshall, Esq. [P.].	96.5.18.1.
<i>j.</i> ♂ yg. ad. sk.; skull.	Masembeti, Beira, 120'; 3 Nov. 1906 ( <i>C. H. B. Grant</i> ).	C. D. Rudd, Esq. [P.].	7.6.2.10.
<i>k.</i> ♂ ad. sk.; skull.	Tzaneen Estate, Zoutpansberg, 2500'; 5 June, 1907.	Dr. H. Lyster Jameson [C. & E.].	9.3.2.3.

6. *Epomophorus gambianus*, *Ogilby*.

*Epomophorus macrocephalus*, Dobson, *Cat. Chir. B. M.* p. 8.

- Pteropus gambianus*, *Ogilby*, *P. Z. S.* 1835, p. 100 (9 Oct. 1835: *Gambia*); *Waterhouse*, *Cat. Mamm. Mus. Zool. Soc.*, 2 ed. p. 13, n. 107 (1838: type); *Wagner*, *Schreber's Säug., Suppl.* i. p. 366 (1839); *Temminck*, *Mon. Mamm.* ii. p. 361 (1841); *Schinz*, *Syst. Verz. Säug.* i. p. 135, n. 38 (1844); *Giebel*, *Säug.* p. 1003 (1855).
- Epomophorus gambianus*, *Gray*, *Mag. Zool. & Bot.* ii. p. 504 (1838); *id.*, *Voy. 'Sulphur'*, *Zool.* i. p. 29 (1844); *Tomes*, *P. Z. S.* 1860, p. 52 (type and paratypes); *id.*, *op. c.* 1861, pl. i. figs. 2, 2 a, 2 b (skull of type); *Peters*, *MB. Ak. Berlin*, 1867, p. 869; *Fitzinger*, *SB. Ak. Wien*, lx. Abth. i. p. 595 (1870); *Gray*, *Cat. Monk. &c.* p. 126 (pt.) (1870: *Gambia*: paratypes); *Dobson*, *P. Z. S.* 1873, p. 247 (pt.) (secondary sexual characters); *id.*, *Cat. Chir. B.M.* p. 11, specimen a (1878: *Gambia*); *Trouessart*, *Rev. & Mag. Zool.* (3) vi. p. 208, n. 334 (pt.) (1879); *Rochebrune*, *Faune Sénégal*, *Mamm.* p. 44 (1883: *Albreda*; *Casamance*); *Bocage*, *J. Sci. Lisboa*, (2) i. p. 2, fig. 2 (palate-ridges) (1889: *Bolama*; in 1898 made the type of *E. guineensis*); *id.*, *op. c.* (2) ii. p. 179 (1892: *Bolama*); *Trouessart*, *Cat. Mamm.* i. p. 88, n. 476 (pt.) (1897).
- Pachysoma gambianus* (sic), *Temminck*, *Esq. Zool.* p. 69 (1853).
- Pteropus* [*Pachysoma*] *gambianus*, *Wagner*, *Schreber's Säug., Suppl.* v. p. 607 (1853-55).
- Pteropus macrocephalus*, *Ogilby*, *P. Z. S.* 1835, p. 101 (9 Oct. 1835: *Gambia*); *Waterhouse*, *Cat. Mamm. Mus. Zool. Soc.*, 2 ed. p. 13, n. 108 (1838: type); *Wagner*, *Schreber's Säug., Suppl.* i. p. 367 (1839); *Temminck*, *Mon. Mamm.* ii. p. 362 (1841); *Schinz*, *Syst. Verz. Säug.* i. p. 135, n. 39 (1844); *Giebel*, *Odontogr.* p. 9, pl. iv. fig. 4 (dentition) (1855); *id.*, *Säug.* p. 1003 (1855).
- Epomophorus macrocephalus*, *Gray*, *Mag. Zool. & Bot.* ii. p. 504 (1838); *Tomes*, *P. Z. S.* 1860, p. 50 (types of *E. macrocephalus* and *ukitei*); *id.*, *op. c.* 1861, pl. i. figs. 1, 1 a, 7 (skull of type); *Peters*, *MB. Ak. Berlin*, 1867, p. 869; *Fitzinger*, *SB. Ak. Wien*, lx. Abth. i. p. 609 (1870); *Gray*, *Cat. Monk. &c.* p. 125 (1870: *Gambia*); *Dobson*, *Cat. Chir. B. M.* p. 8, pl. ii. fig. 2 (palate-ridges) (1878: *Gambia*); *Trouessart*, *Rev. & Mag. Zool.* (3) vi. p. 208, n. 333 (1879); *Dobson*, *P. Z. S.* 1881, pp. 393, 690, fig. 6 (digastric: pharynx; larynx; hyoid bones); *id.*, *Proc. R. Soc.* 1881, p. 31 (digastric); *id.*, *Trans. Linn. Soc.* (2) *Zool.* ii. pt. v. p. 260 (1882: digastric); *Rochebrune*, *Faune Sénégal*, *Mamm.* p. 44 (1883); *Jentink*, *Cat. Ost. Mamm.* p. 251 (pt.) (1887: *Gold Coast*); *id.*, *Cat. Syst. Mamm.* p. 136 (1888: *Gold Coast*); *Bocage*, *J. Sci. Lisboa*, (2) i. p. 4 (1889: not known from *Congo* and *Angola*); *Matschie*, *Mitth. D. Schutzgeb.* vi. II. iii. p. 6 (1893: *Gambia*; *Lagos*); *id.*, *SB. Ges. nat. Fr.* 1893, p. 256 (*Accra*; *Lagos*); *id.*, *Mitth. Geogr. Ges. Lübeck*, (2) II. vii.-viii. p. 133 (1894: *Accra*; *Togo*; *Lagos*); *Trouessart*, *Cat. Mamm.* i. p. 88, n. 472 (1897); *Bocage*, *J. Sci. Lisboa*, (2) v. p. 136 (1898: *Bolama*); *Seabra*, *t. c.* p. 165, pl. i. fig. 2 (palate-ridges) (1898: *Bolama*); *Matschie*, *Megachir.* p. 44 (1899); *De Winton*, *Ann. & Mag. N. H.* (7) iv. p. 354 (1899: *Gambaga*); *Trouessart*, *Cat. Mamm.*, *Suppl.* p. 55, n. 506 (1904); *Miller*, *Fam. & Gen. Bats*, p. 67 (1907).
- Pachysoma macrocephala* (sic), *Temminck*, *Esq. Zool.* p. 70 (1853).
- Pteropus* [*Pachysoma*] *macrocephalus*, *Wagner*, *Schreber's Säug., Suppl.* v. p. 606 (1853-55).

- Pteropus megacephalus*, *Swainson, Nat. Hist. & Class. Quadr. (Lardner's Cyclop.)*, pp. 91, 92, fig. 31 (head), p. 356, fig. 154 (front view of dentition) (1835: Gambia).
- Pteropus epomophorus*, *Bennett, P. Z. S.* 1835, p. 149 (12 Feb. 1836: Gambia); *Wagner, Schreber's Säug., Suppl. i.* p. 367 (1839).
- Pteropus whitei*, *Bennett, Trans. Z. S.* ii. pt. i. p. 37, pl. vi. (animal), pl. vii. (structure of hairs) (1836: Gambia); *Waterhouse, Cat. Mamm. Mus. Zool. Soc.*, 2 ed. p. 13, n. 109 (1838: type); *Temminck, Mon. Mamm.* ii. p. 360 (1841); *Rüppell, Mus. Senck. Abh.* iii. H. ii. p. 154, specimens II. A. 8 a, b (1842: Sennaar); *Gervais, Hist. Nat. Mamm.* i. p. 190 (1854); *Hartmann, Zeitschr. Ges. Erdk. Berlin*, iii. p. 40 (pt.) (1868).
- Epomophorus whitei*, *Gray, Mag. Zool. & Bot.* ii. p. 504 (1838); *id., List Mamm. B.M.* p. 38 (1843: Gambia); *id., Voy. 'Sulphur,' Zool.* i. p. 29 (1844); *Tomes, P. Z. S.* 1860, p. 51 (measurements of type); *Gray, P. Z. S.* 1866, p. 65; *Fitzinger, SB. Ak. Wien*, lx. Abth. i. p. 604 (1870).
- Pachysoma whitei*, *Temminck, Esq. Zool.* p. 65 (1853).
- Pteropus [Pachysoma] whitei*, *Wagner, Schreber's Säug., Suppl. v.* p. 607 (1853-55).
- Epomophorus guineensis*, *Bocage, J. Sci. Lisboa*, (2) v. p. 136, fig. 3 (palate-ridges) (1898: Bolama); *Seabra, t. c.* p. 165 (1898).
- Epomophorus macrocephalus a. guineensis*, *Trouessart, Cat. Mamm., Suppl.* p. 55 (1904).
- Epomophorus zechi*, *Matschie, Megachir.* p. 46, pl. x. figs. 3 a c (skull) (1899: Gold Coast; Togo; Lagos); *Trouessart, Cat. Mamm., Suppl.* p. 56, n. 510 (1904).

*Diagnosis*.—Similar to *E. crypturus*, but larger and with relatively longer rostrum and palate. Skull, total length 59.5-62 (males) and 52-55 (females), mandible 47.7-50.2 (males) and 40.8-44.5 (females), e-m<sup>1</sup> 20.8-23.3 (males) and 18-20 (females), forearm 87-93 (males) and 81-86.5 (females). *Hab.* From Senegal and Gambia, east through Sierra Leone, Gold Coast, Togo and Nigeria, to Sennaar and South Abyssinia (Omo R.).

*Description*.—Skull (fig. 36, p. 515) considerably longer than that of *E. crypturus*, owing chiefly to a lengthening of the rostrum and palate. Male skulls show an increase in the length of the postpalatal portion (palation to basion), as compared with male skulls of *crypturus*, of only about 6 per cent., female skulls about 4 per cent., whereas the increase in the length of the palate (incisive foramina to palation) is about 20 per cent. in males, 16 in females. Owing to the disproportionately long rostrum and palate, the median palatal length is in males  $2\frac{1}{3}$  to  $2\frac{1}{2}$ , in females  $2\frac{1}{4}$  to  $2\frac{1}{3}$  the breadth across the external surfaces of m<sup>1</sup>-m<sup>1</sup>; the postdental palate more than (males) or subequal to (females) same breadth; the length of the rostrum, from front of orbit to tip of nasals, much more than e-m<sup>1</sup>; the front of the orbit in both sexes considerably behind m<sup>1</sup>; and the zygomatic breadth considerably less than half the total length of the skull. Palate-ridges (fig. 37 D, p. 516) essentially as in *crypturus*; four interdental, two postdental ridges; fourth ridge at level of fronts of m<sup>1</sup>-m<sup>1</sup>, fifth (anterior postdental) considerably behind a line connecting posterior edges of m<sup>1</sup>-m<sup>1</sup>, sixth rather behind than at middle of postdental palate.

Externally very similar to *E. crypturus*, but conspicuously larger. Vertical fasciæ of mesopatagium of adults varying individually between 13 and 24 (*e. g.* in three adults from Freetown, Sierra Leone, respectively 13, 19, and 24). Hairing of tibia distinctly shorter and thinner than in *E. wahlbergi* and *crypturus*.

Colour of fur of upperside generally some tinge of café-au-lait, or inclining to wood-brown, but varying individually within the same limits as in *E. wahlbergi* and *crypturus*, the darkest and lightest extremes being sometimes represented in specimens from the same locality and season; abdominal patch in adults sometimes present and rather well-defined, though scarcely as sharply marked off as in many *E. anurus*, often obsolescent, indicated only by a rather greyer tinge of the centre of the underparts, often again entirely absent. Of a series of six skins from Thiès, Senegal, all collected in June or July, one has the back a very light tinge of wood-brown (buffy wood-brown), underparts similar, but a little duller, and with an ill-defined lighter area on belly; in a second the back is much darker, dark wood-brown, tinged with pale cinnamon, breast and flanks light greyish hair-brown with middle of belly rather sharply defined greyish-white; in a third the back is an indefinite tinge of brownish, somewhat approaching Prout's brown, though distinctly washed with hair-brown, underparts much lighter; the three others are more or less intermediate. Most of the Togo specimens seen (all alcoholic) are similar to the first of the above described specimens from Thiès, but one is still conspicuously paler (approaching cream-buffy above), while another is as dark as the darkest specimen from Thiès.

*Measurements.* On pp. 545, 547, 549, 551, 553.

*Specimens examined.* Fifty, in the collections of the Leyden (two), Berlin (twenty-one), Frankfurt-on-Main (two), Lisbon (one), and British Museums, from:—

Senegal:—Thiès: six, skulls of four.

Gambia:—Nine, skulls of eight, including the type and four paratypes (all with skulls) of the species, and the type of *Pteropus epomophorus* and *whitei*.

Portuguese Guinea:—Bolama: type of *E. guineensis*.

Sierra Leone:—Freetown: three, with skulls.

Gold Coast:—"Gold Coast," Pel coll.: three; Accra: three, skull of one; Gambaga, N. Territory: three, with skulls.

Togo:—"Togo": two; Kradji: five, skull of one; Kunjuruma: three, including type (with skull) of *E. zechi*; Grand Popo: one.

Nigeria:—Lagos: three, skull of one; Benin: one, with skull; Jebba: one, with skull; Gombe: two.

Sennar (Rüppell Collection):—Two, skull of one.

South Abyssinia (Omo R.):—Djiren, Djimma, 7° 40' N., 37° E., O. Neumann coll.: one, with skull; Djala, Gofa, 6° 20' N., 36° 50' E., O. Neumann coll.: one, with skull.—The skulls and skins of the Sennar and Omo River specimens have been compared directly with western specimens and found identical; palate-ridges as in these, not as in *E. pousarguesi*.

*Earliest technical names.*—A series of specimens collected by Lieutenant Rendall at Gambia were brought to London by his brother



and exhibited before the Zoological Society on the 14th of July, 1835. Specimens of this series were described by three authors under five names. *Pteropus gambianus* (Ogilby, 9 Oct. 1835) is the name of the female, *Pt. macrocephalus* (Ogilby, same date) that of the male, *Pt. megacephalus* a name suggested by an author (Swainson, 1835) who had access to the same series, *Pt. epomophorus* (Bennett, 1836) that of the male with large erected epaulettes, *Pt. whitei* (Bennett, 1836) the latter specimen renamed in honour of Gilbert White of Selborne. *Pt. gambianus* has page priority of *macrocephalus*; whether *megacephalus* was published earlier or later in 1835 than either of these is unknown. The type (fixed by Tomes) and four paratypes of *gambianus* and the type skin (skull lost) of *epomophorus* and *whitei* are in the collection; the type of *macrocephalus* (fixed by Tomes) was, like the foregoing, once in the collection of the Zoological Society, then passed into Tomes's possession, but is now apparently lost; the type of *Pt. megacephalus* cannot be pointed out with certainty, only so much being sure that it was one of Rendall's specimens. The type skulls of *Pt. gambianus* and *macrocephalus* were figured by Tomes (1861, *l. c.*), and these figures alone would be sufficient evidence that *gambianus* is the female, *macrocephalus* the male of one species. By Peters, Gray, and Dobson the name *gambianus* was unfortunately transferred to *E. wahlbergi*, for which species it since then has been in general use.

*Epomophorus guineensis*, Bocage; 1898.—Type, in the Lisbon Museum, a mounted adult male, skull extracted, collected at Bolama, Portuguese Guinea, by Sr. Damasceno da Costa. Type skin examined, skull not seen. The only tangible difference between the type and an ordinary *E. gambianus* would seem to be that the normal fourth (posterior interdental) palate-ridge is represented by two distinct ridges, the one at the posterior edges of  $p^1$ - $p^1$ , the other at the posterior edges of  $m^1$ - $m^1$ ; none of the other ridges differing in position. Probably an abnormal *E. gambianus*. Third metacarpal 62.5 mm. (forearms broken).

*Epomophorus zechi*, Matschie; 1899.—Lectotype, skin and skull of an adult male, Kunjurma, Togo, Baumann coll., Berlin Museum 10170 (skin) and 10171 (skull). The type as well as the other specimens in the Berlin Museum referred by Matschie to *E. zechi* are in every respect indistinguishable from *E. gambianus*. Measurements of type: skull, total length —?, mandible 50,  $c$ - $m^1$  23.3, third metacarpal 65 mm. (forearms incomplete).

<i>a-c.</i> ♂ yg. ad., ♀ yg. ad., ♀ imm. sks.; skulls.	Thiès, Senegal; 8. 10 June. 4 July, 1907.	F. W. Riggensbach [C.].	9.11.2.26-28.
<i>d-f.</i> 2 ♀ yg. ad., 1 ♀ imm. sks.; skulls.	Gambia.	Lieut. Rendall [C.].	{ 74 <i>a-c.</i> 124 <i>b-d.</i>
<i>g.</i> ♀ yg. ad. sk.; skull.	Gambia (Rendall).	Tomes Coll.	7.1.1.231. (Paratype of species.)
<i>h.</i> ♀ ad. sk.; skull.	Gambia (Rendall).	Tomes Coll.	7.1.1.233. (Type of species.)

i. ♂ ad. sk.	Gambia ( <i>Rendall</i> ).	Tomes Coll.	7.1.1.232.
j. ♀ imm. sk.; skull.	Gambia.	(Type of <i>Pteropus epomophorus</i> and <i>whitei</i> ). Purchased.	43.12.29.15.
k-m. 2 ♂ ad., 1 ♀ yg. ad. al.; skulls.	Freetown, Sierra Leone.	Sir H. H. Johnston [P.].	83.4.24.1-3.
n-p. ♂ ad., ♀ yg. ad., ♀ juv. sks.; skulls.	Gambaga, Gold Coast, N. Territory, 1300'; 20 Aug., 15 Dec. 1898.	Lieut.-Col. W. Giffard [P.].	99.6.15.1-3.
q. ♂ ad. al.	Lagos.	Sir A. Moloney [P.].	95.5.5.1.
r. ♀ imm. al.	Lagos.	A. Millson, Esq. [C. & P.].	93.1.7.1.
s. ♂ ad. al.; skull.	Benin, Niger Delta.	A. Millson, Esq. [P.].	94.7.25.9.
t. ♀ imm. al.; skull.	Jebba, N. Nigeria ( <i>Capt. Abadie</i> ).	Dr. C. Christy [P.].	99.8.24.10.
u, v. ♂ imm., ♀ imm. sks.	Gombe, N. Nigeria.	Alexander-Gosling Expedition [P.].	7.7.8.27.28.

## 7. *Epomophorus angolensis*, Gray.

*Epomophorus gambianus* (pt.), Dobson, Cat. Chir. B. M. p. 10.

*Epomophorus macrocephalus* var. *angolensis*, Gray, Cat. Monk. &c. p. 125 (1870: "Angola").

*Epomophorus angolensis*, Matschie, *Megachir.* p. 47 (pt.) (1899: Benguela; Swakopmund); Trouessart, Cat. Mamm., Suppl. p. 55, n. 512 (pt.) (1894).

*Epomophorus macrocephalus* (nec Ogilby), Peters, P. Z. S. 1872, p. 364 (Benguela).

*Epomophorus gambianus* (nec Ogilby), Dobson, Cat. Chir. B. M. p. 10 (pt.) (1878: Benguela); Trouessart, Rev. & Mag. Zool. (3) vi. p. 208, n. 334 (pt.) (1879); Matschie, Mitth. Geogr. Ges. Lübeck, (2) H. vii.-viii. p. 133 (pt.) (1894: Benguela); Trouessart, Cat. Mamm. i. p. 88, n. 476 (1897).

*Diagnosis*.—Similar to *E. gambianus*, with four interdental and two postdental palate-ridges, but arrangement of fourth, fifth, and sixth ridges different (fig. 37 B, p. 516). Skull, total length 58.5-61.5 (males), mandible 47.8-50.5 (males), c-m<sup>1</sup> 20.5-22.2 (males) and 17.5 (female), forearm 87.5-91 (males) and about 82.5 mm. (female). *Hab.* Benguela and Damaraland.

*Description*.—Fourth palate-ridge situated much nearer the third than the fifth ridge, the interspace between third and fourth about half that between fourth and fifth; fourth ridge therefore at level of middle (or posterior half) of p<sup>1</sup>-p<sup>1</sup>, entirely in front of a line connecting anterior edges of m<sup>1</sup>-m<sup>1</sup>, whereas in *E. gambianus* and allied forms the ridge is situated midway between third and fifth, entirely between fronts of m<sup>1</sup>-m<sup>1</sup>. Fifth ridge so closely behind tooth-rows as to be touched, or even slightly cut, by a line connecting hinder edges of m<sup>1</sup>-m<sup>1</sup>; in *gambianus* always some distance behind tooth-rows. Sixth ridge at or a little in front of (in *gambianus* rather behind) middle of postdental palate.—Other characters essentially as in *gambianus*. Skull perhaps averaging slightly



## Epomophorus: External measurements of males (1.).

	<i>E. w. ballemani.</i>		<i>E. w. walthergi.</i>		<i>E. labiatus.</i>		<i>E. minor.</i>	
	4 ♂ ad. Chinchico; Loanda.	5 ♂ ad., incl. type of <i>neumanni</i> ; Kitui; Malindi; Mombasa; Dar-es-Salaam.	5 ♂ ad., incl. type of <i>stahlmanni</i> ; Ft. Hall; Moshi; Zanzibar; Usaramo.	8 ♂ ad., incl. type of species; Zambesia; Zululand; Tugela; Grahamstown.	4 ♂ ad. Sennar (Botta); Roseires; Abyssinia; Let Marecia.	5 ♂ ad., incl. type of species; Shoa; Farre; Pangani; Zanzibar; Bagamoyo.		
Forearm	Min. 78 Max. 87	Min. 77 Max. 85	Min. 81.5 Max. 89	Min. 81.5 Max. 89	Min. 62 Max. 66.5	Min. 62 Max. 64		
Pollex, total length, c. u.	34	37.5	35.5	36.5	26.5	25		
" metacarpal	11.5	13.5	12.5	14	10	11		
" 1st phalanx	17	18.5	17.5	18	12.5	13		
2nd digit, metacarpal	38	41.5	41	41.5	29.5	30		
" 1st phalanx	8.5	9.5	9	9	6	6		
" 2nd-3rd phalanx, c. u.	10	12	11	12.5	8	7.5		
3rd digit, metacarpal	56	61	57.5	59	44	43		
" 1st phalanx	35	38	36	37	26.5	27.5		
" 2nd phalanx	48	54.5	48	48	38	37.5		
4th digit, metacarpal	53	57	54	56	42	41		
" 1st phalanx	26	28.5	26	27	20	19.5		
" 2nd phalanx	31	33	31	31	23	21		
5th digit, metacarpal	53	57.5	54.5	56	41.5	41		
" 1st phalanx	25	27.5	25.5	27	19.5	19		
" 2nd phalanx	26	29	27	27.5	20.5	21		
Ear, length from orifice	22.5	24	23	23.5	18	17.5		
" greatest width, flattened	16.5	18	18	18	12	12		
Tail	0	5	1	2	0.5	0.5		
Interfemoral in centre, depth	4.5	8	4.5	5	6	6.5		
Tibia	30.5	35	31.5	32	25	25.5		
Foot, c. u.	22	23	22.5	24	18	17		
Calcaneal	7	9	8	9	5.5	5		

## Epomophorus: External measurements of males (II.).

	<i>E. anurus</i> , 6 ♂ ad., incl. cotype of species. Bongo; Dad Majok; Uganda; Ruwenzori; Mt. Elgon.		<i>E. crypturus</i> , 2 ♂ ad. Masembeti; Zoutpansberg.		<i>E. gambianus</i> , 14 ♂ ad. Gambia; Bolama; Sierra Leone; Gold C.; Togo; Nigeria; Senнар.		<i>E. angulatus</i> , 3 ♂ ad. Benguela (Monteiro); Damaraland.	
	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.
Forearm .....	71.5	78	81	85.5	87	93	87.5	91
Pollex, total length, c. u. ....	31.5	33.5	31.5	34.5	36	39.5	36.5	38.5
" metacarpal .....	10.5	11.5	12	12.5	11.5	13.5	...	12.5
" 1st phalanx .....	14.5	16	16	17	18.5	20	...	20.5
2nd digit, metacarpal .....	36	39	37.5	42	42.5	46	41	44.5
" 1st phalanx .....	7.5	8.5	9	9.5	8.5	11	9.5	10.5
" 2nd-3rd phalanx, c. u. ....	9.5	10.5	9	10.5	11	12.5	11.5	12.5
3rd digit, metacarpal .....	51	55.5	57	60	61	65.5	62	64.5
" 1st phalanx .....	31.5	35.5	36	37.5	39	42	40	41.5
" 2nd phalanx .....	44	49	47	48.5	52	60	54.5	56
4th digit, metacarpal .....	48.5	53.5	53	56.5	58	62	59.5	61
" 1st phalanx .....	23.5	26.5	26.5	28	28	30.5	29	30
" 2nd phalanx .....	25.5	29	28.5	30	31	34.5	33	33.5
5th digit, metacarpal .....	48	52.5	53	56.5	57	62	58	60
" 1st phalanx .....	23	25	26.5	26.5	26.5	29.5	28.5	30.5
" 2nd phalanx .....	23	26	25.5	26	28.5	31.5	29.5	30.5
Ear, length from orifice .....	...	...	...	...	22.5	25	24	25.5
" greatest breadth, flattened ..	...	...	...	...	16.5	18.5	18	19
Tail .....	...	...	...	...	0	4.5	0	+
" greatest breadth, flattened ..	...	...	...	...	4	9	6	6
Interfemoral in centre, depth ..	29.5	30.5	...	...	34	39.5	36	36
Tibia .....	21	22	...	23.5	23	25.5	...	24
Foot, c. u. ....	...	...	...	...	8	11	7	9
Calcaneal .....	...	...	...	...	...	...	...	...

## Epomophorus: External measurements of females (L.).

	<i>E. w. haldemanni</i> .		<i>E. w. wahlbergi</i> .		<i>E. labiatus</i> . ♀ ad. Sennar (Botta).	<i>E. minor</i> . 5 ♀ ad. Bagamoyo; Gouda.	
	11 ♀ ad., incl. type of <i>zeheri</i> . Gaboon; Chin- choso; Loanda.	6 ♀ ad. Kitui; Taka- ungu; Mom- basa; Zanzibar.	5 ♀ ad. Zanzibar; Dar-es-Salaam; Usarano.	7 ♀ ad., incl. type of <i>unicolor</i> . Zambia; Inhambane; Grahamstown.		Min. mm.	Max. mm.
Forearm .....	Min. 74 Max. 81.5	Min. 72 Max. 80	Min. 78 Max. 85	Min. 80 Max. 86	mm. 66	Min. 60 Max. 65	Min. 25 Max. 27
Pollex, total length, c. u. ....	33	31.5	33.5	34	...	8.5	9.5
" metacarpal .....	12	11	12.5	12	...	12	13.5
" 1st phalanx .....	15.5	15.5	17	16	...	29	32.5
2nd digit, metacarpal .....	34	33.5	39	39	30	5.5	7
" 1st phalanx .....	8.5	7.5	9	9	8	7.5	8.5
" 2nd phalanx .....	10	9.5	10.5	10.5	9	43.5	46
3rd digit, metacarpal .....	51	50	54	56	47	27.5	29.5
" 1st phalanx .....	34	32	35	36.5	29.5	37	43
" 2nd phalanx .....	44.5	43.5	46	47.5	45	41	44
4th digit, metacarpal .....	48.5	47	52	54	45	19	21.5
" 1st phalanx .....	24	23	26	27	22.5	21.5	24
" 2nd phalanx .....	28	27	29	29	24	40.5	43.5
5th digit, metacarpal .....	47	46.5	52	54	44.5	18.5	20.5
" 1st phalanx .....	23.5	22	24	25	21	18.5	19.5
" 2nd phalanx .....	25	24	26	26.5	21	13.5	14.5
Ear, length from orifice .....	20	19.5	22	21	...	1	...
" greatest breadth, flattened .....	16	16	18	18	...	5	6
Tail .....	2	3	5	3	...	23	18
Interfemoral in centre, depth .....	3	3.5	5	2	...	17	18
Tibia .....	29	28.5	30	31	...	5.5	6
Foot, c. u. ....	19.5	19.5	21	20	...	...	...
Calcaneal .....	6.5	6	6.5	5.5	...	...	...

	<i>E. aurus</i> , 11 ♀ ad., incl. cotyle of species and type of <i>doris</i> , Bogos; Abyssinia; Bah-el-Ghazal; Uganda; B. E. Africa; Massailand.	<i>E. crypturus</i> 4 ♀ ad., incl. type of species, Katanga; Tette; Umfuli R.	<i>E. gambianus</i> , 13 ♀ ad., incl. type of species, Thies; Gambia; Sierra Leone; Gold C.; Togo; Senaar; Djiren, Djumma.	<i>E. angolensis</i> , ♀ ad., Damaraland.	<i>E. pousarguesi</i> , ♀ ad., Type.	
	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Forearm .....	65.5	74	79	80	81	82.5
Pollex, total length, c. u. ....	30	33	33	35	34	38.5
" metacarpal .....	10	11.5	11	12	11	14
" 1st phalanx .....	13.5	16.5	16	17.5	15	20
2nd digit, metacarpal .....	33	37.5	39	40	40	45
" 1st phalanx .....	7	8.5	8	8.5	8	10
" 2nd-3rd phalanx, c. u. ....	8	10.5	10	11	10.5	13
3rd digit, metacarpal .....	48	53.5	54.5	56.5	56	63
" 1st phalanx .....	20.5	36	36.5	39	37	41
2nd phalanx .....	41.5	48.5	49	53.5	49	55
4th digit, metacarpal .....	45	50	52.5	54.5	53.5	60
" 1st phalanx .....	22	26	25.5	27.5	27	30
2nd phalanx .....	24	29.5	29.5	31	30	33
5th digit, metacarpal .....	45	50.5	52	54	53.5	60.5
" 1st phalanx .....	21.5	25	24.5	26	27	29.5
2nd phalanx .....	20.5	26	25.5	27.5	26.5	30.5
Ear, length from orifice .....	19	21	23	23	21.5	24
" greatest breadth, flattened .....	14	15.5	...	16	15	16.5
Tail .....	1	3	...	...	1	4.5
Interfemoral in centre, depth .....	...	...	...	...	...	...
Tibia .....	...	...	...	...	3.5	8
Foot, c. u. ....	28	30.5	29.5	30	32	36.5
Calcaneus .....	19	22.5	21	24	22	26
Calcaneus .....	...	6.5	...	7.5	7.5	10.5

## Epomophorus: Measurements of male skulls (I.).

	<i>E. m. haldemani</i> . 2 ♂ ad. Loanda.		<i>E. m. haldemani</i> . 5 ♂ ad., incl. type of <i>neumannii</i> . Kitui; Malindi; Mombasa; Dar-es-Salaam.		<i>E. w. wahlbergi</i> . 4 ♂ ad., incl. type of <i>stuhlmanni</i> . Ft. Hall; Moshi; Zanzibar; Usaramo.		<i>E. w. wahlbergi</i> . 8 ♂ ad., incl. type of species. Zambesia; Natal; Grahamstown.		<i>E. labiatus</i> . 3 ♂ ad. Senmaar (Botta); Roseires; Let Marefia.		<i>E. minor</i> . 4 ♂ ad., incl. type of species. Shoa; Farri; Zanzibar; Bagamoyo.	
	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.
Skull, total length to gnathion .....	47	51	48	50	52	55.5	53	55	37.2	39.7	35.8	37
" palation to incisive foramina .....	24.5	27.5	25	26.2	27	29.8	26.8	28.8	20.8	22	19.5	20
" palation to basion .....	16	17.8	16.8	...	17.8	19	18.8	19	12	...	...	11.8
" postidental palate .....	10.2	11.7	10.5	11.5	10.7	12	11	11.8	8.2	9	8.2	9
" front of orbit to tip of nasals .....	17.5	18.8	17.8	18.2	19	21.2	19.5	20.8	12.5	14.2	12.2	12.7
" width of brain-case at zygomatica .....	17.5	17.8	17.2	17.5	18	19	18.5	19.5	...	15.8	14.5	15.5
" zygomatic width .....	25.8	27.5	26	28	27.8	29.5	28.5	30	21	...	20.8	21.7
" across crowns of m <sup>1</sup> , externally .....	13.5	14.5	13.7	14.8	14.2	15.8	15.2	16.5	10.8	11.5	10	10.8
" lachrymal width .....	12.5	14	12.7	14.8	14.2	15.5	14.5	16	10	...	10.2	11
" across crowns of canines, externally .....	9	10.2	9.6	10.5	10.5	11	10.8	11.5	7.6	7.8	7.3	7.7
" postorbital width .....	9.2	10	10	10.3	9.8	10.3	9	10.7	...	...	...	...
" interorbital width .....	7.8	8.8	8.6	9	9	10	9	10.2	6.2	6.8	6.8	6.8
" width of mesopterygoid fossa .....	7.2	7.8	7.8	7.8	8	8.7	8	8.5	...	6	...	6
" between p <sup>4</sup> -p <sup>4</sup> , internally .....	8	8.5	8.2	8.8	8.8	9.8	9	9.8	6.5	6.8	...	6.5
" between cingula of canines .....	4.5	5.5	5	5.8	5.5	6	5.2	6	4	4	3.7	4.2
" orbital diameter .....	9.8	10.5	10	10.8	10.2	11	10.8	11	...	8.5	8.2	8.3
Mandible, length from condyle .....	38.8	41.5	38.8	40.5	41.8	44.8	43	45	28	31.2	28	29.8
" coronoid depth .....	...	16.7	16.5	17.5	17	18.5	17	19.2	...	12	11	12
Upper teeth, c-m <sup>1</sup> , crowns .....	16.8	17.8	16.6	18	18	19.2	18	19	13.2	15	12.8	13
Lower teeth, c-m <sub>2</sub> , crowns .....	18.8	20	18.8	20	20	22	20.3	21.2	14.5	16	14	14.8



Epomophorus: Measurements of male skulls (11.).

	<i>E. anurus</i> . 6 ♂ ad., incl. cotype of species. Bongo; Dad Majok; Uganda; Ruwenzori; Mt. Elgon.		<i>E. crypturus</i> . 3 ♂ ad. Shupanga; Masembeti; Zoutpansberg.		<i>E. gambianus</i> . 7 ♂ ad., incl. type of <i>zechi</i> . Sierra Leone; Gold C.; Togo; Nigeria; Sennar.		<i>E. angolensis</i> . 5 ♂ ad. Benguela (Monteiro); Damaraland.	
	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.
Skull, total length to gnathion .....	46	48.8	52	56	59.7	62	58.5	61.5
" palation to incisive foramina .....	25.2	27	29.2	31	35	37.5	...	34.5
" palation to basion .....	14	15	16	17.2	17	18	...	20
" postdental palate .....	11.2	12.8	13	14	15	17.2	...	...
" front of orbit to tip of nasals .....	16.3	18.7	20.8	21.8	24	27	...	25.5
" width of brain-case at zygomatic .....	15.8	17	17.8	18	18.7	19.7	...	19
" zygomatic width .....	23.2	25	26.5	27	28	29	...	27.8
" across crowns of m <sup>1</sup> , externally .....	12.2	13	13.8	14	14	16	15.8	16.5
" lacrymal width .....	12	13	12	14.5	13.8	15	...	14.2
" across crowns of canines, externally ..	8.5	9.5	10	10.5	10.2	11.2	...	10.8
" postorbital width .....	9.8	11	9	10	9.8	11.2	...	10.2
" interorbital width .....	7.2	8.8	7.8	8.8	8.7	9.5	...	9
" width of mesopterygoid fossa .....	6.8	7.8	7.8	8.2	8.7	9.2	...	8.2
" between p <sup>4</sup> -p <sup>1</sup> , internally .....	7.7	7.8	8	8.7	8.8	10.2	9.5	10.2
" between cingula of canines .....	4.5	5	5.2	6	5	6.8	...	6.2
" orbital diameter .....	9.5	10	10.2	10.5	10.5	11.2	...	11
" Mandible, length from condyle .....	36.8	38.7	42	43.8	47.7	50.2	47.8	50.5
" coronoid depth .....	13.8	15	16.5	18	17	19.8	...	16.2
" Upper teeth, c-m <sup>1</sup> , crowns .....	16	17.2	18	19	20.8	23.3	20.5	22.2
" Lower teeth, c-m <sub>2</sub> , crowns .....	17.7	19	19.5	20.2	22.8	24.3	22.5	23.5

## Epomophorus: Measurements of female skulls (I.).

	<i>E. w. haldemanni</i> . ♀ ad., incl. type of <i>zenkeri</i> . Gaboon; Chino- choxo; Loanda.		<i>E. w. wachtherqi</i> . 3 ♀ ad. Zanzibar; Usaramo.		<i>E. w. wachtherqi</i> . 6 ♀ ad., incl. type of <i>unicolor</i> . Zambesia; Grahamstown.		<i>E. minor</i> . 3 ♀ ad. Bagamoyo; Gonda.	
	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.
Skull, total length to gnathion .....	44	49	43	47.8	46	50.5	37	...
" palation to incisive foramina .....	22.2	24.8	22	24	23.8	26.5	19	19.7
" palation to basion .....	15	16.5	16	16.5	16	17.5	12	...
" postdental palate .....	8.5	9.8	8	9.5	9.5	11	8.4	...
" front of orbit to tip of nasals .....	15.2	17	14.8	16.5	16.2	18	12.8	12.8
" width of brain-case at zygomatica ..	16.8	17.8	16.2	17.2	18	18.8	...	14.5
" zygomatic width .....	25	26	24.2	26	26.5	28	...	21
" across crowns of m <sup>1</sup> , externally ..	13	14.2	13	14	14.2	14.7	...	11
" lachrymal width .....	12.2	13	12.8	13.5	13.5	13.7	10.2	10.5
" across crowns of canines, externally	9	9.8	8.8	9.5	9.2	10	7	7.7
" postorbital width .....	9.2	10.2	8.8	9.5	9.3	9.7	...	8.8
" interorbital width .....	7.8	8.5	7.8	8.5	8.8	9	7	7.2
" width of mesopterygoid fossa .....	6.7	7.2	7.5	7.8	7.2	8.8	...	6
" between p4-p4 internally .....	7.8	8.7	7.8	8.2	8.5	8.8	...	6.8
" between angula of canines .....	4.7	5	4.7	5	5	5.2	...	4
" orbital diameter .....	10	10.5	10	10.5	10.3	10.8	8	8.8
" Mandible, length from condyle .....	35	38.5	34.8	37.5	37.5	41	29.8	30
" " coronoid height .....	14.8	15.2	14.2	15.5	15.5	...	...	12.5
" Upper teeth, c-m <sup>1</sup> , crowns .....	15.5	17.2	15	17	16.5	17.8	12	13
" Lower teeth, c-m <sup>2</sup> , crowns .....	17	18.5	17	18.2	18	19.3	13.7	14.2

## Epomophorus: Measurements of female skulls (II.).

	<i>E. anurus.</i> ♀ ad., incl. type of species. Bogos; Abyssinia; Uganda; B. E. Africa.		<i>E. crypturus.</i> 5 ♀ ad., incl. type of species. Katanga; Tette; Unfuli R.		<i>E. gambianus.</i> 7 ♀ ad., incl. type of species. Thies; Gambia; Sierra Leone; Gold C.; Djiren, Djinnia.		<i>E. angolensis.</i> ♀ ad. Damaraland.		<i>E. pousarquesi.</i> ♀ ad. Type.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.		MIN.	
Skull, total length to gnathion .....	mm.	mm.	mm.	mm.	mm.	mm.	mm.		mm.	
" palation to incisive foramina .....	40	45	46.2	49.7	52.2	55	...		55.5	
" palation to basion .....	21.2	25.5	24.8	27.7	29	32	...		...	
" postdental palate .....	12.5	14.3	14.8	15.5	15	16.2	...		...	
" front of orbit to tip of nasals .....	8.8	11	11	13	12	14.8	...		...	
" width of brain-case at zygomata .....	14.2	16.2	17	19.2	21	22.8	...		...	
" zygomatic width .....	15	16	17	17.8	17.5	17.8	...		21.5	
" across crowns of m <sup>1</sup> , externally .....	21	24.5	24.8	25.2	...	26	...		26.5	
" lacrymal width .....	11	13	12.2	14.5	12.8	14.2	...		14.3	
" across crowns of canines, externally .....	11.2	13.5	12	13.5	12.8	13.7	...		13.5	
" postorbital width .....	8	9.2	8.8	9.8	9.7	10.5	...		9.7	
" interorbital width .....	8	9.5	8.8	10.2	9.8	11	...		...	
" width of mesenterygoid fossa .....	6.8	7.2	7.5	8	8	8.8	...		...	
" between p <sup>1</sup> -p <sup>1</sup> , internally .....	6	6.8	6.8	7.8	7.8	8.5	...		...	
" between cingula of canines .....	6.8	7.5	6.8	8.5	8.2	8.8	...		8.8	
" orbital diameter .....	4.2	5	4.3	5.8	5	5.8	...		...	
" Mandible, length from condyle .....	9	9.7	9.8	10	10	10.5	...		...	
" coronoid height .....	31.5	36.5	36.3	39.8	40.8	44.5	...		43.8	
" Upper teeth, c-m <sup>1</sup> , crowns .....	11.8	14.8	14.2	15	15.2	17.8	...		...	
" Lower teeth, c-m <sup>2</sup> , crowns .....	14.6	16	16.2	17.5	18	20	...		19.2	
	15.8	17.5	18	19	19.2	21.8	19		21	

## Epomophorus: Measurements of teeth (I.).

	<i>E. w. haldemani</i> . 12 skulls. Western *.		<i>E. w. wahlbergi</i> . 12 skulls. Northern †.		<i>E. labiatus</i> . 6 skulls ‡.		<i>E. minor</i> . 8 skulls §.
	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	MIN. mm.	MAX. mm.	
p <sup>3</sup> , length .....	2.7	3	3	3.4	2.7	2.9	MIN. 2.1 MAX. 2.4
" width .....	1.8	2.1	1.8	2.1	1.7	1.9	1.3 1.6
p <sup>4</sup> , length .....	3	3.5	3.1	3.8	2.8	3.1	2.5 2.7
" width .....	2	2.2	1.9	2.2	2	2.3	1.6 1.8
m <sup>1</sup> , length .....	3.2	3.8	3.7	4.2	3.1	3.7	2.8 2.9
" width .....	1.8	2.2	1.9	2.2	1.9	2	1.7 1.8
p <sup>3</sup> , length .....	2.5	2.8	2.7	3.2	2.4	2.6	2 2.2
" width .....	1.7	2	1.8	2.2	1.6	1.8	1.2 1.5
p <sup>4</sup> , length .....	2.9	3.2	3	3.7	2.6	2.8	2.3 2.5
" width .....	1.9	2.1	1.9	2.2	1.6	1.9	1.5 1.7
m <sub>1</sub> , length .....	3.1	3.6	3.5	4.1	2.9	3.2	2.5 2.8
" width .....	1.9	2.1	1.9	2.2	1.8	1.9	1.5 1.7
m <sub>2</sub> , length .....	2	2.5	2.2	2.9	2	2.5	1.8 2
" width .....	1.5	2	1.8	2	1.7	1.8	1.2 1.5

\* Gaboon; Cabinda (type of *zeukeri*); Loanda; "Angola" (Monteiro and Welwitsch).† Kiui; Malindi; Takaungu; Mombasa (type and topotype of *neumani*); Dar-es-Salaam; Zanzibar.‡ Mt. Kenya (Smara, Ft. Hall); Kilimanjaro (Moshi); Zanzibar; Vikindo; Usaramo (type and topotypes of *stuhlmanni*); Lindi.§ Shupanga (type and topotypes of *unicolor*); Masembeti, Beira; Inhambane; Zoutpansberg; Zululand; Natal; Tugela R. (type of species); Pondoland; Grahamstown.|| Sennaar, Botta coll. (type and topotype of species); Roseires; Shoa (type of *schwensis*); Let Marefa.

¶ Shoa; Farri; Bagamoyo; Zanzibar (type of species); Gonda, Uganda; Uji.

Epomophorus: Measurements of teeth (II.).

	<i>E. auratus</i> . 21 skulls*.		<i>E. crypturus</i> . 11 skulls †.		<i>E. gambianus</i> . 23 skulls ‡.		<i>E. angolensis</i> . 7 skulls §.		<i>E. pousarguesi</i> . Type.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	mm.	mm.
p <sup>3</sup> , length .....	2.3	3	2.8	3.1	3	3.7	2.8	3.1	3.4	3.4
" width .....	1.6	2	1.8	2.2	1.8	2.2	2	2	2	2
p <sup>4</sup> , length .....	2.8	3.3	3	3.2	3.1	3.8	3.1	3.6	3.6	3.6
" width .....	1.7	2.1	2	2.1	1.8	2.1	2	2.2	2.1	2.1
m <sup>1</sup> , length .....	3	3.8	3.1	3.8	3.4	4	3.5	4	4	4
" width .....	1.7	2.1	2	2.1	1.8	2.1	2	2	2.2	2.2
p <sub>3</sub> , length .....	2.1	2.8	2.5	2.8	2.5	3.2	2.7	3	2.8	2.8
" length .....	1.4	1.8	1.7	1.9	1.7	2	1.8	1.9	1.8	1.8
p <sub>4</sub> , length .....	2.5	3.2	2.9	3.1	3	3.8	2.8	3.3	3.2	3.2
" width .....	1.5	2	1.8	2	1.8	2.1	2	2.1	2	2
m <sub>1</sub> , length .....	2.7	3.5	3	3.4	3	3.8	3.2	3.7	3.7	3.7
" width .....	1.6	2	1.8	2	1.8	2.1	1.8	2.1	2	2
m <sub>2</sub> , length .....	2	2.5	1.9	2.2	2	2.8	2	2.8	2.3	2.3
" width .....	1.5	1.8	1.4	1.8	1.6	1.9	1.8	1.9	1.8	1.8

\* "Bogoss" (type of *doriae*); Abyssinia (Simen); Bellagas; Gofa; Bahr-el-Ghazal (Bongo, one cotype of species; Dad Majok); Uganda and B. E. Africa (Unyoro; Ft. Alice; Mungo; Entebbe; Kiriauno; Ruwenzori; Kirimba; Mt. Elgon).  
 † Katanga; Zomba; Tette (type and topotypes of species); Shupanga; Unfuli R.; Masembeti; Zoutpansberg.  
 ‡ Tlhis; Gambia (type and topotypes of species); Freetown; Gold Coast (Accra; Gambaga); Togo (type of *zeckel*); Nigeria (Benin; Jebbu); Sennar; Djiren, Djinnua; Djala, Gofa.  
 § "Benguel", Monteiro coll. (4, incl. type of species); Damaraland.

13. MICROPTEROPUS, *Matschie*.*Epomophorus* (pt.), Dobson, Cat. Chir. B. M. p. 4.

Type.

1899. *Micropteropus* (subgenus of *Epomophorus*), *Matschie*,  
*Megachir.* pp. 36, 57 ..... *M. pusillus*.  
*Epomophorus* (pt.), *Tomes*, *P. Z. S.* 1860, p. 42; *Peters*, *MB. Ak.*  
*Berlin*, 1867, p. 869; *Dobson*, *l. s. c.* (1878); *Miller*, *Fam. & Gen.*  
*Bats*, p. 65 (1907).  
*Micropteropus*, *Lydekker*, *Zool. Rec.* xxxvi. *Mamm.* p. 25\* (1900);  
*K. Andersen*, *Ann. & Mag. N. H.* (8) v. p. 99, footnote (1910).

*Diagnosis*.—*Epomophorine* section (incisors  $\frac{2}{2}$ — $\frac{2}{2}$ , cheek-teeth  $\frac{3}{5}$  external tail rudimentary, small whitish hair-tufts at base of ears anteriorly and posteriorly, males with shoulder-pouches and “eпаulettes”). Cranial rostrum short and broad, almost *Cynopterine*, palate very broad between  $m^1$ — $m^1$ , abruptly narrowed behind zygomatic processes, maxillary tooth-rows extending backward nearly to orbital cavity, postdental palate depressed posteriorly, palation rim prominent, palate-ridges peculiar (see fig. 39). General size small, forearm about 50–53 mm. [One species. Range, the whole of the western Ethiopian forest region.]

*Skull* (fig. 38).—Length of rostrum (front of orbit to tip of nasals) subequal to breadth across lower edges of lachrymal foramina. Interdental palate broad, maxillary tooth-rows strongly diverging antero-posteriorly, breadth between postero-internal corners of  $m^1$ — $m^1$  much more than twice the breadth between bases of canines; maxillary tooth-rows extending backward very nearly to ventral margin of orbital cavity; palate abruptly narrowed immediately behind zygomatic processes of maxillaries, breadth of postdental palate at middle therefore slightly less than (or at most equal to) its length and only about three-fourths of breadth between  $m^1$ — $m^1$ ; postdental palate distinctly depressed posteriorly, hinder edge raised and prominent (compare *Epomophorus*), lateral edges subparallel, mesopterygoid fossa broad. Premaxillæ in contact anteriorly but not fused, tapering above to a recurved point. Brain-case flattened (*Epomophorine*), basiscranial axis only slightly deflected against facial axis. Temporal ridges rather broadly separated (no sagittal crest), postorbital much greater than interorbital breadth, zygomata deeper at middle than anteriorly and posteriorly, zygomatic processes of squamosals nearly horizontal (not drawn upward in a strong curve by fascia temporalis), postorbital processes short and thin. Rami of mandible slender, coronoid rather broad but low and sloping, angular process weak and broadly rounded off, condyle distinctly above level of alveolar line.

\* Miswritten *Micropterus*.

Dentition (fig. 38).— $\frac{i^1 i^2 c \quad p^3 p^4 m^1}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2} = 28$ . Dental formula and characters of individual teeth as in *Epomophorus* and *Epomops*, but dentition on the whole weaker, and, in conformance with the shortening of the facial portion of the skull, the diastemas  $c-p^3$  and  $c-p_3$  narrower.

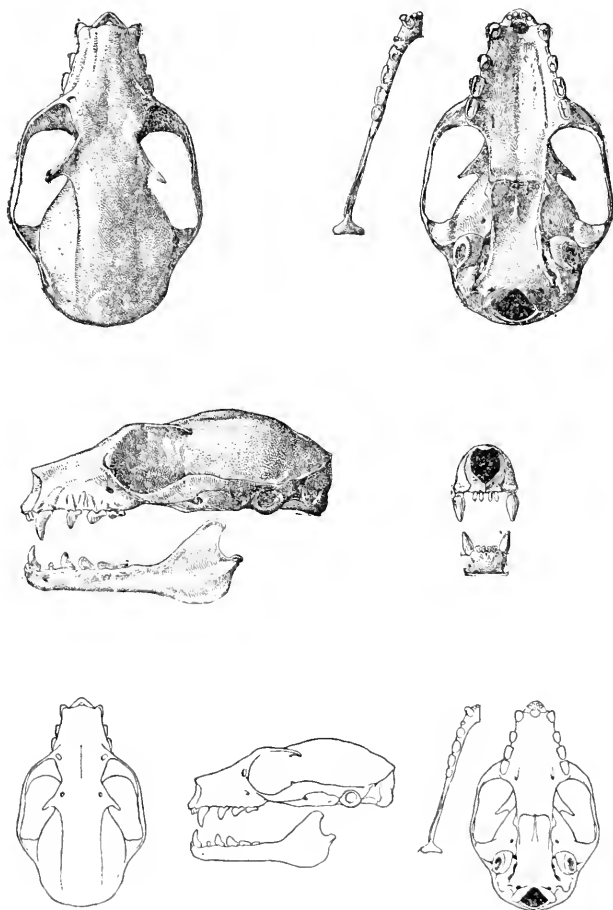


Fig. 38.—*Micropteropus pusillus*, ♂. Liberia. No. 8.7.27.2.  
Upper and middle row  $\frac{1}{2}$  (linear), lower row  $\frac{1}{4}$ .

*Palate-ridges* (fig. 39).—Five thick and prominent ridges, and two (or three) inconspicuous thin and serrate ridges close together at palation rim. First ridge at canines and postcanine diastemas, undivided, hastate, with the point directed backward. Second to fifth ridges divided by a deep groove extending along median line of palate, broadest in front and gradually narrowing posteriorly ;



Fig. 39.—Palate-ridges of *Micropteropus pusillus* (8.7.27.2).  
 $\frac{3}{2}$  (linear).

thus divided in the middle the ridges form four thick triangular prominences along either border of the groove ; for position of these prominences see figure.

*External characters*.—General aspect as *Epomophorus*, but muzzle much shorter, centre of eye almost midway between ear and nostril (in *Epomophorus* much nearer the former), lips less expansible, ears relatively much shorter but scarcely differing in shape, and size of animals smaller. External tail generally more easily detected by touch than by eye (caudal vertebræ three). Interfemoral well developed in centre (depth about 3–6 mm.) and laterally, calcar one-third to one-fourth of hind foot with claws (compare *Plerotes*). Vertical fasciæ of mesopatagium (those crossing in antero-posterior direction the main internal cutaneous line) few, 11–16 ; membranes arising low down on sides of back and inserted posteriorly at middle or distal half of first phalanx of second toe. Pollex and metacarpals and terminal phalanges of third, fourth, and fifth digits a little longer than in *Epomophorus*. The table below shows in the upper row the wing-indices of *Micropteropus* calculated from measurements of eight adult individuals, in the lower row those of *Epomophorus* for comparison :—

Forearm.	Pollex c.u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c.u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	441	472	104	132	699	443	612	674	324	382	672	315	336
1000	411	471	109	127	680	436	594	647	320	358	641	309	315



*Sexual differentiation.*—Adult males with deep shoulder-pouches and erectile epaulette-like hair-tufts ("when erected the tuft had a vibratory movement," collector's label, B.M.); adult females without epaulettes, but often (like subadult males) with distinct though much shallower pouches. Males scarcely differing from females in size.

*Affinities.*—*Micropteropus* has probably originated from a bat closely allied to but more primitive than the living species of *Epomophorus*. The distinctly depressed postdental palate and prominent palation rim are characters unknown in all genera of Megachiroptera except these two. But whereas the skull of *Epomophorus* shows a remarkable, in its extreme phase even excessive, lengthening and narrowing of the rostrum, *Micropteropus* has taken the opposite line of development, the rostrum being almost as short and heavy as in *Cynopterus*. The palate-ridges of *Micropteropus*, though different in total aspect from those of any other genus of Megachiroptera, undoubtedly exhibit only the climax of certain modifications present, in initial stages, in various *Epomophorine* bats; the five ridges of *Micropteropus* are probably homologous with the five ridges of *Epomops dobsoni* (fig. 31 C, p. 489), with which they closely correspond in position; in *E. dobsoni* (as in all species of *Epomophorus*, compare also *Nanonycteris*) the first ridge is slightly, in *Micropteropus* strongly hastate; in *E. dobsoni* the fourth and fifth ridges are modified into two pairs of triangular prominences, in *Micropteropus* not these ridges only, but also the second and third are similarly modified and separated by a deep and broad median groove. In the distribution and general colour of the fur the present genus is very similar to *Epomophorus*, and like the smallest species of that genus (*E. labiatus* and *minor*) it has not developed any appreciable sexual difference in size.

### 1. *Micropteropus pusillus*, Pet.

*Epomophorus pusillus*, Dobson, Cat. Chir. B. M. p. 14.

*Epomophorus schoënsis* (nec Heuglin), Tomes, P. Z. S. 1860, p. 56 (Gambia; Gaboon); *id.*, op. cit. 1861, pl. i. figs. 4, 4 a (skull: Gaboon).

*Epomophorus pusillus*, Peters, MB. Ak. Berlin, 1867 (19 Dec.), p. 870 (Yoruba); *id.*, J. Sci. Lisboa, iii. p. 123 (1871: Angola); Dobson, Cat. Chir. B.M. p. 14, pl. ii. fig. 6 (palate-ridges) (1878: Abeokuta; Lagos; Gaboon); Trouessart, Rev. & Mag. Zool. (3) vi. p. 208, n. 337 (1879); Dobson, P. Z. S. 1881, pp. 690, 693 (pharynx; larynx; hyoid bones); Peters, SB. Ges. nat. Fr. 1881, p. 132 (Malange, Loanda); Dobson, Trans. Linn. Soc. (2) Zool. ii. pt. v. pp. 260, 261 (1882: digastric); Rochebrune, Faun. Sénégal., Mamm. p. 45 (1883); Jentink, Notes Leyd. Mus. x. p. 51 (1887: Little Cola, Liberia); *id.*, Cat. Ost. Mamm. p. 252 (1887: Robertsport, Liberia); *id.*, Cat. Syst. Mamm. p. 138 (1888: Robertsport and Little Cola, Liberia; Congo); Bocage, J. Sci. Lisboa, (2) i. p. 15 (1889: Loanda); Noack, Zool. Jahrb., Syst.

iv. p. 206, pl. v. figs. 54, 55 (skull) (1889: Banana and Netonna, Congo); *Thomas, P. Z. S.* 1890, p. 446 (Kiriama); *Büttikofer, Reisebild. Liberia*, ii. p. 471 (1890); *Matschie, Mitth. D. Schutzgeb.* vi. H. iii. p. 6 (1893: Bismarekburg); *id.*, *Mitth. Geogr. Ges. Lübeck*, (2) H. vii.-viii. p. 133 (pt.) (1894: Togo; Lagos; Cameroon; Gaboon; Chinchoxo; Malange; Pungo Andongo); *Ponsargues, Ann. Sci. Nat.* (7) Zool. iii. p. 255 (1896: French Congo; Kemo, Oubangui-Shari region); *Trouessart, Cat. Mamm.* i. p. 89, n. 480 (1897); *Bocage, J. Sci. Lisboa*, (2) v. p. 137 (1898: Angola); *Seabra, t. c.* p. 166 (1898); *De Winton, Ann. & Mag. N. H.* (7) iv. p. 354 (1899: Gambaga); *Thomas, in Johnston's The Uganda Protectorate*, i. p. 421 (1902); *Cabrera, Mem. Soc. Esp. H. N.* i. Mem. i. p. 6 (1903); *Thomas, Ann. & Mag. N. H.* (7) xiii. p. 406 (1904: Canhoca); *Miller, Fam. & Gen. Bats*, p. 67 (1907).

*Epomophorus* (*Micropteropus*) *pusillus*, *Matschie, Megachir.* p. 58 (1899: Togo; Lagos; Cameroon; Chinchoxo; Malange; Pungo Andongo; Ngoroine, Ngare Dobash); *Neumann, Zool. Jahrb., Syst.* xiii. p. 537 (1900: Ngoroine); *Trouessart, Cat. Mamm., Suppl.* p. 58, n. 526 (1904); *Lönnberg, Ark. Zool.* iv. n. 16, p. 2 (1908: Mukimbungu, Lower Congo).

*Fur*.—Rather short, silky, closely adpressed on underparts. Approximate length, middle of back 9, nape of neck 8, belly 6 mm. Distribution of fur as in *Epomophorus* (see p. 521).

*Colour*.—♂ ad. skin, teeth slightly worn, Canhoca, Loanda, 19 Nov.:—Back brownish fawn (café-au-lait distinctly washed with fawn), head and nape of neck similar but slightly lightened with wood-brown; breast and belly drab; tufts at base of ears and epaulettes whitish, the latter narrowly encircled by brownish-black hairs. The majority of skins examined, independent of locality, season, sex, and age, are essentially similar to this, though the general colour of the upperside varies somewhat in tinge between a more wood-brown and more brownish café-au-lait. A single skin (same locality, date, sex, and age as the above-described Canhoca skin) is conspicuously lighter, buffy wood-brown above, breast and belly drab, passing into light grey on flanks. Evidently the individual variation in colour is quite similar to that of the species of *Epomophorus*.

*Measurements*. On pp. ~~563~~, ~~564~~.

*Specimens examined*. Fifteen, viz. those catalogued below, one from Yoruba (Berlin Museum, 3438), one from Bongo, Bahr-el-Ghazal (Stuttgart Museum, 1092, Heuglin coll.), and one from Liberia (skeleton, Leyden).

*Range*. From Gambia, along the Guinea coast, east to Bahr-el-Ghazal (Bongo), the Semliki River (Kiriama), and the eastern side of Victoria Nyanza (Ngare Dobash), south to Loanda.

*Cotypes*.—First described and the skull figured by Tomes (1860, 1861), who wrongly identified it with Rüppell's *Epomophorus schoënsis*. Recognized as a distinct species and named *E. pusillus* by Peters (1867). Technically the name *pusillus* hangs on Tomes's description and figures, not on the Yoruba specimen (Berlin Museum,

no. 3438) incidentally mentioned but not described by Peters. Tomes's description of *E. schoënsis* was based on two specimens ticketed Gambia and acquired by him at the dispersal of the Museum of the Zoological Society, and on one in the Paris Museum received from Gaboon together with the specimen described by Tomes as *E. franqueti*. The Gambia cotypes are probably no longer in existence; in any case they are not in the Tomes Collection lately acquired by the British Museum. Also the Gaboon specimen appears to be lost; the writer has not found it in the Paris Museum nor even any record of it in the old or new registers of the Chiroptera of that collection. Gambia may be fixed as the type locality of the species.

a. ♀ imm. al.; skull.	Bathurst, Gambia.	Dr. P. Rendall [C.].	89.3.2.1.
b. ♂ ad. al.; skull.	Liberia.	Dr. A. McCloy [P.].	8.7.27.2.
c. ♂ ad. sk.; skull.	Gambaga, Gold Coast, N. Territory, 1300'; 25 July, 1898.	Lieut.-Col. W. Giffard [P.].	98.10.24.1.
d. ♀ ad. al.; skull.	Lagos.	Purchased (Cut-ter).	72.10.24.6.
e, f. 1 ♀ ad., 1 imm. sks.; skulls.	Abeokuta, Lagos.	F. Nicholson, Esq. [P.].	Not reg.
g. ♀ yg. ad. al.; skull.	Asaba, Nigeria.	Dr. J. W. Crosse [C. & P.].	92.6.22.1.
h. ♀ imm. al.; skull.	Gaboon.	H. F. Ansell, Esq. [P.].	75.10.15.2.
i, j. 2 ♂ ad. sks.; skulls.	Canhoca, Loanda; 19 Nov. 1903.	Dr. W. J. Ansorge [C.].	4.4.9.9.10.
k. ♀ imm. sk.; skull.	N'soro, Kibali R., 3° 15' N., 29° 25' E.; 13 Mar. 1906.	Alexander-Gesling Expedition [P.].	7.7.8.29.
l. ♂ imm. sk.; skull.	Kiriamio, Semliki R.; 14 May, 1889.	Dr. Emin Pasha [C. & P.].	90.6.8.14.

#### 14. NANONYCTERIS, *Matschie*.

Type.

1899. *Nanonycteris* (subgenus of *Epomophorus*),  
*Matschie, Megachir.* pp. 36, 58 ..... N. veldkampi.

*Epomophorus* (pt.), *Jentink, Notes Leyd. Mus.* x. p. 51 (1887);  
*Müller, Fam. & Gen. Bats*, p. 65 (1907).

*Diagnosis*.—*Epomophorine* section. Cranial rostrum short and slender, palate narrow between  $m^1$ - $m^1$ , unusually broad postdentally, maxillary tooth-rows not nearly reaching ventral margin of orbital cavity, postdental palate flattened posteriorly, palation rim not prominent, palate-ridges peculiar (see fig. 41). General size small, forearm 45–52 mm. [One species. Range, the Guinea Coast.]

*Skull* (fig. 40).—Rostrum as short as in *Micropteropus*, but much slenderer. Interdental palate much narrower posteriorly, maxillary tooth-rows only slightly diverging antero-posteriorly, breadth

between postero-internal corners of  $m^1-m^1$  less than or equal to twice the breadth between bases of canines; maxillary tooth-row falling short of ventral margin of orbital cavity by a space nearly equal to length of postzygomatic palate. Palate not narrowed behind zygomatic processes of maxillaries (compare *Micropteropus*), but on

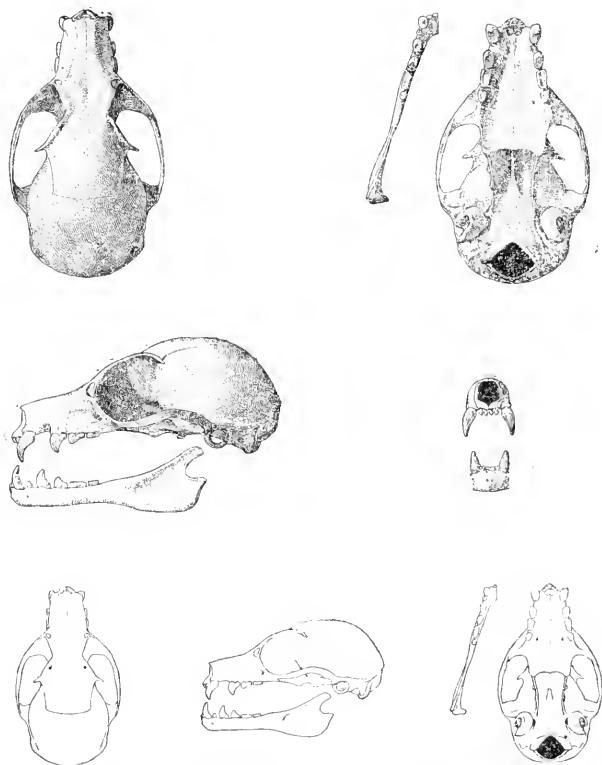


Fig. 40.—*Nanonycteris veldkampii*, ♀ subadult (practically full-grown, though with coronal suture unobliterated). Oban district, South Nigeria. Upper and middle row  $\frac{2}{3}$  (linear), lower row  $\frac{1}{4}$ .

the contrary peculiarly expanded laterally, breadth of postdental palate at middle therefore conspicuously greater than its length and even greater than breadth between  $m^1-m^1$ ; postdental palate longitudinally depressed on either side, slightly convex between these depressions, flattened at extreme posterior extremity,

free edge not prominent. Brain-case less flattened than in *Micropteropus*, basiscranial axis more distinctly deflected against facial axis. Zygomata much slenderer, not heavier at middle than anteriorly and posteriorly, and standing much less widely out laterally. Coronoid low, extremely narrow, scarcely broader at base than at tip, and so much sloping backward as to render profile of mandible from  $m_2$  to top of coronoid an almost straight (very flatly concave) line; condyle at level of alveolar line.

*Dentition* (fig. 40).— $\frac{i^1 i^2 c \quad p^3 p^4 m^1}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2} \times 2 = 28$ . Dental formula and characters of individual teeth as in *Epomops*, *Epomophorus*, and *Micropteropus*, but dentition on the whole unusually weak.

*Palate-ridges* (fig. 41).—4+8 or 9. Four anterior ridges practically similar in position to corresponding ridges of *Epomops franqueti* and *Epomophorus wahlbergi*; first ridge slightly hastate, second to fourth straight or arcuate, second and third undivided, fourth very narrowly divided at middle. Central portion of fifth to ninth



Fig. 41.—Palate-ridges of *Nanonycteris veldkampii* (90.10.6.1).  
 $\frac{3}{2}$  (linear).

thickened and prominent, narrowly divided at middle, lateral portions thin and serrate. This set of ridges passing very gradually into the simple, thin and serrate, extreme posterior ridges.

*External characters*.—Muzzle much narrower than in *Micropteropus*, distance from eye to tip of nostrils less than (in *Micropteropus* equal to or more than) breadth at angle of mouth. Other external characters and sexual differentiation as in *Micropteropus*.

*Affinities*.—In one important cranial character the present genus is similar to *Micropteropus*: both are short-faced Epomophorine bats, and in both the rostrum is shortened almost precisely to the same degree. But, in spite of this fact, the slender rostrum of *Nanonycteris* looks so different from the heavy, Cynopterine rostrum of *Micropteropus*, the profile of the brain-case, the shape of the bony palate, and the development of the palate-ridges are so strikingly dissimilar, that it is difficult indeed to believe in any very close relationship between the two genera. They are probably of quite different origin. Whereas *Micropteropus* appears to be somewhat closely allied to *Epomophorus* (see above p. 557), *Nanonycteris* is, judging from its broad postdental palate, the flattened posterior edge of the palate, and the arrangement of the palate-ridges, almost certainly in its origin more intimately connected with

*Epomops*. As already mentioned above, the four anterior ridges of *Nanonycteris* are practically similar in position to the four anterior ridges of *Epomops franqueti* and, as in that species, the three anterior of these ridges are undivided, the fourth slightly divided: the eight or nine posterior ridges of *Nanonycteris* are homologous with the five to seven posterior ridges of *E. franqueti*; in *Nanonycteris* these ridges are peculiarly modified, being thickened and elevated along the middle of the palate, depressed and very thin laterally. This is almost exactly the reverse of the type of palate-ridges exhibited by *Micropteropus*, in which the soft palate is marked, not with a keel, but with a deep and broad groove along the middle and the ridges reduced to thickened prominences along either side of the groove. Externally the present genus is readily distinguished from *Micropteropus* by its narrow muzzle.

### 1. *Nanonycteris veldkampii*, Jentink.

*Epomophorus veldkampii*, Jentink, *Notes Leyd. Mus.* x. p. 51 (Dec. 1887: Buluma, Fisherman Lake, Liberia): *id.*, *Cat. Syst. Mamm.* p. 138 (1888: type); Büttikofer, *Reisebild. Liberia*, ii. p. 471 (1890); Trouessart, *Cat. Mamm.* i. p. 89, n. 481 (1897).

*Epomophorus* (*Nanonycteris*) *veldkampii*, Matschie, *Megachir.* p. 59 (1899: Gold Coast; Togo; Lagos); Trouessart, *Cat. Mamm., Suppl.* p. 58, n. 527 (1904).

*Epomophorus comptus* (*nec* H. Allen), Jentink, *Cat. Syst. Mamm.* p. 138, specimen *b* (1888: Elmina).

*Epomophorus pusillus* (*nec* Peters), Matschie, *Mitth. Geogr. Ges. Lübeck*, (2) H. vii.-viii. p. 133 (pt.) (1894: Togo; Lagos).

*Fur*.—Proximal half of forearm and the whole of the tibia clothed above. Length of fur: back 10, nape of neck 9, belly 7 mm.

*Colour*.—♂ al., slightly immature, Ashantee: Back light russet (between russet and wood-brown), slightly tinged with pale fawn, underparts nearly cream-buff.—♀ subad. al., South Nigeria: Back brownish drab, distinctly washed with Prout's brown, lightening to almost typical drab on nape of neck and head; underparts light greyish drab.—The former is the lightest, the latter the darkest extreme seen; the other specimens examined (if not faded) are intermediate, though generally rather nearer the light-coloured Ashantee specimen. It would seem from this that the extent of individual colour variation is the same as in *Epomops*, *Epomophorus*, and *Micropteropus*.

*Measurements*. See pp. 573-575.

*Specimens examined*. Ten, in the collections of the Leyden (two), Berlin (six), and British Museums, from the following localities:—Liberia (type), Gold Coast (Ashantee, Elmina, Accra: three, skull of one), Togo (Bismarckburg, Kradji, Misahöhe: four, skull of one), Lagos (one, with skull), Oban, S. Nigeria (one, with skull).

*Range*. Thus far only known from the Guinea Coast, from Liberia in the west to South Nigeria in the east.

*Type*, in the Leyden Museum, ♀ ad. al., skull *in situ*, collected during Büttikofer and Sala's voyage to Liberia, January 1880–April 1882. For external measurements of type see p. 573.

- a. ♂ imm. al.; skull. Ashantee. R. A. Freeman, Esq. 90.10.6.1.  
[P.]  
b. ♀ subad. al.; skull. Oban district, S. P. A. Talbot, Esq. [C.]. 10.6.1.48.  
Nigeria, 609';  
Dec. 1909.

## 15. SCOTONYCTERIS, *Matschie*.

Type.

1894, *Scotonycteris*, *Matschie*, *SB. Ges. nat. Fr.* 1894,  
p. 200 (read 16 Oct.) ..... *S. zenkeri*.

*Scotonycteris*, *Matschie*, *l. s. c.* (1894); *id.*, *Megachir.* p. 70 (1899);  
*Miller, Fam. & Gen. Bats*, p. 64 (1907: characters; affinities).

*Diagnosis*.—Allied to *Nanonycteris*. Cranial rostrum short and slender, postdental palate long with lateral margins forming straight lines converging backwards, maxillary tooth-rows extending to ventral margin of orbital cavity, premolars and molars unusually short, oval or subcircular in transverse section,  $m^1$  and  $m_1$  smaller (in section) than respectively  $p^1$  and  $p_1$ ; membranes from first toe, head with conspicuous white markings, no tuft of white hairs at base of ears. General size small, forearm 48.5–54 mm. [One species. *Hab.* Cameroons and Fernando Po.]

*Skull* (fig. 42).—In profile very similar to that of *Nanonycteris* (fig. 40, p. 560), upper profile line conspicuously descending from the top of the somewhat vaulted brain-case to the much lower rostrum. Rostrum as in *Nanonycteris*, only slightly shorter proportionately, much lower and narrower than and not quite so short as in *Cynopterus*; depth of face at centre of interocular region as in *Nanonycteris* only equal to (in *Cynopterus* much more than) length of rostrum from orbit to nares; height of rostrum above middle of alveolus of canine as in *Nanonycteris* rather less than half (in *Cynopterus* three-fourths) the length of rostrum; breadth across alveolar margins at middle of diastemas  $c-p^3$  as in *Nanonycteris* less (in *Cynopterus* more) than length of rostrum; a distinct posteanine constriction, as in *Nanonycteris*. Nasal branches of premaxilla subequal in breadth throughout (not tapering above); alveolar branches as usual in Megachiroptera in simple contact anteriorly, but considerably deeper than in *Nanonycteris*; plane of their anterior surface not exactly vertical but (like the upper incisors) distinctly retroclivous (see figure of lateral view of skull). Maxillary tooth-rows more diverging antero-posteriorly than in *Nanonycteris*; diastema  $c-p^3$  much wider, equal to the full (in *Nanonycteris* only to half the) space between bases of canines, and the whole row of upper cheek-teeth more posterior in position, extending nearly to (in *Nanonycteris* falling much short of) ventral margin of orbit, and front margin of orbit vertically above front of

$p^4$  (in *Nanonycteris* above posterior half or back of  $m^1$ ). Postdental palate essentially different in length and outline from that of *Nanonycteris*, more similar to that of *Cynopterus*, its median length much more than half the breadth between  $m^1$ - $m^1$ , and its lateral margins converging backwards in straight lines. Postorbital processes very short and thin; temporal ridges widely separated (no sagittal crest), zygomata thin, nearly horizontal (only faintly

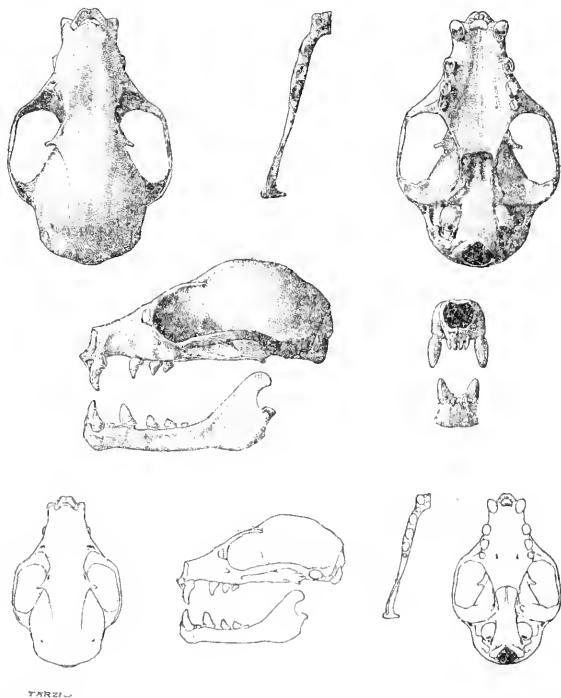


Fig. 42.—*Scolonycteris zenkeri*, ♀. Fernando Po. No. 4.7.1.28 (type of *S. bedfordi*). Shaded figures  $\frac{2}{3}$  (linear), outlines  $\frac{1}{3}$ .

curved upward), but, owing to greater breadth of temporal fossa, standing more widely out posteriorly than in *Nanonycteris*. Horizontal rami of mandible low, somewhat thickened below  $p_4$ - $m_2$ , coronoid low and narrow, but not nearly so thin as in *Nanonycteris* and much less sloping backward, angular process broadly rounded off, condyle above level of alveolar line.

Dentition (figs. 42 and 44).— $\frac{i^1 \ i^2 \ c \ p^3 \ p^4 \ m^1}{i_1 \ i_2 \ c \ p_1 \ p_3 \ p_4 \ m_1 \ m_2} \times 2 = 28$ .

Dental formula as in all Epomophorine bats, except *Pterotes*.



Incisors and canines unmodified Epomophorine. Premolars and molars unusually short (antero-posteriorly), broad, with rounded corners, hence shortly-oval or subcircular in outline (compare the subcircular  $p^1$  and  $m_1$  with the long and narrow corresponding teeth of *Nanonycteris*), and gradually decreasing in size (transverse section) from  $p^3$  to  $m^1$  and from  $p_3$  to  $m_1$ ,  $m_1$  being distinctly smaller than  $p_4$ , and  $m^1$  reduced to half the size of  $p^4$ .  $p^3$  and  $p_3$  higher than usual ( $p_3$  about twice as high as  $p_4$ ), with inner cusp completely fused with outer ( $p^3$  very similar in shape to upper canine, but only two-thirds its height). Outer ridge of  $p^1$ ,  $m^1$ ,  $p_4$ , and  $m_1$  rather high, inner ridge low, but perfectly separated from outer.  $m_2$  subequal in size to  $p_1$ .

*Palate-ridges*.—Not examined. From the published figure (*l.i.c.*), which does not show the extreme anterior ridges distinct enough, it would seem that there are six ridges on the interdental and anterior postdental palate separated by a narrow space from five posterior crowded dentate ridges. First ridge at postcanine diastema, second at  $p^3$ , third at  $p^1$ , fourth at  $m^1$ , fifth and sixth at level of zygomatic processes of maxillaries. The four anterior of these ridges correspond very closely in position to, and are probably homologous with, the four anterior ridges of *Nanonycteris* (fig. 41, p. 561), all the other ridges together to the whole system of postdental ridges in *Nanonycteris*.

*External characters*.—Muzzle as in *Nanonycteris*; ears distinctly smaller, but scarcely differing in shape. Tail, as usual in Epomophorine bats, reduced to a small rudiment more easily perceptible by touch than by eye; interfemoral perfectly well-developed both in centre and along hind limb. Lateral membranes inserted on *first* toe (middle of first phalanx); vertical fasciæ of mesopatagium about 20–23; the whole of the wing-membranes in dried condition of a peculiar reticulated appearance (in live specimens probably pale-coloured; compare *Casinycteris*). Pollex distinctly longer than in *Nanonycteris*; other digits very little differing, except perhaps in the rather shorter metacarpals and longer first phalanges of the third and fourth digits (see table below: in upper row wing-indices of *Scotonycteris*, calculated from two adult specimens, in lower row those of *Nanonycteris* for comparison). Distribution of fur as in *Nanonycteris*; colour of single species known pale, with a very conspicuous white patch on rostrum in front of and between the eyes, and a smaller white patch behind the eyes, but without white tufts at base of ears.

Forearm.	Pollex c.u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c.u.	Mtc.	1st ph.	2nd ph.	Mtc.	1-1 ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	474	478	103	146	682	483	630	678	351	366	688	318	327
1000	429	478	116	139	720	453	617	691	333	284	684	320	333

*Affinities.*—The first describer of this genus (Matschie, 1894 and 1899) placed it near *Cynopterus*, owing, it would seem, to its short rostrum and the insertion of the membranes on the first toe; by Miller (1907) it was classed nearest *Epomophorus*. There is no doubt that the latter is the correct view. By a long series of characters *Scotonycteris* proves itself closely connected with the foregoing Epomophorine genera, and particularly with *Nanonycteris*:—The rostrum, as noted above, is perfectly similar in shape to that of *Nanonycteris* (only a trifle shorter still), but strikingly different from that of *Cynopterus*; the shape of the brain-case quite as in *Nanonycteris*; the ascending branches of the premaxillæ as usual in Epomophorine bats (subequal in breadth throughout, not tapering above to a recurved point); the dental formula as in all Epomophorine bats except *Plerotes*; the incisors unmodified Epomophorine in shape, with the distinct retroclivity so characteristic of Epomophorine bats; the canines typical Epomophorine (curved, somewhat hook-like, slender, crown smooth, cingulum narrow); the palate-ridges easily derived from those of *Nanonycteris*, essentially different from those of *Cynopterus*; the tail reduced exactly as in other Epomophorine bats and unconnected with the interfemoral; the development of the interfemoral typical Epomophorine (in Cynopterine genera without external tail the interfemoral is practically obsolete in the centre); the wing-indices very closely similar to those of *Nanonycteris*, but widely different from those of *Cynopterus*\*; the wing-membranes of the same peculiar reticulated appearance as in *Nanonycteris* (and *Casinonycteris*); the distribution of the fur as usual in Epomophorine bats (tibia hairy above); and even the general colour of the fur much like that of pale-coloured individuals of *Nanonycteris* and many other Epomophorine bats, whereas anything approaching the tinges of *Scotonycteris* is unknown in the Cynopterine section of genera. The reasons which apparently induced Matschie to place *Scotonycteris* nearest *Cynopterus* are in reality valueless for a determination of the affinities of this genus; a considerable shortening of the rostrum is characteristic of all Cynopterine genera, but so it is also of *Micropteropus* and *Nanonycteris* in the Epomophorine section; the membranes are in all the foregoing Epomophorine genera inserted on the second toe, whereas *Scotonycteris* (and *Casinonycteris*) like *Cynopterus* (and most of the allied genera) have them inserted on the first toe; but within the Cynopterine section *Dyacopterus* has the membranes from the second toe though allied to *Cynopterus* (first toe), *Thoopterus* from the second toe though closely allied to *Penthetor* (first toe). The only character which on

\* The following table will show, at a glance, the close resemblance between *Scotonycteris* and *Nanonycteris* in the lengths of the digits (except for the lengthening of the pollex in the former genus) and the very conspicuous differences of both from *Cynopterus*:—

	Forearm.	Pollex.	2nd digit.	3rd digit.	4th digit.	5th digit.
<i>Scotonycteris</i> .....	1000	474	727	1795	1395	1333
<i>Nanonycteris</i> .....	1000	429	728	1820	1411	1337
<i>Cynopterus</i> .....	1000	389	668	1637	1303	1266

first inspection might suggest closer affinities between *Scotonycteris* and *Cynopterus* is the shape of the postzygomatic palate (long, with the lateral margins forming straight lines converging backwards); of all cranial characters those of the postzygomatic palate are, however, the most widely variable in the Epomophorine group of genera; no two genera are alike in the shape of this portion of the palate (broad and simple in *Epomops*; narrower, deeply depressed posteriorly, and with prominent palation rim in *Epomophorus*; long, abruptly narrowed behind zygomatic processes, and with sub-parallel lateral margins in *Micropteropus*; very short and broad in *Nauonycteris*; &c.); but what perhaps more clearly than anything else shows the fallacy of these characters as indicators of relationships in Epomophorine bats, is the fact that in the closest living relative of *Scotonycteris*, viz. *Casinysteris*, the postzygomatic palate is completely obsolete and the combined mesopterygoid fossa and posterior narial passage extend forward, as one continuous fossa, to the level of the zygomatic processes. There is another character which, though apparently very insignificant in this connection, might arouse doubt as to the affinities of *Scotonycteris* with Epomophorine bats, namely, the absence of small white hair-tufts at the anterior base of the ears, these tufts being curiously persistent in all other Epomophori irrespective of cranial, dental, and external differences; but the tufts are present in *Casinysteris*, which otherwise so closely copies *Scotonycteris* externally as to be practically indistinguishable in colour but for the presence of these tufts.

### 1. *Scotonycteris zenkeri*, Matschie.

*Sectonycteris zenkeri*, Matschie, *SB. Ges. nat. Fr.* 1894 (16 Oct.), p. 202 (Yaunde, S. Camercon); *id.*, *Deutschl. u. s. Kolon.* p. 33 (1897); *Sjöstedt, Bih. K. Sv. Vet.-Ak. Handl.* xxiii. Afd. iv. n. 1, p. 46 (1897: Yaunde; Elephant Lake, N.W. Cameroon); *Trouessart, Cat. Mamm.* i. p. 87, n. 467 (1897); *Matschie, Megachir.* p. 71, pl. xiii. (animal, head, wing, skull, palate-ridges) (1899: Yaunde; Elephant Lake); *Cabrera, Mem. Soc. Esp. H. N.* i. mem. 1, p. 6 (1903); *Trouessart, Cat. Mamm., Suppl.* p. 61, n. 542 (1904); *Miller, Fam. & Gen. Bats*, p. 64 (1907). *Scotonycteris bedfordi*, Thomas, *Abstr. P. Z. S.* 1904, n. 4, p. 14 (8 March, 1904: Fernando Po); *id.*, *P. Z. S.* 1904, i. p. 372 (2 Aug. 1904); *id.*, *P. Z. S.* 1904, ii. p. 187, pl. xiii. (animal) (18 Apr. 1905); *Miller, Fam. & Gen. Bats*, p. 65 (1907); *Cabrera, Mem. Soc. Esp. H. N.* i. mem. 25, p. 441 (1908).

*Fur*.—Rather long, dense, sublanose; length of fur on back 7-8 (general mass of hairs) and 10-11 (longest hairs), on middle of belly about 7 mm. Proximal third of forearm and the whole of tibia, except its distal extremity, distinctly though somewhat thinly clothed above.

*Colour* (type of *S. bedfordi*, adult female, skin, January).—General colour of back a slightly russet tinge of wood-brown; individual hairs whitish at middle, seal-brown at base, with short cinnamon or russet tips; the "general colour" produced by the mixture of the cinnamon or russet colour of the hair-tips with

the only incompletely concealed white colour of the middle of the hairs. Head and nape similar to back, though with a deeper russet colour to the tips of the hairs; a sharply defined white patch of oblong shape on the bridge of the rostrum, extending back nearly to level of middle of eyes; a small white patch immediately behind posterior canthus of eye; upper lip narrowly edged with white from angle of mouth to some distance from nostrils. Fore-neck and centre of breast greyish white, shading to hair-brown sprinkled with white on sides of breast; flanks light wood-brown. Ears and wing-membranes in dried state brownish (in the live animal perhaps bright-coloured: compare *Casinycteris*, p. 572).

*Measurements.* On pp. 573-575.

*Specimens examined.* The type of the species (Berlin Museum), the type of *S. bedfordi*, and an immature male from Elephant Lake, N.W. Cameroons (Berlin Museum), these three being apparently the only specimens on record.

*Range.* As yet known only from the Cameroons (Yaunde and Elephant Lake) and the island of Fernando Po.

*Type*, an adult female, preserved in alcohol, skull extracted, Yaunde, S. Cameroons, collected by G. Zenker, Berlin Museum, unnumbered. For measurements see pp. 573-575.

*S. bedfordi*, Thomas; 1904.—Type from Fernando Po, in collection. According to Matschie (*l. c.* 1894) the ear of the type of *S. zenkeri* measures 17 mm.; Thomas found the ear of an adult Fernando Po specimen of the same sex measuring only 11 mm., hence very naturally believed it an insular species distinct from the continental *S. zenkeri*, and named it *S. bedfordi*. In reality Matschie's statement is erroneous; the type of *zenkeri* is in the size of the ears (12.5 mm.) as in all other characters indistinguishable from the type of *bedfordi*. Measurements on pp. 573-575.

- a. ♀ ad. sk.; Fish Town, Fernando Po Committee [P.]. 4.7.1.28.  
 skull. nando Po, 10 m.; (Type of *S. bedfordi*, Thos.)  
 2 Jan. 1904 (*E.*  
*Seimund*).

## 16. CASINYCTERIS, *Thos.*

Type.

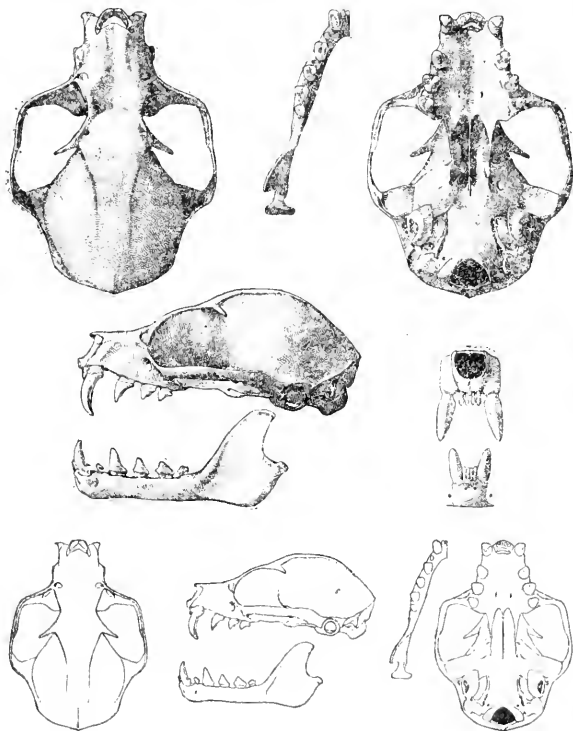
1910. *Casinycteris*, *Thomas, Ann. & Mag. N. H.* (8) vi.

p. 111 (1 July) ..... *C. argynnis*.

*Diagnosis.*—Closely allied to *Scotonycteris*, but postdental palate quite obsolete, posterior nares nearly at level of back of upper molar, inner cusp of  $p^3$  and  $p_3$  well developed and separate from outer. External characters (even colour of fur, including peculiar markings of head) as in *Scotonycteris*, except for larger size of ears and presence of the usual Epomophorine white hair-tuft at base of ears anteriorly. Size of single species known, somewhat larger than *Scotonycteris zenkeri*. [*Hab.* Cameroons.]

*Skull* (fig. 43).—Rostrum distinctly shorter than in *Scotonycteris* (orbit to tip of nasals equal to, in *Scotonycteris* more than, one-fourth of total length of skull, lambda to gnathion), somewhat broader, with interocular region more deeply concave, profile line from lachrymal

foramen to tip of nasals quite horizontal (in *Scotonycteris* distinctly descending), and alveolar margin much more steeply ascending anteriorly, giving the rostrum in profile the appearance of being slightly upturned. Premaxillæ as in *Scotonycteris*. Brain-case in profile closely similar to that of *Scotonycteris*, but rather broader. Postdental palate (floor of posterior nares) completely obsolete, the posterior narial passage and the mesopterygoid fossa forming one



TERZIO

Fig. 43.—*Casinycteris argyrops*, ♀, type of species.  
Shaded figures  $\frac{3}{4}$  (linear), outlines  $\frac{1}{4}$ .

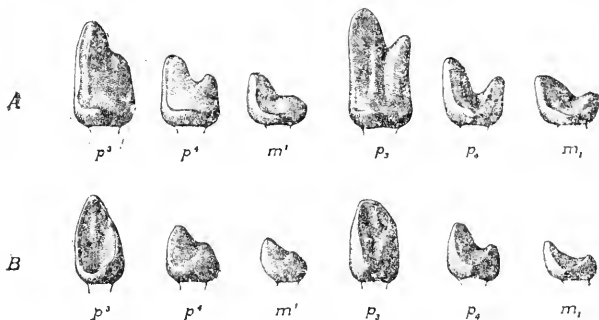
long open fossa extending practically from level of back of  $m^1$  to level of front of glenoid fossa of squamosal, length of this fossa nearly equal to the whole length of the bony palate from incisive foramina to palation.—a modification of the posterior bony palate unparalleled in other Megachiroptera (this fossa, it should be noted, is covered below by the soft palate quite as far backward as in the ordinary Megachiropteran skull). Free palatal edge M-shaped

the median angle in continuation with the long and high vomerine ridge. Orbito-temporal cavity considerably expanded laterally, the zygomata therefore standing widely out laterally; postorbital processes very thin, but rather longer than in *Scotonycteris*; temporal ridges as in *Scotonycteris* not united to form a sagittal crest. Horizontal rami of mandible even more thickened in the region below  $p_4$ - $m_2$  than in *Scotonycteris*; coronoid process higher, broader, and less sloping.

*Dentition* (figs. 43 and 44).— $\frac{i^1 \ i^2 \ c}{i_1 \ i_2 \ e} \frac{p^3 \ p^4 \ m^1}{p_3 \ p_4 \ m_1 \ m_2} \times 2 = 28$ .

Dental formula as in *Scotonycteris* and all other Epomophorine bats, except *Pterotes*.

Upper and lower incisors quite as in *Scotonycteris*. Canines conspicuously longer and slightly slenderer; upper canine with a faint indication of a vertical groove on antero-medial surface of crown. Premolars and molars shortened and broadened, sub-circular in transverse section, as in *Scotonycteris*, but  $m^1$  and  $m_2$



TERZIO

Fig. 44.—A. Right  $p^3$ ,  $p^4$ ,  $m^1$ , and left  $p_3$ ,  $p_4$ ,  $m_1$ , viewed from behind, of *Casinycteris argynnis* (type of species).

B. Corresponding teeth, in same view, of *Scotonycteris zenkeri* (type of *S. bedfordi*).

$\frac{1}{2}$  (linear).

not quite so much reduced in size,  $m^1$  being only slightly smaller than (in *Scotonycteris* about one-half the bulk of)  $p^4$ , and  $m_2$  considerably larger than (in *Scotonycteris* subequal to)  $p_4$ . Outer ridge of  $p^3$ - $m^1$  and  $p_3$ - $m_1$ , as in *Scotonycteris*, high and cusp-like; inner cusp of  $p^3$  and  $p_3$  well-developed and separate (in *Scotonycteris* suppressed or fused with outer); outer and inner cusps of  $p^4$ ,  $p_4$ , and  $p_4$  even distinctly diverging at tips (see fig. 44).

*Palate-ridges* (fig. 45).—Five interdental and a large number of irregular, thin and serrate ridges crowded together on postdental palate. Four anterior ridges thick and prominent; first ridge closely behind canines, second between  $p^3$ - $p^4$ , third between  $p^4$ - $p^1$ , fourth between  $m^1$ - $m^1$ . Fifth ridge closely behind fourth, between  $m^1$ - $m^1$ , but with lateral extremities immediately behind  $m^1$ , thinner

and serrate, thus both in characters and position forming a transition to the postdental system of ridges.—The only essential difference from *Scotonycteris* appears to be the much larger number of postdental ridges.

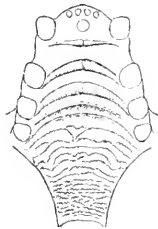


Fig. 45.—Palate-ridges of *Casinycteris argyris* (type of species).  
 $\frac{2}{1}$  (linear).

*External characters.*—Similar in all respects to those of *Scotonycteris* (tail rudimentary, not connected with interfemoral, interfemoral well-developed in centre and laterally, membranes from middle of first phalanx of first toe), except for the presence of whitish hairs at anterior base of ears, as in all Epomophorine genera except *Scotonycteris*. Wing-indices (upper row in table below) essentially as in *Scotonycteris* (lower row), but the pollex perhaps not lengthened quite to the same degree.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c.u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	450	475	117	182	602	467	608	683	375	190	692	225	350
1000	474	478	103	116	682	483	630	678	351	366	688	318	327

*Affinities.*—If the single species of this genus were known only from its external appearance, it would unhesitatingly be considered a *Scotonycteris*, differing from *S. zenkeri* in nothing but its larger size, relatively larger ears, and small white ear-patches: so extraordinary is its resemblance in all external features to *S. zenkeri*, even in the general colour of the fur and the very peculiar white markings of the head (the only parallel to these markings is, curiously enough, found in the Pteropine bat *Styloctenium wallacei* and the related *Pteropus personatus*; the median patch on the rostrum of *Scotonycteris* and *Casinycteris* corresponding to the median stripe in *Styloctenium*, the patch at the posterior canthus of the eye to a similar patch in *Styloctenium* rather more above the eye, in *Pt. personatus* above and behind the eye, and the white edging of the upper lip being practically quite alike in *Scotonycteris*, *Casinycteris*, and the two Pteropine bats). In the characters of the incisors and canines, the peculiarly short-and-broad, subcircular

outline of the premolars and molars, and the heightening of their outer cusps, the dentition of this genus is very similar to that of *Scotonycteris*, and the details in which it differs (chiefly the stronger development of the inner cusp of  $p^3$  and  $p_3$ , the divergence of the outer and inner cusps of the large premolars and molars, and the less pronounced reduction of the posterior molars) would in themselves be far from justifying its generic separation from *Scotonycteris*. With this close external and dental resemblance to *Scotonycteris*, the present genus combines, however, a modification of the bony palate absolutely unique in Megachiroptera and more closely approaching to the type of palate predominant in Microchiroptera. It might seem a little strange, that these two genera, though so closely related as to be evidently modifications of one type of bat, are nevertheless inhabitants of the same faunistic area. It appears reasonable to suppose, however, that the profound difference in the posterior portion of the bony roof of the mouth must be connected either with an essentially different nature of the food on which they subsist or with a different treatment of that food or with both, and in any case there would, as far as the food is concerned, be but little real competition between them.

### 1. *Casinycteris argynnis*, *Thos.*

*Casinycteris argynnis*, *Thomas, Ann. & Mag. N. II.* (8) vi. p. 111 (1 July, 1910: Bitye).

*Fur*.—Distribution, quality, and length of fur as in *Scotonycteris zenkeri* (p. 567); length of fur on back about 8 (general mass of hairs) and 13 (longest hairs), on middle of belly 6–7 mm.

*Colour* (type, adult female, skin, November).—General colour of back a slightly russet tinge of wood-brown; individual hairs whitish at middle, seal-brown at base, with short russet wood-brown tips not quite concealing subapical whitish colour of fur. Nape of neck paler than back, owing to shortness or even absence of wood-brown tips to the hairs. Head similar to back, but slightly deeper in colour; a sharply defined white patch of oblong shape on bridge of rostrum extending back to level of middle of eyes; a smaller white patch immediately behind posterior canthus of eyes; a small white patch at anterior base of ears; upper lip broadly edged with white from angle of mouth to some distance behind nostrils. Foreneck thinly clothed with long whitish hairs; median tract of breast whitish slightly shaded with drab, sides of breast and belly drab sprinkled with white, flanks broccoli-brown. "Wings, ears, eyelids, and muzzle bright orange" in life (*G. L. Bates*).

*Measurements*. On pp. 573–575.

*Specimen examined*. The type, in collection, is so far the only specimen known.

*Range*. The Cameroons (as yet only recorded from Bitye, altitude 2000 feet).

a. ♀ ad. sk.; skull.	Bitye, R. Ja, S.E. Cameroons, 2000'; 19 Nov. 1909.	G. L. Bates [C.]. 11.5.5.1. (Type of species.)
-------------------------	---	---



Micropteropis, Nanonycteris, Sootonycteris, and Casinycteris: External measurements.

	<i>M. pusillus</i> , ♂ ad.*		<i>N. veldkampii</i>		<i>S. zenkeri</i>		<i>C. argyrops</i> .
	Min.	Max.	♀ ad. Type.	♂ ad. Lagos.	♀ subad. S. Nigeria.	♀ ad. Type.	♀ ad. Type.
Forearm .....	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Pollex, total length, c. u. ....	50	53	50	45	52	54	60
" metacarpal .....	22	24	21.5	19.5	22	25	27
" 1st phalanx .....	7.5	8.5	...	7	7.5	8	9
2nd digit, metacarpal .....	10.5	11.5	...	10	11	13	13.5
" 1st phalanx .....	23.5	26.5	24	22	23.5	25	28.5
" 2nd-3rd phalanx, c. u. ....	4.5	6	6	5	6	5.5	7
2nd digit, metacarpal .....	6	7.5	6.5	7	7	7.5	8.5
" 1st phalanx .....	34	38.5	36	33.5	36.5	36	41.5
" 2nd phalanx .....	22	24	22.5	21	23	26	28
4th digit, metacarpal .....	30	33	32.5	29	33.5	33	36.5
" 1st phalanx .....	33.5	36	34.5	32	35.5	36	41
" 2nd phalanx .....	16	17.5	16.5	15.5	17	18.5	22.5
5th digit, metacarpal .....	19	21.5	19	18	19.5	19	24
" 1st phalanx .....	33.5	37	34	31	35.5	36.5	41.5
" 2nd phalanx .....	16	17	16	15	16	17	19.5
Ear, length from orifice .....	16.5	19.5	16.5	16	16.5	17	21
" greatest breadth, flattened .....	13.5	15	14.5	14	15.5	15.5	20.4
Tail .....	12	12	10.5	11	10.5	12.5	...
Interfemoral in centre, depth .....	0	3	...	+	+	+	...
Tibia .....	3	6	...	3	3.5	4	...
Foot, c. u. ....	19.5	23	...	17	19	20.5	24
Culcar .....	16	17.5	...	13	15	12.5	16
" .....	4	4.5	...	3.5	4	5.5	...

\* Liberia; Gambaga; Abeokuta; Lagos; Asaba; Caribaea (Lomda); Bongo (Bahr-el-Ghazal).

+ Perceptible by touch. In one of the immature specimens examined of *N. veldkampii* the tail measures 1.5 mm.

† Collector's measurements in flesh.

## Micropterus, Nanonycteris, Scotonycteris, and Casinycteris: Measurements of skulls and tooth-rows.

	<i>M. pusillus</i> . ♂ ad.*		<i>N. reddkampi</i> .		<i>S. zenkeri</i> .		<i>C. argyris</i> .	
	Min.	Max.	♂ ad. Lagos, mm.	♀ subad. S. Nigeria, mm.	♀ ad. Type, mm.	♀ ad. <i>bedfordi</i> , mm.	♀ ad. Type, mm.	
Skull. total length .....	29	29.8	26	27.2	?	25.7	28.2	
" palation to incisive foramina .....	13.2	14	11	11	12.5	12	8.7	
" palation to basion .....	10	10.5	9.7	10.2	9.5	9	14.6	
" postidental palate, length .....	5.8	6	4.8	5.5	5	4.8	0	
" front of orbit to tip of nasals .....	8	8.8	7.6	7.8	7.8	7.6	7	
" width of brain-case at zygomatic .....	12.8	13.2	12.3	12	11.8	11.8	13.8	
" zygomatic width .....	18.2	18.8	16.2	15.8	17.8	16.7	20.2	
" across crowns of m <sup>1</sup> , externally .....	9.2	10	7.5	7.6	8.3	8.5	10.7	
" lacrymal width .....	8.5	9.2	7.4	7.2	7.5	7.2	8.2	
" across crowns of canines, externally .....	5.8	6.2	5.8	5.6	6	6	6.8	
" post-orbital width .....	8.2	8.8	8.8	...	6.6	7	7.5	
" mesopterygoid fossa, width .....	5	5.8	4.8	4.7	5	5	5.2	
" interorbital width .....	4.7	5	3.8	4.7	3.8	3.8	3.8	
" postidental palate, width at middle .....	5.5	6	...	7	...	...	...	
" between m <sup>1</sup> -m <sup>1</sup> , posteriorly .....	7.8	8.5	...	6	...	...	...	
" between p <sup>1</sup> -p <sup>1</sup> , anteriorly .....	5.7	6.7	4.2	4.8	5.5	5.7	6.8	
" between bases of canines .....	3	3.7	3	3	3	3	3	
" orbital diameter .....	8	8	7.2	7	7	6.7	8.4	
" Mandible, length from condyle .....	22	23.7	19.3	20	20.8	19.8	21.8	
" coronoid height .....	8.5	9.2	6.7	7.8	9.5	8.2	10	
Upper teeth, e-m <sup>1</sup> , crowns .....	8.8	10	7.9	8.1	9	8.8	9.3	
Lower teeth, e-m <sub>2</sub> , crowns .....	10	10.8	8.9	8.7	10	10	10.8	

\* Liberia; Gambaga; Abeokuta; Lagos; Canloca (Angola); Bongo (Bahr-el-Ghazal).

Micropteropus, Nanonycteris, Scotonycteris, and Casinycteris: Measurements of teeth.

	<i>M. pusillus</i> , 13 skulls.*		<i>N. eddhampi</i> ,		<i>N. zenkeri</i> ,		<i>C. argyrops</i> ,	
	Min.	Max.	♂ imm. Ashantee,	♂ ad. Lagos, S. Nigeria,	♀ ad. Type,	♀ ad. <i>bedfordi</i> ,	♀ ad. Type,	♀ ad. Type,
p <sup>3</sup> , length .....	1.8	2	1.6	1.6	1.7	1.6	mm.	1.8
" width .....	1.2	1.2	1.1	1	1.2	1.2	mm.	1.6
p <sup>4</sup> , length .....	2	2.2	1.8	1.7	1.5	1.5	mm.	1.6
" width .....	1.2	1.5	1.1	1	1	1.2	mm.	1.6
m <sup>1</sup> , length .....	1.9	2.5	1.6	1.5	1	1	mm.	1.4
" width .....	1.3	1.6	1	0.9	0.8	1	mm.	1.5
p <sub>3</sub> , length .....	1.7	1.9	1.3	1.2	1.9	1.7	mm.	1.8
" width .....	1	1.2	1	0.9	1.4	1.3	mm.	1.5
p <sub>1</sub> , length .....	1.8	2.1	1.3	1.4	1.6	1.5	mm.	1.6
" width .....	1	1.3	1	0.9	1.2	1.2	mm.	1.5
m <sub>1</sub> , length .....	2	2.2	1.8	1.8	1.5	1.3	mm.	1.5
" width .....	1.1	1.4	0.9	0.8	1.1	1.1	mm.	1.5
m <sub>2</sub> , length .....	1.1	1.6	...	1.1	0.7	0.7	mm.	1.1
" width .....	0.8	1.1	...	0.8	0.7	0.7	mm.	1.3

\* All B. M. skulls (list p. 559) and one from Bongo, Bahr-el-Ghazal.

## 17. MYONYCTERIS, Matschie.

*Cynonycteris* (pt.), Dobson, Cat. Chir. B. M. p. 71.

Type.

1899. *Myonycteris* (subgenus of *Xantharpyia*) (pt.),*Matschie, Megachir.* pp. 61, 63 ..... *M. torquata*.*Cynopterus*, second section, *Gray, Cat. Monk. Sc.* p. 123 (1870).*Cynonycteris* (pt.), *Dobson, l. s. c.* (1878: *C. torquata* only).*Myonycteris* (subgenus, pt.), *Matschie, l. s. c.* (1899: *M. torquata*, excl. *M. angolensis*); (genus), *K. Andersen, Ann. & Mag. N. H.* (7) xix. pp. 503, 511 (1907: characters); *id., op. cit.* (8) ii. p. 456 (1908: new species).*Xantharpyia* (subgenus, pt.), *Matschie, Megachir.* p. 65 (1899: *X. brachycephala* only).*Roussettus* (pt.), *Trouessart, Cat. Mamm., Suppl.* p. 59 (1904).*Roussettus* (pt.), *Miller, Fam. & Gen. Bats*, p. 54 (1907).

*Diagnosis*.—Intermediate between the *Roussettine* and *Cynopterine* sections. Rostrum much shorter than in *Roussettus*, but not quite so short and stout as in *Cynopterus*; dental formula as in *Roussettus* (incisors  $\frac{2}{2} - \frac{2}{2}$ , cheek-teeth  $\frac{5}{6}$ ), but  $m^2$  and  $m_3$  nearly rudimentary,  $m_2$  noticeably reduced. A short tail. Forearm 56–67 mm. [Four species. Range, the western Ethiopian forest region, including the island of San Thomé.]

*Skull* (fig. 46).—Length of rostrum (front of orbit to tip of nasals) little more than breadth across lower edges of lachrymal foramina; rostrum similar in breadth to that of *Roussettus*, slenderer

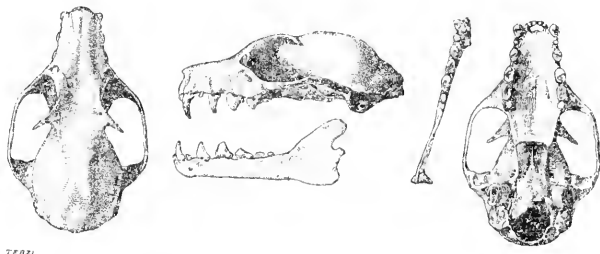


Fig. 46.—*Myonycteris wroughtoni*, ♂, type of species. River Likati, Welle district, N.E. Congo. No. 7.7.8.25. ♀.

than in *Cynopterus*. Orbit quite or nearly as large as in *Cynopterus*, conspicuously larger than in *Roussettus*; orbital diameter about  $\frac{1}{4}$  of total length of skull; front of orbit above back of  $p^1$  or front of  $m^1$ . Basicranial axis less deflected than in *Roussettus*, nearly horizontal as in *Cynopterus*. Coronoid moderate or strong, sloping; condyle of mandible above level of alveolar line.

$$\text{Dentition (figs. 46, 47).} \frac{i^1 i^2 c p^1 p^3 p^4 m^1 m^2}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2 m_3} \times 2 = 34.*$$

Upper incisors terete, acutely pointed, slightly curved, narrowly spaced; lower incisors slightly but quite distinctly bilobed. Canines shorter and thinner than in *Cynopterus* (in *M. brachycephala* unusually short), moderately curved, cingulum narrow.  $p^1$  rudimentary, in basal section equal to an upper incisor;  $p_1$  small but larger than  $p^1$ .  $p^4$ ,  $m^1$ ,  $p_4$ , and  $m_1$  shorter antero-posteriorly than in typical *Rousettus*.  $m^2$  reduced almost to a rudiment, subcircular or elliptical in outline, varying in the different species from about twice, to scarcely more than, the bulk of  $p^1$ ;  $m_2$  markedly reduced, from one-half to one-third the bulk of  $m_1$ .  $m_3$  rudimentary, subcircular or elliptical, smaller than  $m^2$ .

*Palate-ridges*.—4+3+2 (eighth and ninth ridges close together at palation rim). Arrangement of ridges very nearly the same as in *Rousettus* (see fig. 29 A, p. 485).

*External characters*.—Muzzle much shorter than in *Rousettus*, centre of eye about midway between nostril and anterior base of ear. Nostrils more prominent than in *Rousettus*, but not quite as much so as in *Cynopterus*. Eyes relatively larger than in *Rousettus*, very nearly as in *Cynopterus*. Ears short (reaching eyes if pressed forward), narrowly rounded off above; antitragal lobe distinct, acutely triangular. Tail as in *Rousettus* and *Cynopterus*, rather more than half the length of hind-foot with claws. Calcar weaker than in *Rousettus*. Wing-membranes from sides of back and first phalanx of second toe; vertical fasciæ of mesopatagium (those crossing main internal cutaneous line) in *M. torquata* about 15. Third, fourth, and fifth metacarpals subequal, though with a tendency of the third to remain the longest; second phalanx of third digit shorter than metacarpal; second phalanx of fourth and fifth digits generally a little longer than first phalanx. The following table shows the wing-indices of *Myonycteris* calculated from six adult individuals representing all species (upper row) and those of the typical Ethiopian species of *Rousettus* for comparison (lower row):—

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	384	503	108	119	671	465	575	653	342	366	647	302	223
1000	361	442	105	105	644	438	601	635	344	379	622	315	286

\* In one of the skulls examined (*M. leptodon*, ♂ ad., teeth unworn, type of species) an extremely small  $m^3$  is present on both sides. In another (*M. brachycephala*, ♀ yg. ad., type of species) the middle pair of lower incisors is represented by a single tooth entirely filling out the space between  $i_2$ - $i_2$ .

A specimen of *Myonycteris* in the collection (♂ ad. al., skull extracted, teeth unworn, locality unknown, presented by Lieut. Strickland, 50.8.29.1) shows no trace of  $m_3$ ,  $m^2$  is present only on the right side and so exceedingly minute as

*Sexual differentiation.*—Adult males with a well-defined ruff of unctuous hairs across foreneck. The only female examined is young adult (no ruff).

*Affinities.*—In most of its essential characters *Myonycteris* is intermediate between *Rousettus* and *Cynopterus*, but nearer the latter genus. Hence it is here classed as the first (most "primitive") genus of the Cynopterine section, though it might with equal right be considered a specialized offshoot of the Rousettine branch showing modifications similar to or approaching those of *Cynopterus*. In the development and arrangement of the palate-ridges it is similar to *Rousettus*, but the rostrum is much shorter, though not shortened quite to the same degree as in *Cynopterus*; the orbits are relatively quite as large as in *Cynopterus*, and the brain-case scarcely more deflected than in that genus; those molars, viz.  $m_3$  and  $m^2$ , which have entirely disappeared in *Cynopterus*, are reduced to rudiments (on the possible existence of a species of *Myonycteris* which has permanently lost  $m_3$  and is on the point of losing  $m^2$ , see footnote, p. 577); the nostrils are more prominent than in *Rousettus*, but rather less so than in *Cynopterus*; and the unctuous hairs on the foreneck of males are quite as conspicuously developed as in *Cynopterus*. If *Myonycteris* were known only from a fossil state, it would probably without much hesitation be put down as a "connecting link" between *Rousettus* and *Cynopterus*.

*Technical names.*—*Myonycteris* was originally described by Matschie (l. c.) as a subgenus of *Xantharpyia*, including two species, *M. torquata* and *M. angolensis*. The former species, though not known to Matschie from personal inspection, was fixed as type of the "subgenus," but the diagnosis of the subgenus was based on the latter species (*angolensis*), which however is a *Rousettus*. The characters of *Myonycteris*, as given above, are therefore entirely different from those on which it was based by Matschie.

### *Synopsis of the Species.*

- A. Dentition weak (figs. 47 A, B, p. 579);  
 outer and inner ridge of  $p_1$  completely  
 fused anteriorly (fig. 47 C); lower  
 canines at least as high as  $p_3$  (fig. 46,  
 p. 576); no sagittal crest; coronoid  
 process narrow (fig. 46) ..... Subgenus MYONYCTERIS.  
 a. Median palatal length 16.3–16.8 mm.:  
 $m^2$  less reduced, about twice the bulk  
 of  $p^1$ .  
 a'. Molariform teeth larger;  $m^1$ , length  
 2.2, breadth 1.5–1.6 mm.; forearm  
 65–67. (Welle Dist.) ..... 1. *M. wroughtoni*, p. 580.

to be very easily overlooked if not searched for, and the ears are distinctly different in form from those of the other four species known. This may be evidence of the existence of a species of *Myonycteris* which has permanently lost  $m_3$  and is just on the point of losing  $m^2$ ; in other words, a species which has very nearly the same dental formula as *Cynopterus* ( $m_3$  and  $m^2$  permanently lost).

- b'*. Molariform teeth shorter and narrower;  $m^1$ , length 1·8, breadth 1·2 mm.; forearm 61. (Sierra Leone; Liberia) ..... 2. *M. leptodon*, p. 580.
- b*. Median palatal length 14·8–15 mm.;  $m^2$  more reduced, subequal to  $p^1$ . Forearm 56–60·5 mm. (Angola; Lower Congo) ..... 3. *M. torquata*, p. 581.
- B. Premolars and molars much heavier (figs. 47 A', B', below); outer and inner ridge of  $p_4$  widely separated (fig. 47 C'); canines unusually short, those in mandible lower than  $p_3$  (fig. 47 D'); sagittal crest present; coronoid process broad (fig. 47 D') ..... Subgenus PHYGETIS.\*
- a*. Forearm 63·5 mm. (San Thomé) .... 4. *M. brachycephala*, p. 522.

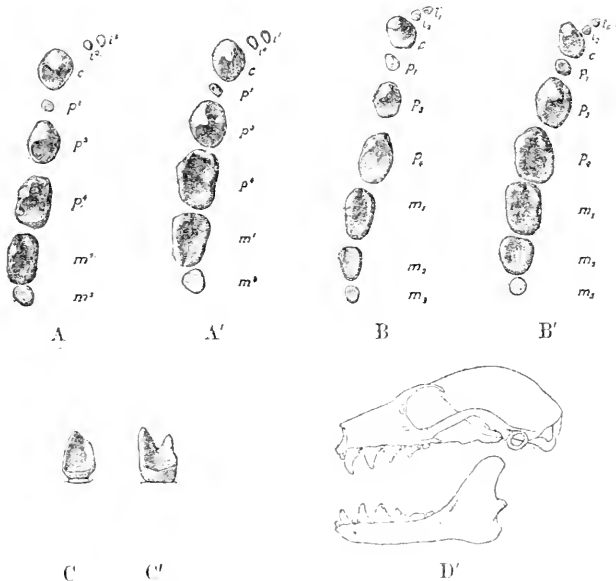


Fig. 47.—A, B, C. *Myonycteris wroughtoni* (type of species).  
A', B', C', D'. *Myonycteris* (*Phygetis*) *brachycephala* (type of species, Lisbon Museum).  
A, A', upper right, B, B', lower left tooth-rows. C, C', left  $p_4$  viewed from behind.  
A, A', B, B', C, C'  $\frac{2}{3}$  (linear); D'  $\frac{1}{2}$ .

\* Subgenus novum. Φυγέτης (feminine φυγέτις), one who has fled from his country; in allusion to the habitat of the only known species, viz. the island of San Thomé; the three species of the subgenus *Myonycteris* are all continental.

1. *Myonycteris wroughtoni*, K. Aud.

*Myonycteris wroughtoni*, K. Andersen, *Ann. & Mag. N. H.* (8) ii. p. 450 (1 Nov. 1908: R. Likati).

*Differential characters*.—Skull larger and more heavily built than in *M. torquata*, rostrum relatively longer and broader, palate longer, interorbital region broader (see measurements, p. 584).  $m^2$  less reduced in size, about twice the bulk of  $p^1$ , actual length of tooth in two specimens 1.1 mm., against 0.7–0.8 in two *M. torquata*, breadth 0.8–0.9, against 0.6. Ear, wing, tibia, and foot conspicuously longer than in *M. torquata* (see measurements, p. 583).

*Fur*.—Fur of back silky, directed posteriorly but not closely adpressed; on breast and belly short, adpressed; unctuous hair of foreneck and sides of neck in males (females not examined) harsh, spreading, forming a distinct ruff. Approximate length of fur: back 8–10, belly 4–5, foreneck 8–9 mm. Fur of back extending on basal two-thirds of forearm; femur, tibia (the terminal third or fourth excepted), and interfemoral (a small area above the calcarex excepted) densely clothed. Fur of underside extending on proximal half or two-thirds of forearm, proximal half or third of tibia, and central portion of interfemoral; short woolly hair on underside of lateral membrane along forearm and flanks.

*Colour* (two males, type and paratype).—Back and rump dark Prout's brown (type), or this colour slightly washed with vandyck-brown (paratype); base of fur similar, but tinged with slate or dark hair-brown. Nape of neck, occiput, crown, and sides of head paler than back, approximately broccoli-brown varied with short Prout's brown tips to the hairs. Breast, belly, and flanks dark hair-brown, or between hair-brown and drab. Ruff on foreneck tawny olive or drab tinged with tawny olive. Chin and throat similar to breast.

*Range*. River Likati, Welle district, N.E. Congo.

*Type* in collection.

a, b. 2 ♂ ad. sks.; R. Likati, Welle dist.; Alexander-Gosling 7.7.8.25, 26.  
skulls. 18 April, 1906. Expedition [P.].  
(7.7.8.25, *Type of species*.)

2. *Myonycteris leptodon*, K. Aud.

*Cynonycteris torquata* (nec Dobs.), Jentink, *Notes Leyd. Mus.* x. p. 52 (1887: Liberia); *id.*, *Cat. Syst. Mamm.* p. 151 (1888: Liberia).

*Xantharpyia* (*Myonycteris*) *torquata* (pt.), Matschie, *Megachir.* p. 64 (1899).

*Roussettus* (*Myonycteris*) *torquatus* (pt.), Trouessart, *Cat. Mamm., Suppl.* p. 59, n. 530 (1904).

*Myonycteris collaris* (pt.), K. Andersen, *Ann. & Mag. N. H.* (7) xix. p. 512 (1907: Sierra Leone).

*Myonycteris leptodon*, K. Andersen, *Ann. & Mag. N. H.* (8) ii. p. 450 (1 Nov. 1908: Sierra Leone).

*Differential characters*.—Skull similar to that of *M. wroughtoni*, but rostrum narrower in front (distance between inner bases of



canines 3·3 mm., against 3·7–4 in *M. wroughtoni* and *torquata*), coronoid process higher and much slenderer.  $p^1$ ,  $m^1$ ,  $p_4$ , and  $m_1$  conspicuously shorter and narrower than in the other species of the genus (for measurements see table p. 585);  $m^2$  relatively of the same size as in *M. wroughtoni*, less reduced than in *M. torquata*. Ears smaller than in the allied species; length of tibia and hind foot as in *M. wroughtoni*, but wings somewhat shorter.

Distribution and colour of fur as in *M. wroughtoni*.

Range. Sierra Leone; Liberia.

Type in collection.

a. ♂ ad. sk.; skull. Sierra Leone. J. Hickman, Esq. [P.]. 91.2.13.1.  
(Type of species.)

### 3. *Myonycteris torquata*, Dobs.

*Cynonycteris torquata*, Dobson, Cat. Chir. B. M. p. 76.

*Cynopterus collaris* (nec *Kolenati*), Gray, Cat. Monk. &c. p. 123 (1870: "W. Africa," i. e. Lower Congo).

*Myonycteris collaris* (pt.), K. Andersen, Ann. & Mag. N. H. (7) xix. p. 512 (1907: Angola; Lower Congo).

*Cynonycteris torquata*, Dobson, Cat. Chir. B. M. p. 76, pl. v. fig. 1 (animal) (June, 1878: Angola; "Africa," i. e. Lower Congo); Trouessart, Cat. Mamm. i. p. 85, n. 451 (1897); Seabra, J. Sci. Lisboa, (2) v. p. 159 (1898).

*Cynopterus* (*Cynonycteris*) *torquata*, Trouessart, Rev. & Mag. Zool. (3) vi. p. 206 (1879).

*Xantharpyia* (*Myonycteris*) *torquata* (pt.), Matschie, Megachir. p. 64 (1899).

*Roussettus* (*Myonycteris*) *torquatus* (pt.), Trouessart, Cat. Mamm., Suppl. p. 59, n. 530 (1904).

*Roussettus torquatus*, Miller, Fam. & Gen. Bats, p. 54 (1907).

*Differential characters*.—Skull smaller and more delicately built than in *M. wroughtoni*: total length 31–31·8 mm., against 34; rostrum relatively shorter and narrower, palate shorter, interorbital region narrower (see measurements, p. 584).  $m^2$  more reduced than in the two other species of the subgenus, subequal to (not about twice the bulk of)  $p^1$ . Ear, wing, tibia, and foot shorter than in *M. wroughtoni* (see measurements, p. 583).

Distribution and colour of fur as in *M. wroughtoni*.

Range. W. Africa; thus far only known from the Lower Congo and Angola.

Type in collection.

*Cynopterus collaris*, Gray; 1870.—The type was obtained "near Congo" by one Mr. Currer, from whom it came into the hands of Dr. (afterwards Sir) J. Richardson, who presented it to the British Museum. Gray's statement that the specimen is "young" is incorrect; his quotation of "Gray, List Mamm. B. M. (1843)," where the specimen is stated to have been mentioned under the name *Xantharpyia collaris*, does not refer to the printed text of that book, but to a hand-written addition by Gray in his own copy of the book. The name *collaris* is invalidated by the combination

*Cynopterus collaris* used by Kolenati (Mon. europ. Chir. p. 11, 1860) for the species now known as *Roussettus leachi*.

- a. Subad. sk.; Near Congo (Cuvier). Sir J. Richardson [P.]. 43.9.27.2.  
 skull. (Type of *Cynopterus collaris*, Gray.)  
 b. ♂ ad. al.; Angola. Dr. Welwitsch [C. & P.]. 66.1.20.4.  
 skull. (Type of species.)

#### 4. *Myonycteris* (Phygetis) *brachycephala*, Bocage.

*Cynonycteris brachycephala*, Bocage, *J. Sci. Lisboa*, (2) i. p. 197 (1889: San Thomé); Trouessart, *Cat. Mamm.* i. p. 84, n. 449 (1897); Bocage, *J. Sci. Lisboa*, (2) v. p. 138, fig. 6 (palate-ridges) (1898); Seabra, *t. c.* p. 170, pl. i. fig. 12 (palate-ridges) (1898); Bocage, *op. cit.* (2) vii. p. 66 (1904: San Thomé).

*Xanthopyia brachycephala*, Matschie, *Megachir.* p. 66 (1899).

*Roussettus brachycephalus*, Trouessart, *Cat. Mamm., Suppl.* p. 59, n. 532 (1904).

*Dentition and skull* (figs. 47 A', B', C', D', p. 579).—Canines shorter than in other species of the genus, those in upper jaw barely exceeding  $p^3$  in height, those in lower jaw conspicuously lower than  $p_3$  (see fig. 47 D').  $p^3-m^1$  and  $p_3-m_2$  much larger than in other species (compare figs. 47 A' and B' with A and B) and with considerably higher and sharper cusps. Outer and inner ridge of  $p_3$  completely fused anteriorly (as in other species), those of  $p^3$  obscurely separated (fused in other species), those of  $p_4$  deeply and widely separated (fused in other species, compare fig. 47 C' with C); inner ridge of  $p_4$  raised anteriorly as a conical cusp nearly as high as outer ridge, inner ridge of  $p^4$  similarly conical and about half as high as outer ridge; antero-internal base of  $p^4$  more prominent and ledge-like than in other species.  $m^2$  little more than twice the size of  $p^1$ ,  $m_3$  subequal to  $p_1$ .—Skull in general aspect and even in size very similar to that of *M. wroughtoni*, but postdental palate distinctly narrower and with lateral margins more rapidly converging antero-posteriorly, interorbital region broader, and (no doubt owing to the much heavier dentition) temporal ridges fused in median line to form a low sagittal crest, zygomatic arches deeper and more strongly curved upward posteriorly (stronger fascia temporalis), coronoid process higher and broader, and angular process more prominently developed.

*Fur*.—Slightly longer and fuller than in foregoing species. Length, back 12, belly 8, foreneck 12 mm. (♀ yg. ad.). Distribution of fur as in *M. wroughtoni*.

*Colour* (♀ yg. ad., type).—Back approximately Prout's brown, gradually lightening to a somewhat paler tinge of brown on nape of neck and crown; bases of hairs dull isabella or wood-brown. Breast and belly drab. Foreneck similar, but washed with a very pale tinge of tawny-olive.

*Measurements*. On pp. 583–585.

*Range*. The island of San Thomé, Gulf of Guinea.

*Type*, in the Lisbon Museum (Reg. no. 449), a mounted young adult female, skull separate, collected by Sr. Pires (received in 1868). The type is the only specimen on record (March, 1911).

## Myonycteris: External measurements.

	<i>M. urongthoni.</i>		<i>M. leptodon.</i>		<i>M. torquata.</i>		<i>M. brachycephala.</i>	
	♂ ad. Type. mm.	♂ ad. Paratype. mm.	♂ ad. Type. mm.	♂ ad. Type. mm.	♂ ad. Type. mm.	Subad.* mm.	♀ subad. Type. mm.	♀ subad. Type. mm.
Forearm .....	67	65	61	61	60.5	60.5	63.5	63.5
Pollex, total length, c. u. ....	25	24.5	...	23	23	23	...	...
2nd digit, metacarpal .....	33.5	33.5	32.5	27.5	27.5	30.5	30.5	30.5
" 1st phalanx .....	7.5	6	7	5.5	5.5	6.5	7.5	7.5
" 2nd-3rd phalanx, c. u. ....	8	7	8	6.5	6.5	7	8	8
3rd digit, metacarpal .....	45	44.5	42	36	36	39	44	44
" 1st phalanx .....	31	28	29.5	25.5	25.5	28	31.5	31.5
" 2nd phalanx .....	38	37	35.5	33	33	33	38	38
4th digit, metacarpal .....	45	42.5	41	35	35	38	42	42
" 1st phalanx .....	23	21	22	19	19	21	22	22
" 2nd phalanx .....	23.5	22.5	22.5	20	20	23.5	24.5	24.5
5th digit, metacarpal .....	45	42.5	40	35	35	38	41	41
" 1st phalanx .....	21	18	20	17	17	17.5	19.5	19.5
" 2nd phalanx .....	22	20	20	17.5	17.5	20	21	21
Ear, length from orifice .....	17.5†	16.5†	14†	14.5	14.5	15†	...	...
" greatest width, flattened .....	12.5†	11.5†	11†	10.5	10.5	11†	...	...
Tail .....	...	...	...	8	8	...	...	...
Interfemoral in centre, depth .....	...	...	...	3.5	3.5	...	...	...
Tibia .....	25	25.5	24.5	21.5	21.5	22	?	25
Foot, c. u. ....	17	18	17.5	14.5	14.5	...	...	...
Calcaneus .....	...	...	...	4	4	...	...	...

\* Type of *Cynopterus collaris*, Gray.

† From relaxed skins.

## Myonycteris: Measurements of skulls and tooth-rows.

	<i>M. wroughtoni</i> .		<i>M. leptodon</i> .	<i>M. torquata</i> .		<i>M. brachycephala</i> .
	♂ ad. Type. mm.	♂ ad. Paratype. mm.	♂ ad. Type. mm.	♂ ad. Type. mm.	Subad.* mm.	♀ subad. Type. mm.
Skull, total length .....	34	...	...	31†	31.8†	34
" palation to incisive foramina .....	16.5	16.8	16.3	14.8	15	15.7
" postidental palate, length .....	5.5	5.5	5.6	4.6	4.5	5.3
" front of orbit to tip of nasals .....	10.7	10.5	10.2	9	9.2	10.6
" width of brain-case at zygomata .....	13.7	14	14	13.2	13.7	13.7
" zygomatic width .....	21	...	...	19.7	...	19.8
" across crowns of m <sup>1</sup> , externally .....	10.2	10.4	9.8	9.8	9.8	10.2
" lachrymal width .....	9.8	10	9.8	8.8	8.8	9.8
" across crowns of canines, externally .....	7.2	7.2	6.6	7	6.8	6.7
" post-orbital width .....	7.2	7.8	7.3	8	7.8	...
" interorbital width .....	6	6	5.8	5	5.2	6.8
" mesopterygoid fossa, width .....	5	4.7	5	4.2	4.7	4.1
" postdorsal palate, width at middle .....	7.8	7.6	7.8	7	7.1	6.2
" between p <sup>1</sup> -p <sup>1</sup> .....	5.8	6.2	5.8	5.7	5.2	...
" between bases of canines .....	3.7	4	3.3	3.8	3.8	3.2
" orbital diameter .....	8.8	...	8.5	8.8	8.8	8
Mandible, length from condyle .....	26.5	26.5	26	24.8	24.5	25.7
" coronoid height .....	10.2	10.8	11	10.2	9.8	13
Upper teeth, c-m <sup>2</sup> , crowns .....	13	13.8	12.8	12.2	12.7	12.8
Lower teeth, c-m <sub>3</sub> , crowns .....	14.5	14.5	14.2	13.2	13.7	13.6

\* Type of *Cynopterus collaris*, Gray.

† Estimate.

## Myonycteris: Measurements of teeth.

<i>M. wroughtoni.</i>		<i>M. leptodon.</i>	<i>M. torquata.</i>		<i>M. brachycephala.</i>
♂ ad. Type. mm.	♂ ad. Paratype. mm.	♂ ad. Type. mm.	♂ ad. Type. mm.	Subad.* mm.	♀ subad. Type. mm.
p <sup>3</sup> , length .....	1.8	1.9	2.1	2	2.6
" width .....	1.6	1.4	1.5	1.3	1.9
p <sup>1</sup> , length .....	2.5	2.1	2.5	2.5	2.9
" width .....	1.8	1.4	1.7	1.5	2.1
m <sup>1</sup> , length .....	2.2	1.8	2.1	2.2	2.6
" width .....	1.6	1.2	1.5	1.3	1.9
m <sup>2</sup> , length .....	1.1	1.2	0.7	0.8	1.1
" width .....	0.9	1	0.6	0.6	1
p <sup>6</sup> , length .....	0.9	1	0.7	0.9	0.9
" width .....	0.7	0.8	0.7	0.9	1
p <sup>3</sup> , length .....	1.6	1.8	1.8	2	2.2
" width .....	1.2	1.2	1.3	1.2	1.7
p <sup>4</sup> , length .....	2.6	2.2	2.4	2.6	2.8
" width .....	1.7	1.5	1.6	1.5	1.9
m <sup>1</sup> , length .....	2.4	2	2.3	2.3	2.6
" width .....	1.5	1.3	1.6	1.3	1.7
m <sup>2</sup> , length .....	1.8	1.6	1.5	1.5	1.9
" width .....	1.1	1.1	1	1.1	1.6
m <sup>3</sup> , length .....	0.9	0.9	0.9	0.8	1
" width .....	0.7	0.7	0.7	0.5	0.9

\* Type of *Cynopterus collaris*, Gray.

18. CYNOPTERUS, *F. Cuv.**Cynopterus* (pt.), Dobson, Cat. Chir. B. M. p. 80.

1824. *Cynopterus*, *F. Cuvier, Dents Mamm.* p. 248. Type.  
C. s. sphinx.  
 1828. *Pachysoma*, *E. Geoffroy, Cours Hist. Nat. Mamm.*, 13 leçon (for 27 June, 1828), p. 26 [*nec* *Pachysoma*, *MacLeay*, 1821, a genus of Coleoptera] ..... C. s. titthæcheilus.  
 1906. *Niadius*, *Miller, Proc. Biol. Soc. Wash.* xix. p. 83 (4 June, 1906) ..... C. princeps.

*Vespertilio*, *Fahl, Skr. Nat. Selsk.* iv. Heft 1, p. 123 (1797).

*Pteropus*, *E. Geoffroy, Cat. Mamm. Mus. Nation. d'Hist. Nat.* p. 45 (pt.) (1803: *Pt. pusillus*, i. e. *C. sphinx*); *id.*, *Ann. Mus. d'Hist. Nat.* xv. p. 90 (1810: genus *Pteropus*, part of section \*\*, "Roussettes à queue"); *Temminck, Mon. Mamm.* i. p. 166 (1825: genus *Pteropus*, part of third section, p. 195); *Gray, Griffith's An. Kingd.* v. p. 54 (1827: genus *Vespertilionida*, subgenus *Pteropus*, part of section 11, "with a tail"); *E. Geoffroy, Hist. Nat. Mamm.*, 13 leçon, p. 17 (pt.) (1828: *Pt. marginatus*, i. e. *C. sphinx*); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 698 (1828: genus *Pteropus*, part of section ††, "Roussettes à queue"); *J. B. Fischer, Syn. Mamm.* p. 80 (1829: genus *Pteropus*, section †, part of subsection *b*, "caudati," and part of section ††, "Pachysomatata"); *Wagner, Schreber's Säug., Suppl.* i. p. 339 (1839: genus *Pteropus*, subgenus *Pteropus*, part of section β, "caudati").  
*Eidolon* (pt.), *Rafinesque, Anal. Nat.* p. 54 (1815: name proposed for *E. Geoffroy's* second section of *Pteropus*, "Roussettes à queue" = the modern genera *Eidolon*, *Rousettus*, *Cynopterus*, and *Macroglossus*).

*Cynoptères*, *F. Cuvier, Dents Mamm.* p. 39 (1822).

*Cynopterus*, *F. Cuvier, l. s. c.* (1824); *Gray, An. Philos.* (2) x. p. 338 (1825); *Lesson, Mon. Mamm.* p. 114 (1827); *Desmarest, Dict. Sci. Nat.* xlv. p. 370 (1827); *Burnett, Quart. J. Sci. Lit. Art*, Apr.-June, 1829, p. 269; *Lesson, Hist. Nat. Mamm. (Compl. Buffon)*, v. p. 65 (1836); *Gray, Mag. Zool. & Bot.* ii. p. 503 (pt.) (1838: = *Cynopterus* + *Chironax*); *Lesson, N. Tabl. R. An., Mamm.* p. 15, n. 46 (1842); *Gray, List Mamm. B. M.* pp. xix, 38 (pt.) (1843 = *Rousettus* + *Cynopterus*); *id.*, *Voy. 'Sulphur,' Zool.* i. p. 29 (pt.) (1844); *id.*, *Zool. 'Samarang,' Vert.* p. 12 (1849); *Peters, MB. Ak. Berlin*, 1865, p. 256 (pt.). *Gray, P. Z. S.* 1866, p. 64 (pt.); *Peters, MB. Ak. Berlin*, 1867, p. 866 (pt.) (= *Cynopterus* + *Chironax*); *Gray, Cat. Monk. &c.* p. 121 (pt.) (1870: = *Cynopterus* + *Thoopterus* + *Myonycteris*); *Dobson, Ann. & Mag. N. H.* (4) xvi. p. 354 (pt.) (1875); *id.*, *Mon. As. Chir.* pp. 14, 23 (genus), pp. 23, 24 (subgenus = *Cynopterus* + *Chironax*) (1876); *id.*, *Cat. Chir. B. M.* p. 80 (genus), p. 81 (subgenus = *Cynopterus* + *Chironax* + *Thoopterus*) (1878); *Leche, Lunds Univ. Årsskr.* xiv. p. 21 & seq. (1878: dental formula; milk dentition); *Robin, Ann. Sci. Nat.* (6) Zool. xiii. Art. 2, p. 4 et seq. (1881: visceral anatomy); *Flower & Lydekker, Mamm.* p. 653 (1891); *Winge, E. Mus. Lundii*, ii. pt. 1, pp. 24, 27, 28, 56 (1892: affinities; dental formula); *Meude, Mém. H. N. Emp. Chin.* iii. p. 176 (1896: dentition); *Motschke, Megachir.* p. 71 (genus), p. 74 (subgenus) (1899); *Miller, Fam. & Gen. Bats*, p. 47 (pt.) (1907: = *Cynopterus* pt. + *Chironax*); *Toldt, Ann. Nat. Hofmus. Wien*, xxiv. pp. 238, 241 (1910: hair).

- Pachysoma*, *E. Geoffroy*, *l. s. c.* (before Sept. 1828 \*); *Is. Geoffroy*, *Dict. Class. d'Hist. Nat.* xiv. p. 703 (pt.) (Sept. 1828 = *Cynopterus* + *Chironax*); *id.*, *Ann. Sci. Nat.* xv. pp. 192, 203 (pt.) ("Oct. 1828") = *Cynopterus* + *Chironax*; *Lesson*, *Hist. Nat. Mamm.* (*Compl. Buffon*), v. p. 61 (pt.) (1836: = *Cynopterus* + *Chironax*); *Temminck*, *Mon. Mamm.* ii. pp. 50, 91 (pt.) (1837: = *Cynopterus* + *Megacerops* + *Chironax*); *Wagner*, *Schreber's Säug., Suppl.* i. p. 362 (1839: subgenus of *Pteropus* = *Cynopterus* + *Chironax* + *Megacerops*); *Lesson*, *N. Tabl. R. An., Mamm.* p. 14, n. 44 (pt.) (1842: = *Cynopterus* + *Chironax*); *Temminck*, *Esq. Zool.* p. 64 (pt.) (1853: = *Epomophorus* + *Cynopterus*); *Wagner*, *Schreber's Säug., Suppl.* v. p. 605 (pt.) (1853-55: subgenus of *Pteropus* = *Epomophorus* + *Cynopterus* + *Chironax*); *Fitzinger*, *SB. Ak. Wien*, lx. Abth. i. p. 618 (1870: = *Pteropus* pt. + *Cynopterus* + *Chironax*); *Marchi*, *Atti Soc. Ital. Sci. Nat.* xv. p. 518, pl. viii. figs. 5-6 (1873: structure of hairs).
- Cynonycteris* (pt.), *Peters*, *MB. Ak. Berlin*, 1869, p. 394 (*C. grandidieri*); *Dobson*, *Cat. Chir. B. M.* p. 70 (1878: *C. grandidieri*).
- Eleutherura* (*nec Gray*), *Macleister*, *Phil. Trans.* 1872, pl. xiii. figs. 1, 4 (myology).
- Niadus*, *Miller*, *l. s. c.* (4 June, 1906); *id.*, *Fam. & Gen. Bats*, p. 49 (1907); *Lyon*, *Proc. U.S. Nat. Mus.* xxxiv. p. 665 † (1908); *Thomas & Wroughton*, *Ann. & Mag. N. H.* (8) iii. p. 439 (1909: subgenus of *Cynopterus*); *id.*, *J. Fed. Mal. St. Mus.* iv. p. 109 (1909: at most a subgenus of *Cynopterus*).

*Summary of characters.*—Cranial rostrum short (orbit to nares less than lachrymal breadth), much lower at canine than at  $p^3$ ; postorbital foramen  $\pm$  large; foramen ovale and rotundum usually united. Incisors  $\frac{2}{2}$  -  $\frac{2}{2}$ ; cheek-teeth  $\frac{4}{5}$  ( $m_3$  and  $m^2$  absent); upper canine with secondary cusp on inner edge, but without vertical groove on front face. Tail distinct; interfemoral normal; calcar present; ears narrowly edged with white; males with conspicuous neck-tufts. Forearm 54-90 mm. [Six species, sixteen recognizable forms. *Hab.* The Oriental Region, extending east to Sanghir Is., Celebes, and Timor.]

*Skull* (fig. 48).—Short, broad, heavily built: shortness of skull due chiefly to reduced length of rostrum; basiscranial axis nearly horizontal, alveolar line if projected backward passing through lower edge of occipital condyle (or very nearly so); occipital portion short, without trace of tubular elongation. Rostrum much shorter than in *Rousettus*, shorter still than in *Myonycteris*, its length (orbit to nares) being decidedly less than breadth across lower edges of lachrymal foramina; upper profile line of rostrum conspicuously descending postero-anteriorly, making depth above canine considerably less than above  $p^3$  (compare *Megacerops*, fig. 52, p. 647). Premaxillæ slender, slightly tapering above, subvertical, in simple contact anteriorly. Orbit large, diameter about one-fourth of total length of skull, front of orbit above posterior half or middle of  $p^4$ . Postorbital processes short, but rather stout; postorbital foramina large. Temporal ridges in smaller species often remaining separate (though usually closely approximated), in

\* See footnote *antè*, p. 448.

† Misspelt *Niadus*.

‡ Through base of postorbital process.

larger species fused into a sagittal crest; zygomatic arches relatively heavy, curved upward posteriorly by fascia temporalis. Palato simple, median length rather more than twice the greatest interdental breadth; maxillary tooth-row extending to inferior margin of orbit; length of postdental palate subequal to breadth between  $p^3$ - $p^3$ , its lateral margins forming straight lines converging backwards, breadth at palation border a little greater than between bases of canines. Foramen rotundum and ovale usually fused.

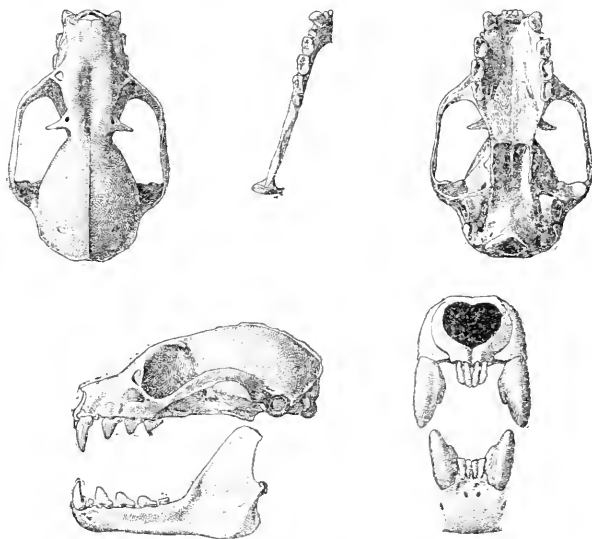


Fig. 48.—*Cynopterus sphinx titthæcheilus*, ♂. Buitenzorg, Java.  
No. 9.1.5.105.  $\frac{1}{2}$ , with front view  $\frac{1}{2}$  (linear).

Tympanie ring as in *Rousettus*, broader than in *Pteropus*. Rami of mandible heavy, symphysis short, subvertical, coronoid high, broad, rather steeply ascending, angular process distinct, rounded, condyle considerably above level of alveolar line.

Dentition (figs. 48, 49).—
$$\frac{i^1 i^2 c p^1 p^3 p^4 m^1}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2} \times 2 = 30^*.$$

\* Dental anomalies, in about 200 skulls, representing all forms known.—Of the seven anomalies observed no less than three are instances of the absence of one  $i_1$ , either right or left (*C. b. angulatus*, ad., teeth worn, 60.3.19.1400; *C. b. brachyotis*, ad., teeth unworn, 97.1.2.9; *C. b. javanicus*, ad., teeth unworn, 79.11.21.68); this anomaly is of some interest as, so to say, foreshadowing those *Cynopterine* genera in which the middle pair of lower incisors is permanently lost. One skull shows a reduplication of  $i^2$  on left side (*C. b. angulatus*, imm., 6.11.6.42). The left  $m_2$  is absent in two skulls (*C. b. angulatus*, ad., teeth nearly unworn, 8.2.5.13; *C. b. minutus*, ad., teeth slightly worn, U.S.N.M. 141243), but in one (the former) of these the jaw looks at that point diseased. A small  $m_3$ , quite hidden in the bone, is present on the left side in one skull (*C. b. javanicus*, imm., 9.1.5.73).



Upper incisors subterete, crown not peculiarly differentiated, slightly flattened antero-posteriorly,  $i^2$  slightly but distinctly shorter than  $i^1$ ; lower incisors subequal in height, but  $i_2$  a little heavier in bulk than  $i_1$ , crown somewhat flattened laterally (its antero-posterior distinctly greater than its transverse diameter), cutting-edge simple or with a faint median notch. Diastema  $i^2$ - $c$  subequal to or a little narrower than  $c$ - $p^3$ . Upper and lower canines short and stout, with a distinct secondary cusp near middle of inner edge, produced by a prolongation of cingulum; anterior surface of crown perfectly smooth (no vertical groove).  $p^1$  rudimentary, but not deciduous, terete, scarcely as high as cingulum of canine;  $p_1$  about twice to four times the bulk of  $i_2$ .  $p^3$ - $m^1$  and  $p_3$ - $m_1$  very similar to corresponding teeth of *Rousettus*, but outer and inner ridge of  $p^3$  always separated at tip (though connected by a commissure at base), ridges of  $p_3$  not quite completely fused, and  $p_4$  and  $m_1$  (or the latter only) often with a more or less conspicuous surface cusp (see next paragraph), as in some species of *Dobsonia*.  $m_2$  small, subequal to or rather a little larger than  $p_1$ .

*Surface cusp in  $m_1$  and  $p_4$  (fig. 49).*—The genus taken as a whole



Fig. 49.—A, upper right, B, lower left tooth-row of *Cynopterus sphinx* *tithæchilus* (9.1.5.116).

A', B', corresponding tooth-rows of *Cynopterus princeps*  
(U.S. National Museum, no. 14127 $\frac{1}{2}$ , paratype of species).  
 $\frac{2}{3}$  (linear).

exhibits any gradation, from complete absence of a surface cusp in  $m_1$  and  $p_4$ , through a barely perceptible trace of such cusp in  $m_1$  or both in  $m_1$  and  $p_4$ , or a small but quite distinct cusp in  $m_1$  or both  $m_1$  and  $p_4$  (fig. 49 B), to a perfectly well-developed or even large cusp in both teeth (fig. 49 B'). But there is in this respect decidedly a difference of degree between *C. sphinx*, *brachyotis*, and *major* on the one hand, and *C. horsfieldi*, *harpax*, and *princeps* on the other. As the latter three species are further distinguished by rather shorter and broader, more subrectangular or subquadrate cheek-teeth, the genus may conveniently be divided into two sections, the *Cynopterus*

section (the three former species) and the "*Niadius*" section (the three latter; *Niadius* originally a new generic name proposed by Miller for one of these species, *C. princeps*). In the *Cynopterus* section the surface cusp is either entirely undeveloped (40 per cent. of 183 skulls) or barely traceable (44 per cent.) or perfectly distinct (16 per cent.), though never quite as large as in the *Niadius* section; the variation as here described appears to be perfectly individual; it is quite common to find any gradation, within these limits, in a series of individuals of the same species or race, taken on the same spot. Only in the "*Niadius*" section are these cusps constantly present and always relatively large, though even here varying considerably in size from individual to individual; they are often larger in  $m_1$  than in  $p_1$ ; in  $m_1$  a smaller supplementary cusp is often present behind the principal surface cusp, or these two cusps may be fused so as to form a short longitudinal surface ridge. Subjoined, the details from about 200 skulls representing all species and races known:—

	Number of skulls examined.	Surface cusp		
		completely absent.	traceable in $m_1$ , or in both $m_1$ and $p_1$ .	perfectly distinct, or even large, in $m_1$ , or both in $m_1$ and $p_1$ .
<i>s. sphinx</i> .....	21	3	14	4
<i>s. gangeticus</i> .....	2	...	2	...
<i>s. tithæcheilus</i> .....	23	8	9	6
<i>b. angulatus</i> .....	35	10	15	10
<i>b. brachyotis</i> .....	60	28	29	3
<i>b. javanicus</i> .....	19	13	2	4
<i>b. insularum</i> .....	3	1	2	...
<i>b. ceylonensis</i> .....	4	...	3	1
<i>b. minutus</i> .....	5	3	1	1
<i>b. brachysoma</i> .....	3	3	...	...
<i>b. scherzeri</i> .....	2	...	2	...
<i>major</i> .....	6	4	2	...
<i>h. horsfieldi</i> .....	13	...	...	13
<i>h. minor</i> .....	4	...	...	4
<i>harpax</i> .....	1	...	...	1
<i>princeps</i> .....	2	...	...	2
<i>C. sphinx</i> .....	46	24 p.ct.	54 p.ct.	22 p.ct.
<i>C. brachyotis, major</i>	137	45 "	41 "	14 "
<i>Cynopterus</i> section.	183	40 p.ct.	44 p.ct.	16 p.ct.
<i>Niadius</i> section.....	20	0 "	0 "	100 "

*Palate-ridges* (fig. 50).—Ten (or eleven or twelve) thick and rather sharply projecting, almost equidistant ridges, occupying the

whole of the interdental and the anterior portion of the postdental palate, and separated by a narrow ridgeless space from two thin ridges near the palation border. From the anterior ridge, which is flatly convex, sometimes nearly straight, the ridges become gradually more strongly curved or hastate posteriorly; the two (or three, four, or five) posterior of the principal set are slightly divided at middle, the two palation-ridges usually distinctly divided. Specific



Fig. 50.—Palate-ridges of *Cynopterus brachyotis* (94.6.19.2).  
 $\frac{3}{2}$  (linear).

variation very small; the larger species possess usually twelve or eleven, the smaller ten or eleven ridges in front of the ridgeless space. The number of ridges is somewhat greater and the arrangement more crowded than in *Rousettus* (fig. 29 A. p. 485).

*External characters.*—Muzzle short and stout, centre of eye in the middle between base of ear and tip of muzzle; nostrils subtubular, directed obliquely forward and outward; odontoid papillæ fringing inner side of upper and lower lips (from angle of mouth to points opposite fronts of  $p^3$  and  $p_3$ ) unusually large, numerous, and crowded (posteriorly as a rule arranged in three rows, then in two, anteriorly in a single row). Ears moderate, reaching hinder canthus or centre of eye, tip narrowly rounded off; antitragal lobe small, subtriangular or rounded, generally perfectly distinct, sometimes rudimentary, but scarcely ever completely obsolete. Tail always shorter than (about one-half to three-fourths of) hind foot with claws, connected with interfemoral by its dorsal integument, extreme tip free (caudal vertebrae four). Calcar short, one-half to one-third of hind foot with claws.

Lateral membranes widely separated at origin from sides of back, inserted posteriorly on first toe (tip of metacarpal, or base or proximal half of first phalanx). Vertical fasciæ of mesopatagium (those crossed by internal cutaneous line) about 15–25, rather narrowly spaced. Basal fourth or fifth of first phalanx of pollex included in membrane. Index clawed. Third metacarpal equal to about two-thirds of forearm; fourth always slightly but distinctly shorter than third, fifth usually a trifle longer than fourth but shorter than third. Terminal phalanx of third digit much shorter than metacarpal of same digit; terminal phalanx of fourth digit always, that of fifth usually, a little longer than proximal phalanges. Subjoined, the wing-indices of *Cynopterus* calculated from measure-

ments of more than 200 specimens representing all species and subspecies known :—

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c.u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	389	429	121	119	610	429	568	599	326	378	625	305	335

Fur short; basal third or fourth of forearm clothed above; tibia practically naked above (thinly scattered hairs on basal third). Colour of hair in fully adult individuals some tinge of brown on the whole of the upperside, sometimes a nearly pure olive or bistre, but more often lightened with raw-umber or tawny-olive or russet, more rarely approaching isabella or wood-brown; breast and belly usually some degree of drab or broccoli-brown, often washed with tawny-olive; fur of sides of neck and foreneck in adult males forming a conspicuous semirigid "ruff" contrasting in colour with underparts, varying from ochraceous through tawny, russet, or cinnamon-rufous, to chestnut. The taxonomic value of the colour of the fur is small, the individual being decidedly greater than the specific variation; in some species (e. g. *C. sphina*) the adult individuals show any gradation from dark (olive or bistre) to bright colours, independent of sex and season, in others (e. g. *C. b. angulatus*) dark tinges are predominant, in others again (*C. b. brachyotis*, *javanicus*, *insularum*) brighter tinges. In the "*Nidius*" section the ruff of adult males averages deeper, more saturated, in colour than in the *Cynopterus* section. Ears (probably in all species without exception) narrowly edged with white; metacarpals and phalanges of the three long digits often (not always!) whitish or brownish white or whitish brown, contrasting with dark membranes.

Externally the species of *Cynopterus* are generally easily distinguished from *Rousettus* of similar size by the shorter muzzle, more projecting (subtubular) nostrils, *much heavier odontoid papillæ on inner side of lips*, white ear edgings (which, however, sometimes completely disappear after death, both in alcoholic specimens and skins), shorter and thinner tail, warmer tinges of the colour of the upperside, more numerous (15-25, as against 10-17) and more narrowly spaced vertical fasciæ of the mesopatagium, and by the insertion of the membranes rather on the *preaxial* (tibial, "external") side of the first toe than on the *dorsal* surface of the metatarsus at the base of first or second toe.

*Sexual differentiation*.—Ruff of adult males much more rigid and averaging considerably deeper in colour than in adult females. No sexual difference in size.

*Range*.—The whole of the Oriental Region, extending west to the Indian Peninsula and Ceylon, north to Sind, Nepal, Assam (North Lakhimpur), and North Siam, south to Sumatra and Java,

east to Borneo and the Philippines, and beyond the limits of the Region to Celebes, Sanghir and Sulu Islands, Lombok and Timor. [Peters's "*Cynonycteris grandidieri*," stated to be from Zanzibar, is a *Cynopterus b. brachyotis*, and the locality no doubt wrong; Dobson's record of "*Cynopterus scherzeri*" from New Guinea (P. Z. S. 1878, p. 875) rests on a mistake, the specimens in the Paris Museum referred to by him (collected by Laglaize) being in reality from the Sanghir Islands; a specimen of *Cynopterus* in the Berlin Museum is ticketed, probably erroneously, "Aru Inseln."]

The following table shows the distribution of the species and subspecies:—

	<i>Cynopterus</i> section.		" <i>Niudius</i> " section.
	<i>C. sphinx</i> .	<i>C. brachyotis</i> , <i>major</i> .	
Indian Pen., N.W. ....	s. gangeticus		
" " S. and E. ....	s. sphinx		
Ceylon .....	s. sphinx	b. ceylonensis	
Assam .....	s. sphinx	b. angulatus	
Burma .....	s. sphinx *	b. angulatus	
Siam .....	s. sphinx	b. angulatus	
Cochinchina .....		b. angulatus	
Natuna Is. ....		{ b. angulatus	
		{ ? b. brachyotis	
Lower Siam .....		{ b. angulatus	
		{ b. brachyotis	
Malay Pen. ....		{ b. angulatus	harpax
		{ b. brachyotis	
Sumatra.....	s. titthæcheilus	{ b. angulatus	horsfieldi
		{ b. brachyotis	
Mentawai Is. ....		b. angulatus	[minor
Borneo .....		b. brachyotis	
Philippines .....		b. brachyotis	
Celebes .....		b. brachyotis	
Java .....	s. titthæcheilus	b. javanicus	b. horsfieldi
Lombok .....	s. titthæcheilus		
Timor.....	?s. titthæcheilus		
Kangean Is. ....		b. insularum	
Mata Siri Is. ....		b. insularum	
Nias .....		{ b. minutus	princeps
		{ major	
Nieobars .....		b. scherzeri	
Andamans.....		b. brachysoma	

\* Probably occurring, but no specimens examined.

*Habits*.—Bats of this genus are common everywhere in suitable places throughout South Asia and Malaya; judging by the large numbers brought home by collectors, they must be the commonest, or in any case the most easily captured, of all Oriental Fruit-bats. In the daytime they are found on trees, sometimes solitary in the

forest, but more often hanging in bunches among the crowns of plantains, cocoanut, or Palmyra palms, or under the eaves of the houses, frequently also in caves or deserted mine-galleries. They have been met with from sea-level to an altitude of 6000 feet (*C. s. titthoecheilus* in Java, *fule* Salomon Müller). Their movements when on wing are light, swift, and buoyant, far different from the measured rowing, the direct and heavy flight of the large *Pteropus*; they rarely, if ever, frequent the higher branches of the trees, are usually observed dodging about amongst bushes and low trees, hence easily escape notice if not looked for. The voracity of captive specimens has been described by several writers. Dobson gave a *C. sphinx* a ripe banana which, with the skin removed, weighed two ounces; the animal immediately, as if famished with hunger, fell upon the fruit, seizing it between the thumbs and the index fingers, and took large mouthfuls out of it, opening the jaws to their fullest extent with extreme avidity; while eating it "seemed to be a kind of living mill, the food passing from it almost as soon as devoured"; after three hours the whole fruit was consumed, but the bat itself, when killed next morning, was found to weigh only one ounce. Of gnava it swallows the juice only, opening and closing its mouth very leisurely in the act of mastication, and rejecting the residue (Blyth). In nature *Cynopecterus* has been found feeding on wild figs and on the flowers of plantains and Areca palms; "anyone who chooses to watch a plantain tree in flower, about half an hour after sunset, is pretty sure to get a chance of making its acquaintance" (Wroughton, Bombay region). There is no evidence that it ever feeds on insects, but Wroughton once found in the mouth of a freshly killed *C. sphinx* a pellet which may have been shell-fish. In some places, *e. g.* North Siam, these bats are caught and sold for food in the markets (collector's label, B. M. 2.6.6.1). Young ones, evidently several weeks old, were taken by Mr. Everett in Sirhassen, S. Natuna Islands, on September 20th, while some of the females had not yet brought forth, though the wet season was beginning.\*

*Affinities.*—*Cynopecterus* has undoubtedly originated from a *Rousettus*-like stock; but it is in many important characters more specialized than the genus *Rousettus*; it has followed a line of development to a large extent parallel to that of *Myonycteris* (see p. 578), but is still more specialized. The rostrum is considerably shortened as compared with that of *Rousettus*, the postdental palate narrower, the orbital cavities larger; the posterior molars below and above ( $m_3$  and  $m_2$ ), which even in the most primitive living Fruit-bats are reduced in size, have entirely disappeared, while the rudimentary anterior premolars ( $p^1$  and  $p_1$ ) have been preserved unmodified; the large premolars and molars are relatively heavier (shorter and broader) than in *Rousettus*, and  $m_1$  and  $p_4$  show a very pronounced tendency to develop a surface cusp or ridge; also the

\* S. Müller, Temminck's Nat. Gesch. Ned. Or. Bez., Zoogd. p. 21 (1839-44); Blyth, J. A. S. B. xiii. p. 479 (1844); Dobson, Cat. Chir. B. M. p. 83 (1878); A. Everett, Nov. Zool. i. p. 655 (1894); Wroughton, J. Bomb. N. H. Soc. xii, p. 717 (1899); Robinson & Kloss, J. Fed. Mal. St. Mus. iv. p. 108 (1909).

canines are heavier, with stronger cingulum, and a small but always quite distinct supplementary (cingulum) cusp on the inner edge; on the other hand, the incisors are slightly reduced, the crowns of those in the upper jaw less distinctly differentiated,  $i_1$  smaller in bulk than  $i_2$ , and  $i^2$  a little shorter than  $i^1$  (in certain other Cynopterine genera  $i_1$  disappears, and  $i^2$  is more conspicuously reduced in size, and in *Nyctimene* all lower incisors as well as  $i^2$  disappear). As a consequence of the heavier dentition, the zygomata are deeper, more flaring, and more strongly curved upward posteriorly, the rami of the mandible deeper, the coronoid process broader, and the condyle of the mandible higher above the alveolar line; also the more horizontal (less deflected) position of the basi-cranial axis is in all probability connected with the heavier dentition (in *Rousettus* and *Pteropus* weak dentition seems to be invariably associated with greater, heavy dentition with less deflection of the brain-case). The papillæ on the inner side of the lips are much more strongly developed. The external peculiarities of *Cynopterus*, as compared with *Rousettus*, are few and (apart from the shorter muzzle) rather trivial, but some of them are significant as foreshadowing further modifications in related genera. The nostrils are decidedly more prominent, "subtubular" (a character carried to an extreme in *Nyctimene*), the tail a little more reduced (4 caudal vertebræ as against 5-7; tail disappeared in certain other genera of the Cynopterine section), the colours of the fur rather more inclining to the brighter tinges of brown, and the unctuous hairs on the sides of the neck and foreneck ("ruff") of males more conspicuously differentiated.

*Chronology of species and revisions of genus.*—Thirty names occur in literature for the sixteen forms of *Cynopterus* recognized in the present Catalogue. The table on p. 596 gives the names in chronological sequence, together with the authors, type localities, and identifications (the numbers in the last column indicate the sequence of the primary descriptions of the recognized species and subspecies).

As will be seen from the table, during one century (1797-1897) seven of the sixteen now known forms were described, and twenty names proposed for these seven forms; the other nine forms have been discovered during the last thirteen years (1898-1910). Peters, when revising the genus in 1867, recognized three species of "*Cynopterus*," one of which, Temminck's *melanocephalus*, must however be separated as a distinct genus (*Chironax*): the other two were *marginatus* (= *sphinx*, *titthæcheilus*, *horsfieldi*, and *scherzeri*) and *brevicaudatus* (= *brachyotis*). According to Gray (1870) the genus numbered two species, *C. marginatus* and *collaris*, but the latter is a *Myonycteris*; *C. marginatus* he divided into nine "varieties," viz., *elliotti* (= *sphinx*), *ceylonensis* (subspecies of *brachyotis*), *titthæcheilus* (subspecies of *sphinx*), *brevicaudatus* (perhaps *brachyotis*), *horsfieldi* (distinct species), *brachyotis* (= *b. brachyotis*), *philippensis* (= *b. brachyotis*), *cumingi* (= *b. brachyotis*), and *nigrescens* (= *Thoopterus nigrescens*). Dobson's "subgenus"

Year.	Name.	Author.	Type locality.	Identification.
1797	sphinx	Vahl	Tranquebar	1. sphinx sphinx
"	fibulatus	Vahl	Tranquebar	sphinx sphinx
1803	pusillus	E. Geoff.	India	sphinx sphinx
1810	marginatus	E. Geoff.	Bengal	sphinx sphinx
1825	tittthæcheilus	Temm.	Buitenzorg	2. sphinx tittthæcheilus
1828	diardi	E. Geoff.	Sumatra	? sphinx tittthæcheilus
"	duvauceli	E. Geoff.	Sumatra	? brachyotis brachyotis
"	brevicaudatus	Is. Geoff.	Sumatra	? brachyotis brachyotis
1838	brachyotis	S. Müller.	R. Dewi, Bornco	3. brachyotis brachyotis
1843	horsfieldi	Gray	Java	4. horsfieldi horsfieldi
1861	luzoniensis	Peters	Luzon	brachyotis brachyotis
1869	grandidieri	Peters	"Zanzibar"	brachyotis brachyotis
"	scherzeri	Zelevor	Car Nicobar	5. brachyotis scherzeri
1870	elliotti	Gray	S. Bombay	sphinx sphinx
"	ceylonensis	Gray	Ceylon	6. brachyotis ceylonensis
"	philippensis	Gray	Philippines	brachyotis brachyotis
"	cumingi	Gray	Philippines	brachyotis brachyotis
1871	brachysoma	Dobson	Andamans	7. brachyotis brachysoma
1873	andamanensis	Dobson	Andamans	brachyotis brachysoma
1881	montanoi	Robin	Malacca	brachyotis brachyotis
1898	angulatus	Miller	Lower Siam	8. brachyotis angulatus
1906	princeps	Miller	Nias	9. princeps
"	major	Miller	Nias	10. major
"	pagensis	Miller	N. Pagi I.	brachyotis angulatus
"	minutus	Miller	Nias	11. brachyotis minutus
1908	minor	Lyon	E. Sumatra	12. horsfieldi minor
1909	harpax	Thos. & Wrought.	Malay Pen.	13. harpax
1910	s. gangeticus	K. And.	Lucknow	14. sphinx gangeticus
"	b. javanicus	K. And.	Buitenzorg	15. brachyotis javaniens
"	b. insularum	K. And.	Kangean Is.	16. brachyotis insularum

*Cynopterus* numbered five species, two of which must be placed in separate genera, viz., *melanocephalus* (*Chironax*) and *latidens* (*Thoopterus nigrescens*); the remaining three were *marginatus* (= *s. sphinx*, *s. tittthæcheilus*, *b. angulatus*, *b. brachyotis*, *b. ceylonensis*, and *h. horsfieldi*), *scherzeri* (subspecies of *brachyotis*), and *brachysoma* (subspecies of *brachyotis*). The latest writer on the subject (Matschie, 1899) catalogued all the then described forms geographically, without expressing any definite opinion on their distinctness.

*History of generic names.*—The name now universally adopted for the present genus was proposed by F. Cuvier in 1822 (*Cynoptères*) and 1824 (*Cynopterus*); the only species then known was "*marginatus*" (= *s. sphinx*), and the principal generic characters pointed out by F. Cuvier were, quite correctly, the shortness of the rostrum and the absence of  $m^2$  and  $m_3$ . But F. Cuvier's proposal was not accepted by the leading French authority on Chiroptera of that period, viz., E. Geoffroy (1828); this author refused to recognize *Cynopterus* as a distinct genus, leaving the species "*marginatus*" in the old genus *Pteropus*; but at the same time he



created a new genus, *Pachysoma* (name preoccupied), for the three closest relatives of *marginatus*, viz., *diardi* (probably = *s. tittha-cheilus*), *tittha-cheilus* (may be fixed as type of his *Pachysoma*), and *duvauceli* (probably = *brachyotis*), and his description of *Pachysoma* is practically identical with that given by F. Cuvier of *Cynopterus*! The result was, of course, that of the subsequent writers some (Is. Geoffroy, Temminck, Peters in his earlier papers) accepted *Pachysoma* as a name of the present genus; others (Desmarest, Gray, Peters in his later papers) *Cynopterus*; while others again (*e.g.* Lesson) accepted both genera, viz., *Cynopterus* for *marginatus* only, and *Pachysoma* for the other species known. A further confusion arose when Temminck in his latest publications (1853), and after him Wagner (1853-55), extended the genus *Pachysoma* to comprise both the present genus and *Epomophorus* (in spite of the diametrically opposed cranial characters of these genera, but presumably owing to the fact that the number of cheek-teeth is reduced in both). It is only since Peters's revision (1867) and Dobson's Catalogue (1878) that *Cynopterus* has been definitely recognized as the proper name of the present genus.—Quite recently it has been proposed to separate in a distinct genus (*Niadius*, Miller, 1906) those species of *Cynopterus* which possess a well-developed surface cusp in  $p_4$  and  $m_1$ . A glance at the table p. 590 will show that this character is far from being of generic importance.

### Synopsis of the Species.

- |   |                                   |
|---|-----------------------------------|
| A. Cheek-teeth narrower, oval in outline; surface cusp in $p_4$ and $m_1$ small or entirely absent. ( <i>Cynopterus</i> section.)                               |                                   |
| a. Ears relatively longer, 18-20.5 mm. from orifice. Forearm 66-83 mm. (Ceylon; Indian Pen.; N. Siam; Sumatra; Java; Lombok).....                               | 1. <i>C. sphinx</i> , p. 598.     |
| b. Ears relatively shorter, 13-18 mm. from orifice.   |                                   |
| a'. Smaller: forearm 54.5-72 mm. (Indo-Malayan subregion, W. to Ceylon, N. to Assam, E. to Celebes) .....   | 2. <i>C. brachyotis</i> , p. 609. |
| b'. Larger: forearm 75.5-82 mm. (Nias) .....  | 3. <i>C. major</i> , p. 629.      |
| B. Cheek-teeth broader, subrectangular or subsquarish in outline; surface cusp of $p_4$ and $m_1$ always present and well-developed. ( <i>Niadius</i> section.) |                                   |
| c. Size medium: forearm 64.5-77.5 mm.   |                                   |
| c'. $p_4$ and $m_1$ quite as broad posteriorly as anteriorly. (Java; Sumatra) .....   | 4. <i>C. horsfieldi</i> , p. 630. |
| d'. $p_4$ and $m_1$ conspicuously narrower posteriorly than anteriorly. (Malay Pen.) .....  | 5. <i>C. harpax</i> , p. 633.     |
| d. Largest species of genus: forearm 84.5-89.5 mm. (Nias) .....   | 6. <i>C. princeps</i> , p. 633.   |

1. *Cynopterus sphinx*, Vahl.

*Cynopterus marginatus* (pt.), Dobson, Cat. Chir. B. M. p. 81.

(Synonyms under the subspecies.)

*Diagnosis*.—Surface cusp of  $p_1$  and  $m_1$  small or absent; ears long, 18–20.5 mm. from orifice; general size medium or large, forearm 66–83 mm.

*Range*. Indian Peninsula generally, south to Ceylon, north-west to Sind, north-east through Assam and North Burma to North Siam; unknown from Lower Siam and the Malay Peninsula; reoccurring in Sumatra, Java, and Lombok.

*Synopsis of the Subspecies of Cynopterus sphinx.*

- a. Cranial rostrum (front of orbit to nares) usually a little more than, rarely equal to, one-fourth of total length of skull (lambda to gnathion); general size averaging smaller, forearm 66–78 mm.
- a'. Averaging smaller; forearm 66–73.5 mm. (Ceylon; Indian Pen. S., E., and N.E.; Assam; N. Burma; N. Siam) . . . . . 1 a. *C. s. sphinx*, p. 598.
- b'. Averaging larger, forearm 73–78 mm. (Indian Pen. N.W.) . . . . . 1 b. *C. s. gangeticus*, p. 604.
- b. Cranial rostrum usually a little less than or equal to one-fourth of total length of skull; largest form of the species, forearm 74.5–83 mm. (Sumatra; Java; Lombok; ? Timor) . . . . . 1 c. *C. s. titthecheilus*, p. 605.

1 a. *Cynopterus sphinx sphinx*, Vahl.

- Vespertilio sphinx*, Vahl, *Skr. Nat. Selsk.* iv. Heft 1, p. 123 (1797: Tranquebar).
- Cynopterus sphinx* 2. *sphinx*, Matschie, *Megachir.* p. 75 (1899: S. India; Coorg).
- Cynopterus sphinx*, Bonhote, *P. Z. S.* 1900, p. 191 (pt.) (Nan); Trouessart, *Cat. Mamm., Suppl.* p. 61, n. 543 (1904).
- Cynopterus sphinx sphinx*, K. Andersen, *Ann. & Mag. N. H.* (8) vi. p. 624 (1910: Ceylon; Indian Pen. S., E., N.E.; Assam; N. Siam).
- Vespertilio fibulatus*, Vahl, *Skr. Nat. Selsk.* iv. Heft 1, p. 124 (1797: Tranquebar).
- Pteropus pusillus* (La Roussette olive), E. Geoffroy, *Cat. Mamm. Mus. Nat. d'Hist. Nat.* p. 49 (1803: "Inde"); Desmarest, *N. Dict. d'Hist. Nat.* xxiv., *Tabl. Méth. Mamm.* p. 11 (1804).
- Roussette ou Ptérope olive, Desmarest, *N. Dict. d'Hist. Nat.* xxiv., *Addit.* p. 29 (1804).
- Pteropus marginatus*, E. Geoffroy, *Ann. Mus. d'Hist. Nat.* xv. p. 97, pl. v. (animal) (1810: Bengal); Oken, *Lehrb. Naturg.* iii. Abth. 2, p. 934 (1816); Desmarest, *N. Dict. d'Hist. Nat.*, new ed. xxix. p. 514, pl. vii. fig. 2 (copy from Geoffroy) (1819); *id.*,

- Mamm. i.* p. 111, n. 146 (1820); *Schinz, Thierr. i.* p. 156 (1821); *F. Cuvier, Dents Mamm.* p. 40 (1822), p. 248 (1824); *Schinz, Naturg. u. Abb. Säug. i.* p. 70 (1824); *Temminck, Mon. Mamm. i.* p. 202, pl. xiv. (copy from Geoffroy) (1825); *Gray, Griffith's An. Kingd. v.* p. 57, n. 163 (1827); *Desmarest, Dict. Sci. Nat. xvi.* p. 370 (1827); *E. Geoffroy, Hist. Nat. Mamm., 13 leçon,* p. 25 (1828); *Is. Geoffroy, Dict. Class. d'Hist. Nat. xiv.* p. 763 (1828); *J. B. Fischer, Syn. Mamm.* p. 86, n. 18, p. 549 (1829); *Wagler, Syst. Amphib.* p. 9 (1830); *Anonymous, Syn. Cont. Brit. Mus., 26 ed.* p. 33 (1832: India); *G. Curier, R. An., 3 ed. i.* p. 138, footnote (1836); *Wagner, Schreber's Säug., Suppl. i.* p. 361 (1839); *Macgillivray, Cuvier's An. Kingd. ii.* p. 10, pl. vii. B, fig. 2 (head: copy from Geoffroy) (1840); *Blainville, Ost. Mamm. i. Chêir.* pp. 101, 102, 103, Atl. i. Chêir. pl. ix. fig. 2 (pelvis; caudal vertebrae), pl. x. fig. 3 (hyoid bones), pl. xii. fig. 2 (hind limb), pl. xiii. fig. 4 (dentition) (1840); *Schinz, Syst. Verz. Säug. i.* p. 132, n. 31 (1844); *Giebel, Säug.* p. 1000 (1855).
- Cynopterus marginatus*, *Lesson, Man. Mamm.* p. 115, n. 299 (1827); *Burnett, Q. J. Sci. Lit. Art,* Apr.-June 1829, p. 269; *Lesson, Hist. Nat. Mamm. (Compl. Buffon), v.* p. 65 (1836); *Gray, Mag. Zool. & Bot. ii.* p. 503 (1838); *Lesson, N. Tabl. R. An., Mamm.* p. 15, n. 202 (1842); *Blyth, J. A. S. B. xiii.* p. 479 (1844: habits in captivity); *Gray, List Ost. Spec. B. M.* p. 10 (1847: India); ? *Layard, J. R. As. Soc. (Ceylon), ii.* n. 5, p. 189 (pt.) (1849: Ceylon, abundant in southern and central provinces, not seen in Jallia Pen.); ? *Kelaart, t. c.* p. 316 (pt.) (1849: Ceylon); *Gray, Zool. 'Samarang,' Vert.* p. 12 (pt.) (1849: India; "Nepal," errore); *Kelaart, P. Z. S. 1850,* p. 156 (pt.) (Ceylon); *Blyth, J. A. S. B. xx.* p. 155 (pt.) (1851: Ceylon); *Horsfield, Cat. Mamm. Mus. E. Ind. Co.* p. 30 (1851: Continental India); *Kelaart, Prodr. F. Zeyl.* p. 28 (pt.) (1852: Ceylon); ? *Blyth, J. A. S. B. xxi.* p. 345 (pt.) (1852: Ceylon); *Tytler, Ann. & Mag. N. H. (2) xiii.* p. 376 (1854: Barrackpoore); *Gerrard, Cat. Bones Mamm. B. M.* p. 58, skulls *c, d* (1862); *Blyth, Cat. Mamm. Mus. As. Soc.* p. 22 (pt.) (1863: Calcutta); *Peters, M.B. Ak. Berlin,* 1867, p. 866 (pt.); *Jerdon, Mamm. Ind.* p. 20 (pt.) (1867: India; Ceylon; habits); *Cooke, J. Quekett Micr. Cl. i.* pp. 8, 56, pl. i. figs. 8, 9 (1868-69: structure of hairs); *P. L. Selater, P. Z. S. 1871,* pp. 543, 773 (in confinement); *id., P. Z. S. 1873,* p. 193 (breeding, 6 March, 1872); *Dobson, J. A. S. B. xlii.* pt. 2, p. 200, pl. xiv. fig. 4 (ear) (1873); *id., Cat. Chir. Ind. Mus.* p. 4 (pt.) (1874: Calcutta; ? Darjeeling; Cachar; Cherra Punji, Assam); *Blyth, J. A. S. B. xliii.* Extra number, p. 16 (1875: Burma; habits); *Dobson, Mon. As. Chir.* p. 24, fig. (ear), p. 190 (pt.) (1876: Calcutta; ? Darjeeling; Cachar; Cherra Punji; Bharno, Upp. Burma); *id., Cat. Chir. B. M.* p. 81, specimens *g, h, i, j, k, l, m', n', r', v'* (1878: Madras; Dharwar, S. Bombay); *Trouessart, Rev. & Mag. Zool. (3) vi.* p. 207, n. 321 (pt.) (1879); *J. Anderson, Cat. Mamm. Ind. Mus. i.* p. 104 (pt.) (1881: Calcutta; Alipore; ? Darjeeling; Cachar; Cherra Punji; Bharno); *Theobald, Mason's Burma,* i. p. 424 (1882); *Sterndale, Mamm. Ind.* p. 40, n. 33, fig. (head) (1884); *Blanford, J. A. S. B. lvii.* p. 271 (1888); *Jentink, Cat. Syst. Mamm.* p. 153 (pt.) (1888: Bengal); *Blanford, Faun. B. Ind., Mamm.* pt. ii. p. 263 (pt.), fig. 77 A (ear) (1891: Indian Pen.; Ceylon); *Flower & Lydekker, Mamm.* p. 653 (pt.) (1891); *Thomas, Ann. Mus. Cir. Genova, (2) x.* p. 921 (pt.)

- (1892: Kakhyen Hills; Bhamo; Mandalay); *Lydekker, R. Nat. Hist.* i. p. 259 (pt.) (1893-94); *Bardeleben, P. Z. S.* 1894, p. 358 (præpollex); *P. L. Slater, List An. Zool. Soc. Gard.*, 9 ed. p. 105 (1896); *Trouessart, Cat. Mamm.* i. p. 85, n. 456 (pt.) (1897); *Seabra, J. Sci. Lisboa*, (2) v. p. 170, pl. i. fig. 16 (palate-ridges: India) (1898); *Wroughton, J. Bombay N. H. Soc.* xii. p. 717 (1899: Bandra; habits).
- Pteropus* (*Cynopterus*) *marginatus*, *Elliot, Madras J. Lit. Sci.* x. pp. 94, 96 (1839: Dharwar, S. Bombay).
- Pteropus* [*Pachysoma*] *marginatus*, *Wagner, Schreber's Säug., Suppl.* v. p. 609 (pt.) (1853-55).
- Pachysoma marginatum*, *Fitzinger, SB. Ak. Wien*, lx. Abth. i. p. 630 (1870).
- Eleutherura marginata*, *Maculister, Phil. Trans.* 1872, pl. xiii. figs. 1, 4 (myology).
- Pachysoma* (*Pteropus*) *marginatus*, *Marchi, Atti Soc. Ital. Sci. N.* xv. p. 518, pl. viii. figs. 5 a-f (structure of hairs) (1873).
- Cynopterus sphinx* 3. *marginatus*, *Matschie, Megachir.* p. 75 (pt.) (1899: Bengal). *b. marginatus*, *Trouessart, Cat. Mamm., Suppl.* p. 61 (pt.) (1904).
- Pachysoma brevicaudatum* (cf. *Is. Geoffroy*), *Temminck, Mon. Mamm.* ii. p. 92 (pt.) pl. xxxv. fig. 9 (head), pl. xxxvi. figs. 20, 21 (skulls) (1837: Calcutta).
- Cynopterus horsfieldi* (pt.), *Gray, List Mamm. B. M.* p. 38, specimens *b, c, e, f, k, l* (1843: "Madras," i. e. Dharwar, S. Bombay).
- Cynopterus titthacheilus* (nec *Temminck*), *Gray, List Ost. Spec. B. M.* p. 10 (skull, excl. skeleton) (1847).
- Cynopterus marginatus* var. *elliotti*, *Gray, Cat. Monk. &c.* p. 122 (1870: "Madras," i. e. Dharwar, S. Bombay).
- Cynopterus montanoi* (errore), *Müller, Fam. & Gen. Bats*, p. 49, fig. 6 (skull) (1907).

*Differential characters.*—See synopsis p. 598, and the subjoined table of measurements showing its difference in size from *C. s. gangeticus* and *titthacheilus*. Externally (in general size, colour, &c.) very similar to *C. brachyotis angulatus*, with which it occurs together in Assam, Upper Burma, and North Siam, but readily distinguished by its relatively longer cranial rostrum and longer ears (compare p. 612).

	<i>sphinx.</i>	<i>gangeticus.</i>	<i>titthacheilus.</i>
	17 skulls,	3 skulls,	15 skulls,
	21 specim.	3 specim.	17 specim.
Skull, lambda to gnathion...	31·5-34·5	33 -36	35·5-38·5 mm.
„ condylo-basal length .	30·5-33·6	32 -34·6	34·2-37 „
„ rostrum .....	8 - 9·1	9 - 9·3	8·6- 9·6 „
Mandible .....	24·5-27·2	25·5-27·8	27·8-30 „
c-m <sup>1</sup> , crowns .....	10·8-12·2	11·8-12·3	12·2-13 „
Forearm .....	66 -73·5	73 -78	74·5-83 „
Third metacarpal .....	42 -47·5	46 -51·5	47·5-53 „
Ear from orifice .....	18 -19·5	20	18 -20·5 „
Tibia .....	25 -27·5	28·5-31	29 -33 „

*Colour.*—Brighter specimens. ♀ ad. skin, February, Trevan-  
drum (0.5.26.1): Back dark drab-brown (dark isabella drab-brown)

conspicuously tinged throughout with tawny-olive, this tinge gradually deepening on anterior portion of back, passing on nape of neck into warm tawny-russet, and this again on sides of neck, foreneck, and flanks into tawny cinnamon-rufous (flanks slightly paler than sides of neck and foreneck); the latter colour sharply defined against and contrasting with that of breast and belly. Breast and belly almost drab, with a faint wash of very light tawny-olive. Colour of nape of neck passing into dark Prout's brown on occiput and vertex, this again into a paler brown on sides of head and chin. Ears narrowly edged with white; metacarpals and phalanges (or the latter only) of long digits usually brownish white or whitish brown more or less contrasting with dark membranes.—Two males from Bandra, nr. Bombay (skins, 97.11.1.1, 2), are practically of the same colour.

Darker specimens. Three ♂ ad. skins, November, Nan, N. Siam (98.2.8.1-3): Back mummy-brown (one skin) or almost bistre conspicuously tinged with raw-umber particularly anteriorly (the others). Sides of neck, foreneck, and flanks deep russet-chestnut (nearly burnt-umber: one skin), or dark mars-brown (another), or pale russet (a third), more or less strongly contrasting with colour of breast and belly. Breast and belly drab-grey, drab, or hair-brown, in any case more or less distinctly tinged with pale tawny-olive. Head similar to back. Ears, metacarpals, and phalanges as in bright-coloured specimens.—Specimens quite similar in colour to these have been examined from Sylhet (♀ ad. skin, June) and Bombay (two ♂ ad. skins, January and August).

Adult females generally differ from adult males in the paler colour of the neck and flanks and consequently less pronounced contrast of these parts of the fur with the centre of the breast and belly. But though the difference is noticeable in any large series of individuals of both sexes, single females are not infrequently found which are scarcely distinguishable in colour from males (the specimen from Trevandrum described above, though a female, is one of the most brilliantly-coloured in the whole series examined).

Young individuals. Different from adults: Back darker or paler slate-brown, sometimes without, more often with, a tinge of tawny-olive or raw-umber; head similar to back or darker; sides of neck, foreneck, and flanks drab-grey with or without a tinge of tawny-olive; breast and belly paler or darker drab. The baby pelage is retained until the individuals are perfectly full-grown (teeth even showing faint signs of wear), but at that age it is sometimes (by no means always) distinctly mixed with hairs and colours of the adult pelage.

*Measurements.* On pp. 634, 637, 640.

*Specimens examined.* Thirty-two, viz., in addition to those catalogued below and seven duplicates in the collection, four in the Leyden Museum and four from the collection of the Bombay Natural History Society,—from the following localities:—Ceylon (one), Trevandrum (one), Kanara (one), Dharwar (five), Bombay

and neighbourhood (seven), Madras (two), "Bengal" (two), South Sylhet (one), Nan (four), uncertain localities (eight).

*Range.* Indian Peninsula, extending south to Ceylon, on the western side of the Peninsula at least as far north as Bombay, and along the whole of the eastern side to Bengal, Assam (specimen examined from Sylhet), North Burma (recorded from Kakhien Hills, Bhamo, and Mandalay), and North Siam (examined from Nan). In Ceylon it occurs together with the small *C. brachyotis ceylonensis*, in N.W. India it probably meets the larger race of the species, *C. sphinx gangeticus*, and in Assam, N. Burma, and N. Siam it extends into the area of *C. brachyotis angulatus*.

*Types.*—Described by Professor Martin Vahl (Copenhagen) from two specimens obtained by Capt. D. C. Daldorf at Tranquebar, among the leaves of *Borassus flabelliformis*. The cotypes, once in the Museum of the Copenhagen Natural History Society ("Naturhistorie-Selskabet"), are probably now no longer in existence (they are not in the Copenhagen Zoological Museum\*). For measurements of a topotype see below, p. 603. For more than a century Vahl's name and description of this bat were overlooked by all authors except Fitzinger (see his synonyms of *Pachysoma marginatum*, l. c., 1870); name revived by Matschie, 1899.—*Vespertilio fibulatus*, Vahl, is an alternative name of *V. sphinx* (the latter name, Vahl says, was suggested to him by the collector; if not, he should have preferred to name this bat *fibulatus*, because the body "er nedad mod Hofferne usædvanlig mere smal end paa de øvrige Arter og næsten ligesom snørt").

*Pteropus pusillus* (1803) and *marginatus* (1810), E. Geoffroy.—*Pt. pusillus* was based on two specimens (register number XCV) from "l'Inde," "envoyés par le citoyen Macé, naturaliste." Having suppressed the Catalogue in which this name occurred, E. Geoffroy, in 1810, redescribed the same specimens as *Pt. marginatus*, giving as locality "la Bengale." Cotypes apparently lost. See measurements below of a topotype and of a specimen from South Sylhet. *marginatus* is the name under which the present bat was commonly known from 1810 to 1899.

*Cynopterus marginatus* var. *elliotti*, Gray; 1870.—Type locality, Dharwar, Southern Bombay (not, as given by Gray, "Madras"); two cotypes in collection, skins (originally mounted). For measurements of one cotype see below; the other cotype is immature.

*Individual variation in size.*—Subjoined a few measurements of twenty adult specimens, from localities spread over the whole area

\* The important collections once in the possession of the Danish "Naturhistorie-Selskab" (established 1789, dissolved 1804) were acquired, in December 1804, by the newly founded R. Natural History Museum, Copenhagen. In the course of the next following sixteen years nearly all mounted specimens and skins had to be destroyed owing to defective preservation. In an official communication to the Trustees of the Museum Reinhardt wrote, 16 July, 1820, that of the collections once belonging to the Copenhagen Natural History Society scarcely anything was then left, except some alcoholic specimens, shells, and insects; all the other zoological specimens had perished or were on the point of perishing (see C. C. A. Gosch, J. C. Schiødte, i. p. 40; 1898).

of the subspecies, chiefly to show the extent of variations in size among individuals from the same region (forearm of nine specimens from the western side of the Peninsula 67.5-73 mm., of eight specimens from the eastern side, as far as N. Siam, 66-72.5):—

	Forearm.	Third metacarpal.	Skull, tot. l.	Rostrum.	c-m <sup>1</sup> , crowns.	
♂. Ceylon.....	69	...	...	...	...	mm.
♀. Trevandrum .....	67.5	43.5	31.5	8.2	10.8	"
♀. Kanara .....	73	47	...	...	...	"
Dharwar .....	72	47.5	...	8.2	11.7	"
[♀.]   "   * .....	68.5	45	32.2	8.3	11.6	"
" .....	...	...	32.5	8	11.8	"
" .....	...	...	33.7	8.5	11.8	"
♂. Bombay .....	68.5	45	33	8.8	11.5	"
♂.   " .....	71.5	47.5	34.2	8.7	12.1	"
♂.   " .....	71	46	34.5	9.1	12.2	"
♂.   " .....	71	46.5	...	...	...	"
♀.   " .....	71.5	46	33.2	...	12	"
♂. Tranquebar † .....	66	44.5	...	...	...	"
♂. Madras .....	70	44	...	...	...	"
♂.   " .....	70.5	45	...	...	...	"
♂. Bengal † .....	66	...	...	...	...	"
♀. S. Sylhet.....	67	44	32.8	8.3	10.8	"
♂. Nan .....	72.5	46	34	8.8	11.5	"
♂.   " .....	69.5	45.5	32.3	8.5	11.5	"
♂.   " .....	69	43	33.2	8.6	11.5	"
a. ♀ ad. sk.; skull.	Trevandrum, Travancore; 6 Feb. 1900.	H. S. Ferguson, Esq. [P.].	0.5.26.1.			
b. Ad. sk.; skull.	Dharwar, S. Bombay.	Sir W. Elliot [P.].	40 e.			
c, d. [♂] imm., [♀] ad. sks.; skulls.	Dharwar.	Sir W. Elliot [P.].	40 k, l.			
e, f. 2 ad. skulls.	(Cotypes of <i>C. marginatus</i> var. <i>elliotti</i> , Gray.) Dharwar.	Sir W. Elliot [P.].	108 c, d.			
g. [♀] imm. sk.; skull.	Bombay.	Dr. Leith [P.].	69.8.24.6.			
h-j. 2 ♂ ad., 1 ♀ subad. sks.; skulls.	Bandra, nr. Bombay; 3, 23, 29 Sept. 1897.	R. C. Wroughton, Esq. [P.].	97.11.1.1, 2. 97.11.4.1.			
k. ♂ juv. sk.; skull.	Bandra; 4 Oct. 1897.	J. Dodgson, Esq. [P.].	98.9.1.1.			
l. ♂ ad. al.; skull.	Madras.	Surg.-Maj. T. C. Jerdon [P.].	46.11.22.221.			
m. ♂ ad. al.	Madras.	Sir J. Boileau [P.].	49.7.27.49.			
n-g. 3 ♂ ad., 1 ♂ imm. sks.; skulls.	Nan, N. Siam, 290 m.; 12, 17, 18 Nov. 1897.	Th. H. Lyle, Esq. [P.].	98.2.8.1-4.			

\* Cotype of *C. marginatus* var. *elliotti*.

† Topotype of species, Copenhagen Museum (measured by Herluf Winge).

‡ Topotype of *Pteropus pusillus* and *marginatus*, Leyden Museum.

1 b. *Cynopterus sphinx gangeticus*, K. And.

*Cynopterus marginatus*, Dobson, J. A. S. B. xlv. p. 310 (1877: Sind); J. Anderson, Cat. Mamm. Ind. Mus. i. p. 104 (pt.) (1881: Karachi); Murray, Vert. Zool. Sind, p. 4 (1884: Mulleer; Larkhana); Blanford, Faun. B. Ind., Mamm. pt. ii. p. 263 (pt.) (1891).

*Cynopterus sphinx gangeticus*, K. Andersen, Ann. & Mag. N. H. (8) vi. p. 623 (1 Dec. 1910: Lucknow; Nasik).

*Differential characters*.—Similar to *C. s. sphinx*, but averaging conspicuously larger; see table p. 600. Large individuals of the present form are equal in size to small individuals of *C. s. titthacheilus* (Sumatra, Java, Lombok), but the cranial rostrum of *gangeticus* averages relatively slightly longer, being usually a little more (in *titthacheilus* as a rule a little less) than one-fourth of the total length of the skull, the dentition is rather weaker, the average difference in the size of the two forms (both skulls and external dimensions) considerable, and their areas of distribution widely separated.

*Colour*.—Young adults. Type (Lucknow): Back between hair-brown and brocoli-brown; concealed bases of hairs considerably lighter, more greyish; sides of neck, throat, foreneck, sides of breast and belly, and flanks dark warm wood-brown; centre of breast and belly hair-brown. Ears narrowly edged with white.—A second specimen (paratype, same age and locality) is darker above, more approaching brownish olive, paler drab below, and with the bright-coloured area of the underparts more inclining to cinnamon wood-brown and restricted to the sides of the belly.—Skins of fully adult individuals not seen.

*Measurements*. On pp. 634, 637, 640.

*Specimens examined*. Three, viz. two from Lucknow and one from Nasik, in the collections of the Bombay Natural History Society and British Museum.

*Range*. Probably generally distributed over the north-western and central provinces of India, but so far only identified from Lucknow and Nasik.

*Type in collection*. Skull, lambda to gnathion 35.5, rostrum, orbit to nares 9, mandible 27.8, c-m<sup>1</sup> (crowns, estimate) 12.3, forearm 78, third metacarpal 51.5 mm.

a. ♀ subad. sk.; Lucknow; Sept. 1908 Bombay N. H. Society 10.11.14.1.  
skull. (Major A. Begbie). [P.]. (Type of subspecies.)



1 c. *Cynopterus sphinx titthæcheilus*, Temm.

- Pteropus titthæcheilus* \* (pt.), Temminck, *Mon. Mamm.* i. p. 198, pl. xv. figs. 17-20 (skulls) (1825: Buitenzorg; ? Bencoulen, Sumatra); *id.*, t. c. p. 261 (1827: possible identity with *margi-natus*); Lesson, *Man. Mamm.* p. 113, n. 294 (1827); Desmarest, *Dict. Sci. Nat.* xlv. p. 370 (1827); Is. Geoffroy, *Dict. Class. d'Hist. Nat.* xiv. p. 704 (1828); Wagler, *Syst. Amph.* p. 9 (1830); Schinz, *Syst. Verz. Säug.* i. p. 132, n. 32 (1844); Giebel, *Säug.* p. 1001 (1855); Schlegel, *Dierk.* i. p. 53 (1857).
- Pachysoma titthæcheilum*, E. Geoffroy, *Hist. Nat. Mamm.*, 13 leçon, p. 28 (pt.) (1828); Is. Geoffroy, *Ann. Sci. Nat.* xv. p. 203 (1828); J. F. Fischer, *Syn. Mamm.* p. 87, n. 19, p. 550 (1829); Lesson, *Hist. Nat. Mamm. (Compl. Buffon)*, v. p. 62 (1836); Temminck, *Mon. Mamm.* ii. pp. 85, 92 (pt.), pl. xxxv. fig. 8 (head) (1837); S. Müller, Temminck's *Nat. Gesch. Ned. Or. Bez., Zoogd.* pp. 21, 53 (1839-44) (habits); Macgillivray, *Cuvier's An. Kingd.* ii. p. 12, pl. vii. B, fig. 4 (head: copy from Temminck) (1840); Lesson, *N. Tabl. R. An., Mamm.* p. 14, n. 197 (1842); Fitzinger, *SB. Akad. Wien*, xlii. p. 390 (pt.) (1861: Java); [Anonymous], *Mém. Quadr. & Chêr. Arch. Ind.* p. 115 (1864); Fitzinger, *SB. Akad. Wien*, lx. Abth. i. p. 623 (pt.) (1870).
- Cynopterus titthæcheilus*, Gray, *Mag. Zool. & Bot.* ii. p. 503 (1833); *id.*, *List Ost. Spec. B.M.* p. 10 (pt.) (1847: Sumatra); ? Horsfield, *Cat. Mamm. Mus. E. Ind. Co.* p. 30 (pt.) (1851: Java); Cooke, *J. Quekett Micr. Cl.* i. pp. 8, 56 (1868-69: structure of hairs); Miller, *Fam. & Gen. Bats*, p. 49 (1907); G. M. Allen, *Bull. Mus. Comp. Zool. Harv. Coll.* lii. n. 3, p. 26 (1908: Buitenzorg); Thomas & Wroughton, *P. Z. S.* 1909, p. 375 (1909: Batavia; Buitenzorg; Sukabumi; Tasikmalaja; Tjilatjap).
- Pteropus* [*Pachysoma*] *titthæcheilus*, Wagner, Schreber's *Säug., Suppl.* i. p. 362 (pt.) (1839); ? Rüppell, *Mus. Senck.* iii. Heft 2, p. 154 (1842: Sumatra).
- ? *Pachysoma diardi*, E. Geoffroy, *Hist. Nat. Mamm.*, 13 leçon, p. 27 (1828†: Sumatra); Is. Geoffroy, *Dict. Class. d'Hist. Nat.* xiv. p. 705 (1828); *id.*, *Ann. Sci. Nat.* xv. p. 203 (1828); Lesson, *Hist. Nat. Mamm. (Compl. Buffon)*, v. p. 63 (1836); Temminck, *Mon. Mamm.* ii. p. 95 (1837: redescription); Macgillivray, *Cuvier's An. Kingd.* ii. p. 12 (1840); Lesson, *N. Tabl. R. An., Mamm.* p. 14, n. 198 (1842); Peters, *MB. Ak. Berlin*, 1869, p. 395 (= *margi-natus*); Fitzinger, *SB. Ak. Wien*, lx. Abth. i. p. 628 (1870).
- Pteropus diardi*, J. B. Fischer, *Syn. Mamm.* p. 87, n. 21, p. 550 (1829); Schinz, *Syst. Verz. Säug.* i. p. 133, n. 35 (1844).
- Cynopterus diardi*, Gray, *Mag. Zool. & Bot.* ii. p. 504 (1835).
- Pteropus* [*Pachysoma*] *diardi*, Wagner, Schreber's *Säug., Suppl.* i. p. 365 (1839).

\* From *τιτθός*, teat, nipple, and *χείλος*, lip; compare Temminck's French translation of the name, "Roussette mammilèvre" and his description (*l. c.*) "deux grosses verrues [in p. 203 called 'mamelons'] séparées par un sillon à la lèvre supérieure," a character which, however, is common to all forms of the genus. Original spelling, *titthæcheilus*; miswritten *tittæcheilus*, *tithæcheilus*, *titthoecheilus*, or *tithæcheilus* by some of the authors referred to in the synonymy (the proper latinized form of the word, *titthochilus*, does not seem to occur in literature).

† For date of publication see footnote p. 443.

- Cynopterus marginatus* (nec *E. Geoff.*), *Gray, List Mamm. B. M.* p. 38, specimens *d* ("India"), *e* (Java) (1843); *id.*, *Zool. 'Samarang,' Vert.* p. 12 (pt.) (1849: Java; Sumatra); *Gerrard, Cat. Bones Mamm. B. M.* p. 58, skeletons *a, b* (1862); ? *Kreff, Cat. Mamm. Austr. Mus.* p. 5 (1864: Java); *Peters, MB. Ak. Berlin*, 1867, p. 866 (pt.); *Zelev r, Reise 'Novara,' Säug.* p. 13 (pt.) (1869: Java); *Dobson, Cat. Chir. B. M.* p. 81, specimens *f, t'* (1878: "India"; Sumatra); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 207, n. 321 (pt.) (1879); *Jentink, Cat. Ost. Mamm.* p. 264 (pt.) (1887: Buitenzorg; Sumatra); *id.*, *Cat. Syst. Mamm.* p. 153 (pt.) (1888: "Ceylon," errore; "Java"; Tjikao, Java; Silago, Sumatra); *id.*, *Weber's Zool. Erg. Nied. Ost-Ind.* i. p. 126 (pt.) (1890: Buitenzorg); *id.*, *Notes Leyd. Mus.* xiii. p. 203 (1891: Buitenzorg); *Trouessart, Cat. Mamm.* i. p. 85, n. 456 (pt.) (1897).
- Pteropus* [*Pachysoma*] *marginatus*, *Wagner, Schreber's Säug., Suppl.* v. p. 609 (pt.) (1853-55).
- Cynopterus marginatus* var. *brevicaudatus* (pt.), *Gray, Cat. Monk.* §c. p. 122 (1870: ? Java).
- Cynopterus scherzeri* (pt., nec *Zelevor*), *Blanford, Faun. B. Ind., Mamm.* p. 264 (1891: Timor).

*Differential characters.*—The largest form of the species; see table, p. 600. The only forms of *Cynopterus* s. str. (excluding "*Niadius*") which approach or equal this species in external dimensions are *C. sphinx gangeticus* (N.W. India) and *C. major* (Nias). Its differences from the former have been pointed out above. From the latter it is at once distinguishable by its larger and heavier skull, longer ears, and longer tibia (see table p. 629).

*Colour.*—Essentially as in dark-coloured specimens of *C. s. sphinx*. Eight male skins, fully adult, July, August, October, November, December; Batavia, Buitenzorg, Sukabumi, and Tjilatjap (9.1.5.99, 100, 104, 105, 107, 108, 111, 114):—Back some shade of olive or bistre, always to a greater or less degree suffused with raw-umber, the latter tinge in some specimens absolutely predominant, almost to the exclusion of the olive or bistre element; rump and hairs of interfemoral often conspicuously paler than centre of back. Head similar to centre of back or darker. Sides of neck, foreneck, and sides of breast varying from nearly typical russet (a little richer than Ridgway's pattern) through several deeper tinges to russet-chestnut, in any case contrasting with dull colour of centre of breast and belly; the lighter (russet) tinges generally found in specimens with predominance of raw-umber on back, the darker tinges in those with predominance of olive or bistre element on back. Centre of breast and belly approximately hair-brown, very often slightly washed with pale tawny-olive or pale raw-umber. Ears narrowly edged with white; metacarpals and phalanges of long digits generally brownish, sometimes more or less suffused with brownish white.—So far as the series goes the variations are independent of the season.

Five female skins, fully adult, July, November, December; Batavia and Tjilatjap (9.1.5.102, 115, 116, 117, 119):—As a rule easily distinguished from males by the much paler colour of the

neck and flanks, but the richest-coloured females very closely approach the palest-coloured males (compare 9.1.5.119 with 114). Sides of neck, foreneck, and sides of breast varying from pale tawny-olive, through russet, to a tinge between mars-brown and burnt-umber (light chestnut), in most specimens only slightly contrasting with centre of breast; bright colour generally not extending so far backward along sides of breast as in males. Centre of breast and the whole of the belly dull drab or broccoli-brown, usually somewhat tinged with tawny-olive or raw-umber. Ears, metacarpals, and phalanges as in males.

Immature specimens rather similar to *C. s. sphinx* of corresponding age, but on the whole darker: Back uniform dark slate-brown with somewhat paler bases to the hairs; underparts slate-grey; sides of neck with (males) or without (females) a slight wash of tawny-olive.

*Measurements.* On pp. 634, 637, 640.

*Specimens examined.* Sixty-three, in the collections of the Leyden (nineteen, including cotypes of subspecies), Paris (one, ticketed *C. diardi*), and British Museums, from the following localities:—Sumatra (four: "Sumatra"; Silago; Bua), Java (fifty-three: "Java"; Batavia; Buitenzorg; Sukabumi; Tasikmalaja; Tjilatjap), Lombok (one), Timor (one), uncertain localities (four).

*Range.* Java generally, extending west to Sumatra, east to Lombok, perhaps to Timor. The single Timor specimen examined is immature; in the size of the teeth it agrees with *C. s. titthacheilus*. In Java this form occurs together with *C. brachyotis javanicus* and *C. horsfieldi*; in Sumatra with *C. b. angulatus*, *C. b. brachyotis*, and *C. horsfieldi minor*.

*Cotypes.*—The original description of *Pteropus titthacheilus* was based on "des individus de Sumatra, envoyés de Bencoulen par MM. Diard et Duvaucel, une grande quantité de sujets capturés à Buitenzorg dans l'île de Java, par MM. Kuhl et Van Hasselt, cinq individus rapportés de Java par M. Horsfield et deux individus reçus de Siam." Diard and Duvaucel's specimens were presumably in the Paris Museum, the Siam specimens admittedly and Horsfield's specimens probably in the India Museum, London; all these may be considered at most paratypes (it is uncertain whether any are still in existence), leaving Kuhl and Van Hasselt's specimens from Buitenzorg as the series from which to select the cotypes of the subspecies. Of these, nineteen are now in the Leyden Museum, viz., six mounted specimens (Cat. Syst., *C. marginatus*, *h*, *i*, *j*, *k*, *l*, *m*, all with skulls *in situ*), one alcoholic (*qq*, skull in), eight skeletons (Cat. Ost. *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*), and four odd skulls (*o*, *p*, *q*, *r*). But the mounted specimen *l* (young) is probably not, *m* (subadult) certainly not *titthacheilus*, the alcoholic specimen *qq* is not *titthacheilus* (probably *C. horsfieldi*), skeletons *b* and *e* are *C. horsfieldi*, skeleton *c* indeterminable (young with milk dentition), and skull *r* immature. This leaves as the real cotypes the mounted specimens *h* (forearm 79 mm.), *i* (80.5), *j* (75), *k* (81), the skeletons *d* (forearm 80.5), *f* (76.5), *g* (77.5), *h* (82.5), *i* (77), and the

skulls *o* (total length 37), *p* (36.5), *q* (37). The only adult specimen of *Pt. titthæcheilus* measured by Temminck had the forearm "3 pouces" = 81 mm. As to Temminck's skull figures, pl. xv. figs. 17, 19, 20 represent *titthæcheilus*, fig. 18 perhaps the same species (dentition abnormal), figs. 23 and 24 probably *horsfieldi*, while figs. 21 and 22 are too young for identification.

*Pachysoma diardi*, E. Geoff.; 1828.—Type locality, Sumatra (Diard and Duvancel); based on two specimens (male and female). Only measurement given by E. Geoffroy, "longueur, 5 pouces," which would agree with *titthæcheilus*; Is. Geoffroy (Dict. Class., l. c.) gives as total length 4.5 inches (French), as expanse about 18 in.; the latter measurement, again, would agree with *titthæcheilus*. The Paris Museum possesses a specimen (A 102, mounted, skull probably *in situ*, fur much faded) ticketed "*Cynopterus Diardii* (Geoff.); type; Inde?" This specimen is indistinguishable from *titthæcheilus*; forearm 80 mm. There is, however, not sufficient evidence that it is really one of the two cotypes of *P. diardi*; the locality "Inde?" looks suspicious as compared with E. Geoffroy's definite statement that the species was obtained in Sumatra, and in the Register of the Museum the word "type" is qualified by a query.

<i>a</i> . Imm. sk.; skull.		Purchased (Frank).	44.4.4.7.
<i>b</i> . ♂ ad. st.	"India."	Leyden Museum	87 d.
		[E.].	
<i>c</i> . Imm. skeleton.	Sumatra.	Purchased (Frank).	108 a.
<i>d</i> . Imm. skeleton.	Java.	Purchased (Frank).	53.1.11.31.
<i>e, f</i> . ♀ subad., ♀ pull. al.	Java.	Col. Taylor [P.].	6.2.3.1.
<i>g-k</i> . 2 ♂ ad., 1 ♀ subad., 2 ♀ ad. sks.; skulls of 99-102.	Batavia, low country; 17 July, 1907 ( <i>Guy C. Shortridge</i> ).	W. E. Balston, Esq. [P.].	9.1.5.99-103.
<i>l-u</i> . 2 ♂ imm., 8 ♀ imm. al.	Batavia ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.877-886.
<i>v</i> . ♀ ad. al.	Buitenzorg.	Leyden Museum [E.].	91.11.3.12.
<i>w-y</i> . 2 ♂ ad., 1 ♀ imm. sks.; skulls.	Buitenzorg, 855'; 28 July, 5, 21 Aug. 1907 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.104-106.
<i>z</i> . ♀ ad. al.; skull.	Buitenzorg ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.887.
<i>a2-c2</i> . 2 ♂ ad. sks., skulls; 1 ♀ juv. sk.	Sukabumi, 2100'; 13 Oct. 1907 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.107-109.
<i>d2</i> . ♀ juv. sk.; skull.	Tasikmalaja, 1145'; 1 Jan. 1908 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.121.
<i>e2-o2</i> . 2 ♂ ad., 3 ♂ juv., 4 ♀ ad., 2 ♀ juv. sks.; skulls.	Tjilatjap, sea-level; 1, 2 Nov., 11 Dec. 1907 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.110-120.
<i>p2</i> . ♂ ad. al.; skull.	Lombok, 1500'; June, 1896.	A. Everett [C.].	97.4.18.11.
<i>q2</i> . ♀ imm. al.; skull.	Timor.	Dr. H. O. Forbes [C.].	84.4.22 I.

2. *Cynopterus brachyotis*, S. Mill.

(Synonyms under the subspecies.)

*Differential characters*.—Surface cusp of  $p_1$  and  $m_1$  small or absent; ears short, 13–18 mm. from orifice; general size small or medium, forearm 54.5–72 mm.

The relatively smaller ears are the only character by which the numerous local forms of *C. brachyotis*, all taken together, can be discriminated from *C. sphinx* and its modifications.

*Range*. The whole of the Indo-Malayan subregion, extending east to Celebes, north to Siam and Assam, and west to the Nicobars, Andamans, and Ceylon. Unknown from the Indian Peninsula.

*Subspecies*.—The range of this species is enormous, and the greater part of the area it occupies is broken up into more or less widely separated islands. Hence it is easy to understand that the species is differentiated into a series of more or less well-defined races. The plastic characters of these races (*i.e.* the characters that vary according to the races, in contradistinction to those that are common to all) are these: first and chiefly, the general size of the animal [*C. b. angulatus* (Siam to Sumatra) the largest, equal to *C. s. sphinx*; *C. b. minutus* (Nias) the smallest race]; second, the relative size of the ears [shortest and narrowest in *C. b. minutus*, *brachysoma* (Andamans), and *scherzeri* (Nicobars)]; third and only to a slight degree, the relative length of the rostrum (usually a little less than, but in *C. b. ceylonensis*, *brachysoma*, and *scherzeri* as a rule subequal to, one-fourth of the total length of the skull). The individual variation of the colour of the fur is considerable, the taxonomic value of this character therefore small; but generally speaking it may be said that darker (olive or bistre) tinges are predominant in *C. b. angulatus*, brighter (brown lightened with russet, tawny-olive, or raw umber) in *C. b. brachyotis*, *javanicus*, and *insularum*.

*C. b. brachyotis* is the only form of *Cynopterus* known from Borneo, the Philippines, and Celebes; in the Malay Peninsula and Sumatra it occurs together with *C. b. angulatus*. The Javan race (*javanicus*) differs only by its slightly greater average size and rather broader skull. Individuals from the Kangean and Mata Siri Islands, Java Sea (*insularum*), average still somewhat larger. The Ceylonese race (*ceylonensis*) is so similar to typical *brachyotis* as to be scarcely distinguishable externally, but the cranial rostrum averages a trifle longer and the dentition a little heavier. While typical *brachyotis* extends perfectly unaltered from the Philippines, Celebes, and Borneo, to the Malay Peninsula and Sumatra, the small island of Nias, though situated close to the western coast of Sumatra, is inhabited by a distinct race (*minutus*), characterized by its small average size (smallest form of the whole genus) and relatively small ears. The latter character, relatively short and narrow ears, reoccurs in the Andaman (*brachysoma*) and Nicobar (*scherzeri*) races, which however average conspicuously larger than *minutus*, while they differ from each other chiefly in size, *scherzeri* being tho

larger of the two. There remains one form, *angulatus*, ranging from Assam and Siam in the north to Sumatra in the south, and characterized, as compared with typical *brachyotis*, by its considerably larger average size; in the Malay Peninsula and Sumatra, as mentioned above, this large race meets and occurs together with typical *brachyotis*; and in the island of Nias it has developed into a distinct species (*C. major*).

It may be considered, and probably is, rather premature to venture any general conclusions from the above facts. But so far as these facts go, they seem to point to the effect that the existence of *C. brachyotis* dates back to an epoch when Ceylon was much more closely approximated to Malaya. This assumption appears necessary to explain the occurrence in Ceylon of a form which has its closest relative not in the Indian Peninsula nor in Indo-China but in Borneo, Sumatra, and the Malay Peninsula (the other alternative being that a form essentially similar to typical *brachyotis* once was distributed over the whole of the Oriental Region, but subsequently disappeared from the Indian Peninsula and Indo-China, while remaining in Ceylon). Already at that period the species was probably differentiated into two distinct races, the one and larger (now represented by *C. b. angulatus*) continental (Indo-Chinese), the other and smaller inhabiting ancient Malaya including Ceylon (now represented by all the other races together). This would explain the remarkable fact that while typical *brachyotis* is the only form occurring in Borneo, the Philippines, and Celebes, it in the Malay Peninsula and Sumatra occurs together with *angulatus*. That *angulatus*, if originally an Indo-Chinese race, has at a more recent period, under altered physical conditions, spread southward over the Malay Peninsula and Sumatra, is only what might be expected; and it is equally easy to understand that, in similarly favourable circumstances, typical *brachyotis*, coming from east, has invaded the Malay Peninsula and Sumatra. That this spreading of *angulatus* and typical *brachyotis*, respectively southward and westward, has taken place in a quite recent period, seems further proved by the facts that *angulatus* from the Malay Peninsula and Sumatra is absolutely indistinguishable from *angulatus* from North Siam, Burma, and Assam, as are individuals of *brachyotis* from the Malay Peninsula and Sumatra from Bornean individuals of *brachyotis*.

*Synopsis of the Subspecies of Cynopterus brachyotis.*

- a. Averaging larger: skull (lambda to gnathion) 30·5-33·2, forearm 65-72 mm. (Assam to Sumatra, incl. Natuna and Mentawai Is.). . . . . [p. 611.  
2 a. *C. b. angulatus*,
- b. Averaging smaller: skull 25·8-31·2, forearm 54·5-70·5 mm.
- a'. Ears relatively larger: length (from orifice) 15-17 mm.
- a<sup>2</sup>. Cranial rostrum (orbit to nares) usually distinctly less than one-fourth of skull (lambda to gnathion).

- a*<sup>1</sup>. Smaller: forearm 57-66 mm. (Philippines; Celebes; Borneo; Malay Pen.; Sumatra) ..... [p. 614.  
*2 b. C. b. brachyotis*,  
*b*<sup>1</sup>. Larger: forearm 61.5-63, third metacarpal 38-42 mm.; skull averaging broader than in *brachyotis*. (Java) .. [p. 622.  
*2 c. C. b. javanicus*,  
*c*<sup>1</sup>. Largest: forearm 66.5-69.5, third metacarpal 42-46.5 mm. (Kangean and Mata Siri Is.) ..... [p. 623.  
*2 d. C. b. insularum*,  
*l*<sup>2</sup>. Cranial rostrum usually subequal to one-fourth of skull. Forearm 59-64 mm. (Ceylon) ..... [p. 624.  
*2 e. C. b. ceylonensis*,  
*b*<sup>1</sup>. Ears averaging shorter and narrower: length (from orifice) 13-15 mm.  
*c*<sup>2</sup>. Cranial rostrum (orbit to nares) usually distinctly less than one-fourth of skull (lambda to gnathion). Smallest form of genus: forearm 54.5-59 mm. (Nias) ..... [p. 625.  
*2 f. C. b. minutus*,  
*d*<sup>2</sup>. Cranial rostrum usually subequal to one-fourth of skull.  
*d*<sup>1</sup>. Smaller: forearm 59-66 mm. (Andaman Is.) ..... [p. 626.  
*2 g. C. b. brachysoma*,  
*e*<sup>1</sup>. Larger: forearm 69.5 (or probably less) -70.5 mm. (Nicobar Is.) .... [p. 627.  
*2 h. C. b. scherzeri*,

## 2 a. *Cynopterus brachyotis angulatus*, Miller.

*Cynopterus marginatus* (pt.), Dobson, Cat. Chir. B. M. p. 81.

*Pteropus titthæcheilus* (pt.), Temminck, Mon. Mamm. i. p. 193 (1825: Siam).

*Cynopterus sphinx* 8. *titthæcheilus*, Matschie, *Megachir.* p. 75 (pt.) (1899: "Sumatra"; "Mentawai"). *g. titthæcheilus*, Trouessart, Cat. Mamm., Suppl. p. 62 (pt.) (1904).

*Cynopterus titthæcheilus* (pt.), ? Stone & Rehn, Proc. Ac. N. Sci. Philad. 1902, p. 136 (Batu Sangkar, Tanah Datar, Padang; Gunong Sugi, Lampung); Miller, Proc. U.S. Nat. Mus. xxvi. p. 474 (pt.) (1903: Pulo Babi; Simalu Is., off W. Sumatra; Tapanuli Bay, W. Sumatra); ? Schneider, Zool. Jahrb., Syst. xxiii. p. 75 (pt.) (1905: Deli; Upper Langkat; Lower Langkat; Battak Mts.; Batu Bahra; Indragiri).

*Pachysoma brevicaudatum* (pt.), S. Müller, Temminck's N. Gesch. Ned. Ov. Bez., Zoogd. pp. 21, 58 (1839-44: Sumatra).

*Cynopterus marginatus* var. *brevicaudatum* (pt.), Gray, Cat. Monk. &c. p. 122 (1870: Sumatra).

*Cynopterus brevicaudatus* (pt.), Lyon, Proc. U.S. Nat. Mus. xxxiv. p. 664 (1903: E. Sumatra).

*Cynopterus marginatus* (nec Geoff.), Gray, List Mamm. B. M. p. 33, specimens *b*, *c* (1843: "Himalaya," error for Sumatra); Cantor, J. A. S. B. xv. p. 187 (pt.) (1846); Dobson, Cat. Chir. B. M. p. 81, specimens *a*, *b*, *w*, *g*<sup>1</sup>, *h*<sup>1</sup>, *i*<sup>1</sup> (1878: Sumatra); Trouessart, Rev. & Mag. Zool. (3) vi. p. 207, n. 321 (pt.) (1879); ? Scully, J. A. S. B. lvi. p. 239 (1887: Nowakot, nr. Katmandu; Nepal valley); Jentink, Cat. Ost. Mamm. p. 264 (pt.) (1887: Sumatra); id., Cat. Syst. Mamm. p. 153 (pt.) (1888: Palembang); id., Weber's Zool. Erg. Nied. Ost-Ind. i. p. 126 (pt.) (1890: Sumanik, nr. Singkarak; Paninggahan); Thomas, Ann. Mus. Civ. Genova, (2) x.

- p. 921 (pt.) (1892: Meetan and Kokareet, N. Tenasserim); *id.*, *Nov. Zool.* i. p. 655 (1894: Sirhassen; Bunguran; habits); *id.*, *Ann. Mus. Civ. Genova*, (2) xiv. p. 664 (1895: Si Oban, E. Sipora); *Trouessart, Cat. Mamm.* i. p. 85, n. 456 (pt.) (1897).
- Cynopterus horsfieldi* (pt.), *Gray, List Mamm. B. M.* p. 38, specimen *m* (1843: "Himalaya," error for Sumatra).
- Cynopterus brachyotis* (pt.), *Jentink, Notes Leyd. Mus.* xiii. p. 202 (1891: Krapoh, Deli-Bedagei; Palembang); *Lyon, Proc. U.S. Nat. Mus.* xxxi. p. 603 (1906: Banka; Biliton).
- Cynopterus angulatus*, *Miller, Proc. Ac. N. Sci. Philad.* 1898, p. 316 (pt.) (Trong, Lower Siam); *id.*, *Fam. & Gen. Bats*, p. 49 (1907); *Kloss, J. Fed. Mal. St. Mus.* ii. n. 3, p. 153 (1908); *Lyon & Osgood, Cat. Types Mamm. U.S. Nat. Mus.* p. 255 (1909).
- Cynopterus sphinx* 7. *montani* (*nec Robin*), *Matschie, Megachir.* p. 75 (pt.) (1899). *f. montanoi*, *Trouessart, Cat. Mamm., Suppl.* p. 62 (pt.) (1904).
- Cynopterus montanoi* (pt.), *Miller, Proc. U.S. Nat. Mus.* xxxi. p. 274 (1906: Rhio-Linga Arch.).
- Cynopterus sphinx* (*nec Fahl*), *Bonhote, P. Z. S.* 1900, p. 191 (pt.) (Nan); *id.*, *P. Z. S.* 1902, i. p. 38 (N. Chiangmai); *id.*, *Fasc. Mal., Zool.* i. p. 14 (pt.) (1903: Biserat, Jalor; compare *C. brachyotis*); *id.*, *P. Z. S.* 1907, p. 8 (Nha-trang, Annam).
- Cynopterus pagensis*, *Miller, Proc. Biol. Soc. Wash.* xix. p. 62 (1 May, 1906: North Pagu I.); *id.*, *Fam. & Gen. Bats*, p. 49 (1907); *Lyon & Osgood, Cat. Types Mamm. U.S. Nat. Mus.* p. 256 (1909).

*Differential characters.*—The largest form of *C. brachyotis*: forearm 65–72 mm.

The table below shows the principal differential characters of the present form as compared with *C. sphinx sphinx* and *C. brachyotis brachyotis*, both of which extend into the area of *angulatus*, the former in the north, the latter in the south. *C. b. angulatus* is practically equal in general size to *C. s. sphinx*, but easily distinguished by its relatively shorter cranial rostrum (orbit to nares less than one-fourth of total length of skull) and shorter ears; the metacarpals and phalanges average a little shorter, the skull rather smaller and more delicate, and the tooth-rows a little shorter. From *C. b. brachyotis* it differs only by its larger size; the average difference in this respect is very conspicuous, but an absolutely hard-and-fast line between the two forms does not exist, small individuals of *angulatus* being in every respect indistinguishable from the largest of *brachyotis* (see also p. 617). On the whole, however, *angulatus* is one of the best differentiated forms of *brachyotis*.

	<i>s. sphinx.</i>	<i>b. angulatus.</i>	<i>b. brachyotis.</i>
	17 skulls,	34 skulls,	65 skulls,
	21 specimen.	34 specimen.	75 specimen.
Skull, lambda to gnathion ...	31.5–34.5	30.5–33.2	27–30.7 mm.
„ condylo-basal length ...	30.5–33.6	29.5–32	25.8–29.5 „
„ rostrum .....	8–9.1	6.5–8.2	6–7.4 „
Mandible .....	24.5–27.2	22.8–25.5	20.2–22.8 „
c-m <sup>1</sup> , crowns.....	10.8–12.2	10.2–11.3	8.8–10.4 „
Forearm .....	66–73.5	65–72	57–66 „
3rd digit, metacarpal .....	42–47.5	40–47	35.5–42.5 „
„ 1st phalanx .....	29–33	26.5–31.5	24.5–29 „
Ear from orifice .....	18–19.5	16–18	15–17 „
Tibia .....	25–27.5	23.5–27.5	21–25.5 „



*Colour*.—The large majority of adult individuals, from any locality, are exactly similar in the colour of the fur to dark-coloured individuals of *C. s. sphinx* (p. 601); a small percentage are brighter-coloured, like the corresponding variety of *C. s. sphinx*. White ear-edgings well marked; metacarpals and phalanges, or at least the latter, in adult individuals usually whitish or brownish white, rather strongly contrasting with dark membranes. Adult males usually differing from adult females by the deeper, more saturated, colour of the sides of the neck and flanks.

*Measurements*. On pp. 634, 637, 640.

*Specimens examined*. Forty-six, viz., in addition to those catalogued below, one from Dejoo, N. Lakhimpur, Assam (in private possession), six from Trong (Tarang), Lower Siam (U.S. National Museum, 83572, '592, '593, 84391, '440, '441, paratypes of subspecies), one from Jambu Luang, E. coast of Johore (U.S. N. M. 112682), and two from N. Pagi Island, Mentawai Group (U.S. N. M. 121582, '583, paratypes of *C. pagensis*).

*Range*. From Assam (North Lakhimpur), Upper Burma (Kindat), and North Siam, south to Sumatra, Simalu (Pulo Babi; no specimens examined, but see measurements of three adults by Miller, *l. c.*, 1903), and Mentawai Islands (Sipora and N. Pagi), east to Natuna Islands (Sirhassen). In Assam and North Siam it extends into the area of *C. s. sphinx*; in the Malay Peninsula and Sumatra it occurs together with *C. b. brachyotis*, with which it probably occasionally interbreeds. In Nias this form is probably replaced by the much larger *C. major* (see p. 629).

*Type* in the U. S. National Museum (male, in alcohol, Trong, Lower Siam, 83569). Of the paratypes measured by Miller (*l. c.* p. 318) one is a *C. b. brachyotis* (83524, specimen examined). Measurements of six paratypes (five skulls): Skull, lambda to gnathion 30.8–32, rostrum, orbit to nares 6.5–7, mandible 22.8–24.7, c–m<sup>1</sup> (crowns) 10.2–11, forearm 66.5–71, ear from orifice 17–18 mm.

*Cynopterus pagensis*, Miller; 1906.—Type locality, North Pagi Island, Mentawai Group; type in the U. S. National Museum (female, skin and skull, no. 121581). Two paratypes examined, viz. ♂ imm. al. and ♀ ad. skin, with skulls of both (121582, '83); further, two adult specimens in collection from the neighbouring island of Sipora. The four specimens are in every respect indistinguishable from *C. b. angulatus*. Measurements of paratype 121583 (♀ ad.) and, in parentheses, the corresponding measurements of the type as given by Miller: Skull, greatest length 32.8 (30.8), rostrum 7.8, mandible 24.5 (23), c–m<sup>1</sup>, crowns 10.8, forearm 69.5 (69.8) mm.; ear from orifice of ♀ ad., Sipora, 17 mm.

<i>a, b.</i> ♂ ad., ♀ ad. al.; skulls.	"India."	India Museum.	60.3.19.1400, 1401.
<i>c, d.</i> ♂ subad., ♀ ad. sks.; skulls.	Kindat, Upper Burma; 11 Oct. 1908.	C. H. Hobart, Esq. [P.].	10.10.19.1.2.
<i>e.</i> Juv. sk.; skull.	Siam ( <i>Finlayson</i> ).	India Museum.	79.11.21.54.
<i>f, h.</i> 2 ♀ imm., 1 ♀ ad. sks.; skulls.	Nan, Siam, 290 m.; 9 Oct., 9 Nov. 1897.	Th. H. Lyle, Esq. [P.].	98.2.8.5–7.

i. ♀ ad. sk.; skull.	N. Chiengmai, Siam, 612 m.; 27 Feb. 1901.	Th. H. Lyle, Esq. [P.].	1.7.7.1.
j-l. 2 ♂ ad., 1 ♀ ad. sks.; skulls.	Chiengsen, Mekong, 385 m.; 15 Feb. 1902.	Th. H. Lyle, Esq. [P.].	2.6.6.1-3.
m. ♂ imm. sk.; skull.	Bangkok, sea-level; 18 May, 1907.	Th. H. Lyle, Esq. [P.].	7.11.13.1.
n-p. 1 imm., 2 ad. sks; skulls.	Cambodja ( <i>Mouhot Coll.</i> ).	Tomes Coll.	7.1.1.264-266.
q. ♂ imm. sk.; skull.	Nha-trang, Annam; 13 Nov. 1905.	Dr. J. Vassul [C.].	6.11.6.42.
r. ♀ ad. sk.	Biserat, Jalor, Malay Pen.; 8 July, 1901.	Messrs. H. C. Robinson & N. Annandale [P.].	3.2.6.16.
s-u. 1 ♂ ad., 2 ♀ ad. al.; skulls.	S. Perak, Malay Pen.	Kuala Lumpur Museum [P.].	8.2.5.12-14.
v. ♀ ad. al.; skull.	K. Jalor, S. Perak; 30 Oct. 1901.	Kuala Lumpur Museum [P.].	8.2.5.10.
w. ♂ imm. al.; skull.	Bidor, S. Perak; Jan. 1902.	Kuala Lumpur Museum [P.].	8.2.5.11.
x, y. ♂ ad., ♀ ad. al.; skulls.	Sirlassen, Natuna Is.; 20 Sept. 1893.	A. Everett [C.].	94.9.28.27-28.
z-b <sup>2</sup> . 1 [♂] ad., 2 [♀] ad. sks.; skulls.	Sumatra.	Purchased (J. Turner).	38.3.13.38-40.
c <sup>2</sup> . [♂] ad. sk.; skull.	Sumatra.	Purchased (Frank).	44.4.4.8.
d <sup>2</sup> . [♂] ad. sk.; skull.	Sumatra.	Tomes Coll. (Verreaux).	7.1.1.270.
e <sup>2</sup> . ♂ ad. al.; skull.	Sumatra.	Buda-Pesth Museum [E.].	94.7.18.1.
f <sup>2</sup> -h <sup>2</sup> . 2 ♂ ad., 1 ♀ ad. al.; skulls of nos. 6 and 8.	Krapoh, Deli-Be-dagei, N.E. Sumatra ( <i>Kannie-gieter</i> ).	Leyden Museum [E.].	91.11.3.6-8.
i <sup>2</sup> -j <sup>2</sup> . ♂ ad., ♀ ad. al.; skulls.	Si Oban, Sipora, Mentawai Is.; May, 1894 ( <i>Dr. E. Modigliani</i> ).	Genoa Museum [P.].	95.1.9.3,4.

## 2 b. *Cynopterus brachyotis brachyotis*, S. Müll.

*Cynopterus marginatus* (pt.), Dobson, Cat. Chir. B. M. p. 81.

*Cynonycteris grandidieri*, id., op. c. p. 79.

? *Pachysoma duvauceli*, E. Geoffroy, *Cours Hist. Nat. Mamm.*, 13 leçon (27 June, 1828), p. 28 (Sumatra); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 705 (Sept. 1828); *id.*, *Ann. Sci. Nat.* xv. (Oct. 1828), p. 203; Lesson, *Hist. Nat. Mamm. (Compl. Buffon)*, v. p. 63 (1836); Temminck, *Mon. Mamm.* ii. p. 96 (1837: remarks); Wagner, *Schreber's Säug., Suppl.* i. p. 363, footnote (1839); Lesson, *N. Tabl. R. An., Mamm.* p. 14, n. 199 (1842); Schinz, *Syst. Verz. Säug.* i. p. 134, footnote\* (1844); Peters, *MB. Ak. Berlin*, 1869, p. 395 (identified with *marginatus*); Fitzinger, *SB. Ak. Wien*, lx. Abth. i. p. 633 (1870).

? *Pteropus duvauceli*, J. B. Fischer, *Syn. Mamm.* p. 87, n. 22, p. 550 (1829); Waterhouse, *Cat. Mamm. Mus. Zool. Soc.*, 2 ed. p. 13, n. 105\* (Sumatra, Raffles).

? *Cynopterus duvaucelli*, Gray, *Mag. Zool. & Bot.* ii. p. 504 (1838).

\* *Misspelt duvaucelli*.

- ? *Pachysoma brevicaudatum*, *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 705 (Sept. 1828: Sumatra; ? India); *id.*, *Ann. Sci. Nat.* xv. (Oct. 1828), p. 204; *id.*, *Bélangier's Voy. Ind.-Or.*, Zool. p. 94 (1831); *Lesson, Hist. Nat. Mamm. (Compl. Buffon)*, v. p. 64 (1836); *Temminck, Mon. Mamm.* ii. p. 92 (pt.), pl. xxxv. fig. 9 (head) (1837); *S. Müller, Temminck's N. G. Ned. Ov. Bez.*, Zoogd. pp. 21, 58 (pt.) (1839-44: Sumatra); *Macgillivray, Cuvier's An. Kingd.* ii. p. 12, pl. vii. B, fig. 6 (head: copy from Temminck) (1840); *Lesson, N. Tabl. R. An., Mamm.* p. 14, n. 200 (1842); *Waterhouse, P. Z. S.* 1843, p. 67 (Philippines, Cuming); *Tomes, P. Z. S.* 1858, p. 537 (1859: Labuan); [*Anonymous*], *Mém. Quadr. & Chér. Arch. Ind.* p. 115 (pt.) (1864); *Peters, MB. Ak. Berlin*, 1869, p. 395 (identified with *marginatus*); *Fürzinger, SB. Ak. Wien*, lx. Abth. i. p. 635 (1870).
- ? *Pteropus brevicaudatus*, *J. B. Fischer, Syn. Mamm.* p. 87, n. 20 (1829); *Schinz, Syst. Verz. Säug.* i. p. 133, n. 34 (1844); *Giebel, Säug.* p. 1001 (1855).
- Cynopterus brevicaudatus*, *Gray, Mag. Zool. & Bot.* ii. p. 503 (1838); *id.*, *Zool. 'Samarang,' Vert.* p. 12 (1849: Sumatra; Philippines); *id.*, *P. Z. S.* 1866, p. 64; *Peters, MB. Ak. Berlin*, 1867, p. 866 (pt.) (Borneo; Luzon); *id.*, *op. c.* 1868, p. 626 (1869: Sarawak); *Leeche, Lunds Univ. Arsskr.* xiv. p. 17 & seq. pl. ii. fig. 10 (1878: dentition); *Lyon, Proc. U.S. Nat. Mus.* xxxiv. p. 664 (pt.) (1908: E. Sumatra).
- ? *Pteropus* [*Pachysoma*] *brevicaudatus*, *Wagner, Schreber's Säug., Suppl.* i. p. 364 (1839).
- Pachysoma brachyotis*, *S. Müller, Tijd. Nat. Gesch.* v. pt. i. p. 146 (1838: R. Dewei, Borneo); *id.*, *Temminck's N. G. Ned. Ov. Bez.*, Zoogd. pp. 21, 58 (1839-44); *Temminck, Mon. Mamm.* ii. p. 362\* (1841: redescription); [*Anonymous*], *Mém. Quadr. & Chér. Arch. Ind.* p. 115† (1864); *Kreffl, Cat. Mamm. Austr. Mus.* p. 5 (1864: Borneo); *Fitzinger, SB. Ak. Wien*, lx. Abth. i. p. 637 (1870).
- Pteropus* [*Pachysoma*] *brachyotis*, *Wagner, Schreber's Säug., Suppl.* i. p. 363 (1839); *id.*, *op. c.*, *Suppl.* v. p. 610 (1853-55).
- Pteropus brachyotis*, *Schinz, Syst. Verz. Säug.* i. p. 133, n. 33 (1844).
- Cynopterus brachyotis*, *Gray, Zool. 'Samarang,' Vert.* p. 12 (1849); *Jentink, Cat. Ost. Mamm.* p. 266 (1887: cotypes); *id.*, *Cat. Syst. Mamm.* p. 154 (1888: cotypes); *id.*, *Notes Leyd. Mus.* xiii. p. 202 (pt.) (1891: Krapoh, Deli-Bedagei; Palembang); *Blanford, Faun. B. Ind., Man. m.* pt. ii. p. 264 † (pt.) (1891: Borneo); ? *Thomas, Nov. Zool.* i. p. 656 ‡ (1894: Bunguran, recorded by Everett); *Jentink, Notes Leyd. Mus.* xix. p. 49 (1897: Nanga Rann and Sintang, Kapuas R., W. Borneo); *A. B. Meyer, Abh. Mus. Dresden*, vii. n. 7, p. 7 (pt.) (1899: Minahassa); *Willink, N. Tijd. Ned. Ind.* lxx. p. 276 (pt.) (1905); *Lyon, Proc. U. S. Nat. Mus.* xxxi. p. 603 (1906: Banka; Biliton); *id.*, *op. c.* xxxiii. p. 562 (1907: Kapuas R., W. Borneo); *Miller, Fam. & Gen. Bats*, p. 49 (1907).
- Cynopterus marginatus var. brachyotis*, *Gray, Cat. Monk. &c.* p. 123 (1870: Borneo).
- Pachysoma* (*Pteropus*) *brachyotis*, *Marchi, Atti Soc. It. Sci. Nat.* xv. p. 518, pl. viii. figs. 6a-d (hairs) (1873).
- Cynopterus sphinx* 10. *brachyotis*, *Matschie, Megachir.* p. 76 (1899:

\* *Pachysoma brachyotum.*† *Misspelt brachiotis.*‡ *Cynopterus brachyotus.*

- Sintang; Sarawak). i. brachyotis, *Trouessart, Cat. Mamm., Suppl.* p. 62 (1904).
- Cynopterus brachyotis* brachyotis, *K. Andersen, Ann. & Mag. N. H.* (8) vi. p. 624 (1910).
- ? *Pachysoma titthæcheilum* (*nec Temm.*), *Waterhouse, P. Z. S.* 1843, p. 67 (Philippines, Cuming).
- Cynopterus titthæcheilus*, *Horsfield, Cat. Mamm. Mus. E. Ind. Co.* p. 30 (pt.) (1851: Malacca, Griffith); *Miller, Proc. U.S. Nat. Mus.* xxvi. p. 474 (pt.) (1903: Tapanuli Bay, W. Sumatra); ? *Schneider, Zool. Jahrb., Syst.* xxiii. p. 75 (pt.) (1905: Deli; Upper Langkat; Lower Langkat; Battak Mts.; Batu Bahra; Indragiri).
- Cynopterus marginatus* var. *titthæcheilus*, *Gray, Cat. Monks. &c.* p. 122 (1870: Malacca, Griffith).
- Cynopterus marginatus* (*nec E. Geoff.*), *Cantor, J. A. S. B.* xv. p. 187 (pt.) (1846: Penang; Singapore); *Peters, MB. Ak. Berlin*, 1867, p. 866 (pt.); *Dobson, Cat. Chir. B. M.* p. 81 specimens *c, d, e, p, q, r, s, t, v, b', c', d', e'* (1878: "India"; Penang; "Malacca"; Philippines); *id.*, *P. Z. S.* 1878, p. 877 (1879: Singapore); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 207, n. 321 (pt.) (1879); ? *Jentink, Notes Leyd. Mus.* v. p. 173 (1883: Lubu Basong, Priaman, W. Sumatra); *Thomas, P. Z. S.* 1886, p. 73 (Jerome, Selangor: Singapore); *Jentink, Cat. Ost. Mamm.* p. 264 (pt.) (1887: Borneo); *id.*, *Cat. Syst. Mamm.* p. 153 (pt.) (1888: Borneo; Celebes); ? *id.*, *Notes Leyd. Mus.* xi. p. 30 (1888: Deli and Siak, Sumatra); *Everett, P. Z. S.* 1893, p. 494 (Borneo); *Hose, Mamm. Borneo*, p. 39 (1893); *Elera, Cat. Sist. P. Filip.* i. p. 7 (1895: Abra, Luzon; Palawan); *Ridley, Nat. Sci.* vi. p. 28 (1895: Singapore; habits); *Trouessart, Cat. Mamm.* i. p. 85, n. 456 (pt.) (1897); *Hanitsch, Ann. Rep. Raffles Libr. & Mus.* 1897, p. 11 (Singapore); *S. S. Flower, P. Z. S.* 1900, p. 340 (Penang; Singapore); *Sanchez, An. Soc. Esp. H. N.* xxix. pp. 276, 288 (1900).
- Pteropus* [*Pachysoma*] *marginatus*, *Wagner, Schreber's Säug., Suppl.* v. p. 609 (pt.) (1853-55).
- Pachysoma luzoniense*, *Peters, MB. Ak. Berlin*, 1861 (25 July), p. 708 (Volcan Yriga, S. Camarines, Luzon).
- Cynopterus sphinx* 11. *luzoniensis*, *Matschie, Megachir.* p. 76 (1899: type and paratype). j. *luzoniensis*, *Trouessart, Cat. Mamm., Suppl.* p. 62 (1904).
- Cynonycteris grandidieri*, *Peters, MB. Ak. Berlin*, 1869 (13 May), p. 394 ("Zanzibar"); *Dobson, Cat. Chir. B. M.* p. 79 (1878); *Trouessart, Cat. Mamm.* i. p. 85, n. 454 (1897); *Seabra, J. Sci. Lisboa*, (2) v. p. 159 (1898); *Miller, Fam. & Gen. Bats*, p. 52 (1907: type re-examined).
- Cynopterus sphinx* 12. *grandidieri*, *Matschie, Megachir.* p. 76, pl. viii. figs. 4 a-c (type skull) (1899). k. *grandidieri*, *Trouessart, Cat. Mamm., Suppl.* p. 62 (1904).
- Cynopterus marginatus* var. *philippensis*, *Gray, Cat. Monks. &c.* p. 123 (1870: Philippines).
- Cynopterus marginatus* var. *cumingi*, *Gray, Cat. Monks. &c.* p. 123 (1870: Philippines).
- Cynopterus montanoi*, *Robin, Bull. Soc. Philom. Paris*, (7) v. p. 90 (séance 26 Mar. 1881: Kessang, preliminary descr.); *id.*, *Ann. Sci. Nat.* (6) *Zool.* xiii. Art. 2, pp. 1\*, 6\*, pl. xii. figs. 2-4 (interfemoral; 1-3 digits; ear) (1882: detailed descr.); *Trouessart*,

- Cat. Mamm.* i. p. 86, n. 461 (1897); *Müller, Proc. Wash. Ac. Sci.* iii. p. 137 (1901: Sirihassen); *id., Proc. U.S. Nat. Mus.* xxxi. p. 274 (pt.) (1906: Rhio-Linga Arch.); *Kloss, J. Fed. Mal. St. Mus.* ii. p. 153 (1908); *Lyon, Proc. U.S. Nat. Mus.* xxxvi. p. 487 (1909: Rhio-Linga Arch.); *Thomas & Wroughton, J. Fed. Mal. St. Mus.* iv. p. 108 (1909: Si Karang & Tanjong Surat, S.E. Johore; Tanjong Turut, Batam; Pernal, Karimon).  
*Cynopterus sphinx* 7. *montani*, *Matschie, Megachir.* p. 75 (pt.) (1899).  
*f. montanoi*, *Trouessart, Cat. Mamm., Suppl.* p. 62 (pt.) (1904).  
*Cynopterus sphinx* (*nec Vahl*), *Bonkote, P. Z. S.* 1900, p. 875 (1901: Kikalin, Raman; Biserat, Jalor); *id., Fasc. Mal., Zool.* i. p. 14 (pt.) (1903: Biserat; habits); *Miller, Fam. & Gen. Bats*, p. 48, fig. 5 (skull) (1907); *Elliot, Cat. Mamm. Field Col. Mus.* p. 493, n. 869 (pt.) (1907: Sarawak).

*Differential characters.*—Similar to *C. b. angulatus*, but averaging considerably smaller (forearm 57–66 mm.; compare table, p. 612), and colour of fur averaging brighter.

This is the only form of *Cynopterus* known to occur in Borneo, the Philippines, and Celebes; and all the specimens (50) examined from those islands are in every respect typical *C. b. brachyotis*. In the Malay Peninsula (at least as far north as Trong, Lower Siam) and Sumatra it occurs together with *C. b. angulatus*; of 75 specimens examined from that area, 21 are *C. b. angulatus*, 50 *C. b. brachyotis*, while four (about 5 per cent.) are so thoroughly intermediate as to be impossible to allocate to subspecies (see list of specimens, p. 622). One of these intermediate specimens might with equal right be considered a very large *brachyotis* or an unusually small *angulatus*, but is not necessarily a hybrid between the two forms; the other three are in the size of the skull and teeth perfectly within the limits of *brachyotis*, but externally indistinguishable from average specimens of *angulatus* (one of them even equal in size to a rather large *angulatus*: forearm 70 mm.); facts which would seem to support the supposition that the two races occasionally interbreed. Anything similar to or closely approaching these intermediate specimens is so far unknown from localities inhabited exclusively by the one or the other race.

There is apparently no difference whatever between specimens from the Malay Peninsula, Sumatra, Borneo, Philippines, and Celebes. Subjoined a comparative list of measurements:—

	Lower Siam, Malay Pen., Sumatra.	Borneo.	Philippines.	Celebes.
	36 skulls, 37 specim.	24 skulls, 31 specim.	3 skulls, 5 specim.	2 skulls, 2 specim.
Skull, lambda to gnathion ...	27.2–30.6	27–30.7	29–30	28–28.8 mm.
„ condylo-basal length ..	25.8–29.2	25.8–29.5	27.2–28.5	27.5–27.8 „
„ rostrum .....	6–7.3	6–7.4	6.6–7	6.8–6.8 „
„ across $m^1$ – $m^1$ , crowns.	7.7–9.2	7.7–9.2	8.5–8.9	8–8.5 „
Mandible .....	26.2–22.8	20.5–22.7	21.3–21.8	21.8–21.8 „
c- $m^1$ , crowns .....	8.8–10.2	9–10.4	9.5–9.8	9–9.8 „
Forearm .....	57–65.5	58–66	62–64	60–63.5 „
Third metacarpal .....	35.5–42	37.5–42.5	41.5–42.5	39–42 „
Ear from orifice .....	15–17	15–17	15–16	„ „
Tibia .....	21.5–24.5	21–25.5	22–23.5	22 „

*Colour*.—Very similar to that of bright-coloured individuals of *C. s. sphinx* (p. 600).

Adult males (nine skins: Penang; Johore; Singapore; Batam; Kariman; Sarawak):—Back in brightest-coloured specimens a tinge of brown somewhat approaching dark raw-umber and very conspicuously suffused with warm russet or a tinge between russet and tawny-olive; in duller-coloured specimens brownish olive or brownish bistre suffused with raw-umber. Crown similar to back or slightly darker. Centre of breast and belly lighter or darker olive-drab. Sides of neck, sides of breast, and flanks varying from nearly tawny (palest extreme), through lighter or darker cinnamon-rufous, to light warm chestnut, in any case contrasting with colour of centre of breast and belly. Ears conspicuously edged with white; metacarpals and phalanges usually whitish or brownish white, contrasting with dark membranes.

Adult females (twenty-four skins: Penang; Johore; Singapore; Batam; Kariman; Buntok):—Differing from males chiefly by the paler (less saturated) colour of the neck and flanks; back averaging darker. Back brownish olive or brownish bistre, sometimes uniform, rather more often washed with a pale tinge of brown, not infrequently with russet, but never as bright as in the brightest-coloured males. Head similar to back or somewhat darker. Breast and belly some tinge of drab, nearly always more or less suffused with raw-umber or tawny olive, sometimes uniform drab or even greyish drab. Sides of neck and sides of breast some tinge of tawny, or tawny olive, or tawny russet, this colour not extending quite as far back along the flanks as in adult males, and not as strongly contrasting with the colour of the breast and belly. Ears, metacarpals, phalanges, and membranes as in males.

The above-described adult males date from February, April, July, and August; the females from July, August, and October. So far as this series goes the seasonal changes in colour are hardly appreciable.

Young individuals:—Head and back uniform dark hair-brown (nearly slate-brown), in individuals approaching maturity often brownish bistre or this colour slightly washed with raw-umber. Underparts hair-brown or drab. Sides of neck and flanks in females similar to rest of underparts, in males usually tinged with light tawny-olive.

*Measurements*. On pp. 634, 637, 640.

*Specimens examined*. A hundred, in the collections of the Leyden (nineteen), Berlin (two), Paris (two), U.S. National (nine\*), and British Museums, including the types of *Pachysoma brachyotis*, *P. luzoniense*, *Cynonycteris grandidieri*, *Cynopterus marginatus* var. *philippensis*, *C. m.* var. *cumingi*, and *C. montanoi*,—from the following localities:—

Philippines (8):—"Philippines," 4; Luzon (Yriga), 2; Zamboanga, 2.

Celebes (4):—"Celebes," 2; Mt. Masarang, 2.

Borneo (38):—"Borneo," 7; N. Borneo, 1; Sarawak, 5; R. Sempang,

\* Reg. nos. 83524, 112680, '81, '83, '84, '85, 145626, 151892, 153865.

S.W. coast, 1; R. Kendawangan, S.W. coast, 1; R. Dewei, S. C. Borneo, 10; Buntok, 12; Pamukang Bay, S.E. coast, 1.  
 Lower Siam:—Trong, 1.  
 Malay Peninsula (26):—"Malacca," 7; Jalor, 1; Wellesley, 1; Penang, 2; Perak, 1; Selangor, 1; Johore, 8; Singapore, 5.  
 Rhio Archipelago (12):—Batam, 10; Karimon, 2.  
 Sumatra (5):—Deli-Bedagei, 3; Palembang, 2.  
 Uncertain localities, 6.

*Range.* Borneo (probably including the Natuna Islands), extending northward over the whole of the Philippines, east to Celebes, southwest and west to Sumatra (including Banka and Biliton), the Rhio-Linga Archipelago, Malay Peninsula, and Lower Siam (Trong). The area covered by this form thus corresponds to the Indo-Malayan Subregion as defined by Wallace, including Celebes, but excluding the Nicobars, Nias, Java, and the islands in the Java Sea (Kangean and Mata Siri); in all of these islands it is, however, represented by other races of the same species.

*Cotypes.*—Type locality, "eene diepe kalksteen-spelonk, aan den oever van de rivier Dewej," South Central Borneo. Cotypes in the Leyden Museum, four mounted specimens (Cat. Syst. *a-d*, two ♂ ad., one ♀ ad., one juv.) and six odd skulls (Cat. Ost. *b-g*); skull of specimen *a* extracted, those of *b-d* *in situ*; all the seven skulls adult, except *f*; the lower jaw fixed by wire to skull *c* is that of an immature *C. horsfieldi*. Extreme measurements of the whole series of adult cotypes:—Skull, lambda to gnathion 27–30.5, rostrum, orbit to nares 6–7.3, mandible 20.5–22.7, *e-m*<sup>1</sup> (crowns) 9–10.2, forearm 60–63.5 mm. (in a series of ten from Buntok 61–66 mm.).

*Pachysoma duvauceli*, E. Geoff., and *P. brevicaudatum*, Is. Geoff.; 1828.—Both described from specimens collected in Sumatra by Diard and Duvaucel, and both absolutely indeterminable from the descriptions; they may be any of the four forms of *Cynopterus* occurring in Sumatra, though, judging only from the published measurements of the total length and expanse (no measurements of forearms), most probably either *C. b. angulatus* or *brachyotis*. Types probably not in existence. The Paris Museum possesses four specimens of *Cynopterus* (all mounted) originating from Diard and Duvaucel's collections (A 92, A 93, A 94, A 101), but none are marked as types of *duvauceli* or *brevicaudatum*; one is *C. s. tittha-cheilus*, two probably *C. b. angulatus*, and one *C. b. brachyotis*. Whether these are the specimens mentioned by Peters in 1869 (MB. Ak. Berlin, p. 395) as the "Original-Exemplare" of *P. duvauceli* and *P. brevicaudatum*, or whether the types were still in existence in 1869, is uncertain. One of Tomes's specimens of *C. b. brachyotis*, from Malacca (7.1.1.269), is marked, probably in his hand, *P. duvauceli* "similar to type specimen, Paris Museum"; another, of *C. b. angulatus*, from Sumatra (7.1.1.270), is ticketed *P. brevicaudatum* "similar to type, Paris Museum"; but there is no evidence that Tomes had ever seen the real types of *duvauceli* and *brevicaudatum*.

*Pachysoma luzoniense*, Peters; 1861.—Type locality, "am Ostabhange des Vulkans Yriga, Südcamarines, Luzon" (Jagor

coll.). Cotypes, two adult females, alcoholic, both with skull *in situ*, Berlin Museum, nos. 2425 and 2426; the mouth of 2425 is forced open to show the dentition. Six years later (MB. Ak. Berlin, 1867, p. 866) *P. luzoniense* was by Peters considered indistinguishable from "*C. brevicaudatus*" (i. e. *C. brachyotis*). Measurements of cotypes (those of 2426 in parentheses): Forearm 64 (62), third metacarpal 41.5 (41.5), ear from orifice 15.5 (15), tibia 22 (22.5) mm.

*Cynonycteris grandidieri*, Peters; 1869.—The type in the Paris Museum, a senile male, preserved in alcohol (marked 1864—436), with skull separate (*fig. cit.*), is in every respect (skull, teeth, palate-ridges, external characters) indistinguishable from *C. b. brachyotis*. It shows no resemblance whatever to *Megacerops* (compare Miller, Fam. & Gen. Bats, p. 52; 1907).  $m^1$  and  $m_2$  on both sides worn down to the roots; left half of palate-ridges preserved; manimæ unusually large (male). The type is stated to have been obtained by Grandidier in Zanzibar. Skull, lambda to gnathion 30.2, rostrum, orbit to nares 7.2, mandible 22.5, c- $m^1$  (crowns) 10.4, forearm 62, third metacarpal 38.5, ear from orifice 17, tail 10, tibia 22 mm.

*Cynopterus marginatus* var. *philippensis*, Gray; 1870.—Type in collection (♀ imm., forearm 60 mm.).

*Cynopterus marginatus* var. *cumingi*, Gray; 1870.—Cotypes (♂ ad., ♀ ad.) in collection. Measurements (those of the female in parentheses): Skull, lambda to gnathion 29.3 (29), rostrum 7 (6.6), mandible 21.8 (21.3), c- $m^1$ , crowns 9.8 (9.5), forearm 64 (64), third metacarpal 42.5 (42), ear from orifice 16 (15), tibia 22.5 (22.5) mm.

*Cynopterus montanoi*, Robin; 1881.—Type locality, Kesang, Malacca (Montano coll.); type in the Paris Museum, ♀ imm. al. (finger-joints unconsolidated), skull *in situ*, Reg. no. 1879—1818. Forearm 57.5 mm. (probably not quite full-grown). Original spelling of name "*montanoi*," subsequently changed by the author into "*montani*."

a. Ad. skeleton.		Purchased (Frank).	54.4.29.3.
b. Ad. sk.; skull.		India Museum.	60.5.4.20.
c-c. ♀ ad., ♂ pull., ♂ imm. al.; skulls of two.		India Museum.	60.3.19.1401 a-c.
f. ♀ imm. al.; skull.	Philippines.	Zool. Soc. Coll.	Unregistered. (Type of <i>C. m.</i> var. <i>philippensis</i> , Gray.)
g, h. ♀ ad., ♀ pull. al.; skull of ♀ ad.	Philippines.		45.3.6.21. (♀ ad., Cotype of <i>C. m.</i> var. <i>cumingi</i> , Gray.)
i. ♂ ad. al.; skull.	Philippines.	Zool. Soc. Coll.	55.12.26.274. (Cotype of <i>C. m.</i> var. <i>cumingi</i> , Gray.)
j, k. ♀ ad., ♂ juv. al.; skull of ♀ ad.	Zamboanga.	A. Everett [C.].	79.5.3.14, 15.
l, m. 2 ♀ subad. sks.; skulls.	Mt. Masarang, Minahassa, N. Celebes, 3500-4000'; Sept., Oct. 1895.	Dr. Ch. Hose [C.].	97.1.2.9, 10.



<i>n</i> . Imm. sk. ; skull.	N. Borneo.	D. Cator, Esq. [P.].	95.7.30.3.
<i>o, p</i> . ♂ ad., ♀ ad. al. ; skulls.	Sarawak; June, 1892.	A. Everett [C.].	93.4.1.22, 23.
<i>q, r</i> . ♂ ad., ♀ ad. sks. ; skull of ♂ ad.	Baram, Sarawak ; Apr. 1896.	Dr. Ch. Hose [C. & P.].	8.1.27.34, 35.
<i>s</i> . ♂ ad. sk.	Miri R., Baram ; 15 Apr. 1895.	Dr. Ch. Hose [C.].	Unregistered.
<i>t-c<sup>2</sup></i> . 10 ♀ ad. sks. ; skulls.	Buntok, Barito R., S. C. Borneo, 20' ; 1, 2 Oct. 1909 ( <i>Guy C. Short-ridge</i> ).	Oldfield Thomas, Esq. [P.].	10.4.5.34-43.
<i>d<sup>2</sup>, e<sup>2</sup></i> . 2 ♀ ad. al.	Buntok ( <i>G. C. S.</i> ).	Oldfield Thomas, Esq. [P.].	10.4.5.156, 157.
<i>f<sup>2</sup>, g<sup>2</sup></i> . 2 ad. sks. ; skulls.	Malay Pen.	Purchased (Warwick).	43.2.22.3, 4.
<i>h<sup>2</sup>, i<sup>2</sup></i> . 1 ad., 1 subad. sks. ; skulls.	Malay Pen.	India Museum ( <i>Griffith</i> ).	60.5.4.19, 22.
<i>j<sup>2</sup>-l<sup>2</sup></i> . 1 ad., 1 ♀ ad., 1 ♀ subad. sks. ; skulls.	Malay Pen. ; 1854 ( <i>Dr. A. R. Wallace</i> ).	Tomes Coll.	7.1.1.267-270.
<i>m<sup>2</sup></i> . ♀ subad. sk. ; skull.	Biserat, Jalor ; 7 July, 1901.	Messrs. H. C. Robinson & N. Annandale [P.].	3.2.6.15.
<i>n<sup>2</sup></i> . Ad. sk. ; skull.	Penang ( <i>Cantor</i> ).	India Museum.	79.11.21.64.
<i>o<sup>2</sup></i> . ♂ imm. sk. ; skull.	George Town, Penang ; 8 May, 1895.	Capt. S. S. Flower [C. & P.].	96.1.13.2.
<i>p<sup>2</sup></i> . ♀ ad. sk. ; skull.	Prov. Wellesley ( <i>Cantor</i> ).	India Museum.	79.11.21.66.
<i>q<sup>2</sup></i> . ♂ ad. al. ; skull.	Gedong, Batang, Padang, S. Perak ; January.	Kuala Lumpur Museum [P.].	8.2.5.9.
<i>r<sup>2</sup></i> . ♂ ad. sk. ; skull.	Jerome, Selangor ; 12 Aug., 1879 ( <i>H. Davison</i> ).	A. O. Hume, Esq. [P.].	85.8.1.104.
<i>s<sup>2</sup></i> . ♂ ad. sk. ; skull.	Si Karang, Johore ; 2 Aug. 1908 ( <i>H. C. Robinson</i> ).	Government, Federated Malay States [P.].	9.4.1.45.
<i>t<sup>2</sup>, u<sup>2</sup></i> . ♀ ad., ♀ imm. sks. ; skulls.	Tanjong Surat, Johore, 26 July, 1908 ( <i>H. C. R. &amp; E. Seimund</i> ).	Government, Federated Malay States [P.].	9.4.1.46, 47.
<i>v<sup>2</sup>, w<sup>2</sup></i> . ♂ ad., ♂ imm. al. ; skull of ♂ ad.	Singapore I. ( <i>H. N. Ridley</i> ).	Singapore Museum [E.].	94.6.19.1, 3.
<i>x<sup>2</sup></i> . ♂ ad. al.	Singapore I. ; 3 Mar. 1896.	Capt. S. S. Flower [P.].	96.6.16.1.
<i>y<sup>2</sup></i> . Subad. sk. ; skull.	Singapore I.	Capt. S. S. Flower [P.].	96.6.16.8.
<i>z<sup>2</sup></i> . Ad. sk.	Singapore I. ; 31 Aug. 1898.	Capt. S. S. Flower [P.].	98.10.21.1.
<i>a<sup>3</sup>-j<sup>3</sup></i> . 4 ♂ ad., 1 ♂ imm., 4 ♀ ad., 1 ♀ subad. sks. ; skulls.	Tanjong Turut, Bantan ; 12, 15, 16, 17 July, 1908 ( <i>H. C. R. &amp; E. S.</i> ).	Government, Federated Malay States [P.].	9.4.1.48-57.
<i>k<sup>3</sup>, l<sup>3</sup></i> . ♂ ad., ♀ ad. sks. ; skulls.	Pemeral, Pulo Kari-mon ; 12 Aug. 1908 ( <i>H. C. R. &amp; E. S.</i> ).	Government, Federated Malay States [P.].	9.4.1.58, 59.

- $m^3-o^3$ . ♀ ad., ♀ pull., Krapoh, Deli-Bedagei, Leyden Museum [E.]. 91.11.3.9.  
 ♀ imm. al.;  
 skulls of two. N.E. Sumatra (Kanniegieter).  
 $p^3, q^3$ . ♂ ad., ♂ subad. Palembang, Lakat, Leyden Museum [E.]. 91.11.3.10, 11.  
 al.; skulls. Sumatra (Kanniegieter).

*Intermediate between C. b. brachyotis and C. b. angulatus.*

- $r^3$ . ♂ ad. al.; Gedong, Batang, Pa- Kuala Lumpur Mu- 8.2.5.8.  
 skull. dang, S. Perak; seum [P.].  
 January.  
 $s^3$ . ♂ ad. sk.; Singapore I.; 3 Feb. A. O. Hume, Esq. 85.8.1.105.  
 skull. 1879 (W. Davi- [P.].  
 son).  
 $t^3$ . ♂ ad. al.; Singapore I. (Botanic Singapore Museum 94.16.19.2.  
 skull. G.); 24 Sept. 1893 [E.].  
 (H. N. Ridley).  
 $u^3$ . ♀ ad. sk.; Pajo, Padang, Su- Herr Carl Bock [C.]. 79.6.23.2.  
 skull. matra.

## 2 c. *Cynopterus brachyotis javanicus*, K. And.

*Cynopterus marginatus* (nec E. Geoff.), *Jentink, Weber's Zool. Erg. Ned. Ost-Ind.* i. p. 126, ♂ ad. (1890: Buitenzorg); *Trouessart, Cat. Mamm.* i. p. 85, n. 456 (pt.) (1897).

*Cynopterus horsfieldi* (nec Gray), *Matschie, Semon's Zool. Forsch.* v. p. 773 (1903: Buitenzorg); *Thomas & Wroughton, P. Z. S.* 1909, p. 376 (pt.) (Buitenzorg; Pangandaran; Tasikmalaja; Tjilatjap).

*Cynopterus brachysoma* (nec Dobson), *G. M. Allen, Bull. Mus. Comp. Z. Harv. Coll.* lii. n. 3, p. 25 (1908: Buitenzorg).

*Cynopterus brachyotis javanicus*, K. Andersen, *Ann. & Mag. N. H.* (8) vi. p. 624 (1 Dec. 1910: Buitenzorg).

*Differential characters.*—Similar to *C. b. brachyotis*, but skull averaging slightly heavier, external dimensions somewhat larger.

The characters pointed out above are conspicuous only in a series of specimens of both races; single individuals are often difficult or impossible to allocate. The palato of *javanicus* averages decidedly broader than in *brachyotis* (compare measurements of breadth across external surfaces of  $m^1-m^1$ , below); the forearm of the largest specimens is markedly longer than in the largest *brachyotis*, that of the smallest specimens almost exactly as in an average *brachyotis*. Subjoined some comparative measurements of *C. b. brachyotis*, *javanicus*, *insularum*, and *ceylonensis*:—

	<i>brachyotis</i> .	<i>javanicus</i> .	<i>insularum</i> .	<i>ceylonensis</i> .
	65 skulls,	16 skulls,	6 skulls,	4 skulls,
	75 specim.	17 specim.	6 specim.	6 specim.
Skull, lambda to gnathion ...	27 -30.7	28.3-30.8	29.5-31.2	28 -30.8 mm.
„ condylo-basal length ..	25.8-29.5	27 -29.2	28 -29.6	27 -29.8 „
„ rostrum .....	6 - 7.4	6.2- 7.3	7 - 7.5	6.8- 7.7 „
„ across $m^1-m^1$ , crowns .	7.7- 9.2	8.5- 9.7	8.8- 9.5	8 - 9.5 „
Mandible .....	20.2-22.8	21.5-23	22 -23.5	21 -24 „
c- $m^1$ , crowns .....	8.8-10.4	9.5-10.5	9.8-10.6	9.7-11 „
$p^3$ , length .....	1.8- 2.4	2 - 2.3	2.1- 2.5	2.1- 2.5 „
$p_3$ , length .....	1.8- 2.2	1.8- 2.1	2.1- 2.2	1.9- 2.5 „
Forearm .....	57 -66	61.5-68	66.5-69.5	59 -64 „
Third metacarpal .....	35.5-42.5	38 -42	42 -46.5	37 -41 „

*Colour* (nine adult males, seven adult females, skins).—Individuals dating from the months of October, November, December, January, and March do not differ appreciably in colour from average specimens of *C. b. brachyotis* (p. 618). But August individuals (ten skins) are conspicuously paler than *brachyotis* from the same season (August, five skins; July, fourteen): Back isabella largely suffused with golden tawny-olive, or even light wood-brown suffused with buffy tawny-olive; head usually darker brown than back, more approaching olive or bistre; centre of breast and belly drab or broccoli-brown, either uniform or washed with pale tawny-olive; sides of neck, foreneck, and flanks as usual varying from ochraceous (in females even buffy ochraceous) to cinnamon-rufous or light chestnut. Whether this indicates really an ordinary seasonal bleaching of the fur or is due entirely or chiefly to local influences (all the August skins of *javanicus* are from Buitenzorg) is open to question.

*Measurements.* On pp. 635, 638, 641.

*Specimens examined.* Twenty-three, as catalogued below.

*Range.* Java, generally distributed. So far known from Buitenzorg, Pangandaran, Tasikmalaja, Tjilatjap, and the island of Madura.

*Type* in collection. Skull, lambda to gnathion 30·7, rostrum, orbit to nares 7·2, mandible 22·8, c-m<sup>1</sup> (crowns) 9·8, forearm 68, third metacarpal 42, tibia 24·5 mm.

a. Ad. sk.; skull.	Java.	India Museum.	79.11.21.68.
b-g. 5 ♂ ad., 4 ♂ juv., 5 ♀ ad., 2 ♀ juv.sks.; skulls of fourteen.	Buitenzorg, 855'; 5, 6, 7, 9 Aug. 1907 ( <i>Guy C. Shortridge</i> ).	W. E. Balston, Esq. [P.].	9.1.5.68-83.
r, s. 2 ♀ ad. sks.; skulls.	Pangandaran, Dirk de Vries Bay; 18 Mar. 1908 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.84, 85.
t. ♂ ad. sk.; skull.	Tasikmalaja, 1145'; 7 Jan. 1908 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.86.
u, v. 2 ♂ ad. sks.; skulls.	Tjilatjap, sea-level; 30 Oct., 2 Dec. 1907 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.88, 93.
w. ♂ ad. sk.; skull.	Marengan, nr. Su- menep, Madura, 2'; 5 Nov. 1909 ( <i>G. C. S.</i> ).	Oldfield Thomas, Esq. [P.].	10.4.7.1.

## 2 d. *Cynopterus brachyotis insularum*, K. And.

*Cynopterus brachyotis insularum*, K. Andersen, *Ann. & Mag. N. H.* (8) vi. p. 624 (1 Dec. 1910: Kangean Is.; Mata Siri Is.).

*Differential characters.*—Like *C. b. brachyotis*, but averaging conspicuously larger. Forearm about 66·5-69·5, third metacarpal 42-46·5 mm.

The smallest specimens available of this race have the forearm,

metacarpals, and phalanges of about the same length as the largest specimens of *brachyotis*; the difference in the size of the skull and teeth of the two forms is much less conspicuous. From *C. b. javanicus* the present race differs by its larger average size and relatively longer metacarpals and phalanges. Compare the table, p. 622. Colour of fur as in *C. b. brachyotis* (p. 618).

*Measurements.* On pp. 635, 638, 641.

*Specimens examined.* Those catalogued below, and two specimens from Pulo Mata Siri in the collection of the U.S. National Museum (nos. 151891 and 151987).

*Range.* Kangean and Mata Siri Islands, Java Sea.

*Type* in collection. Skull, lambda to gnathion 30.6, rostrum, orbit to nares 7.4, mandible 23, c-m<sup>1</sup> (crowns) 10, forearm 69.5, third metacarpal 46 mm.

- a-d. 1 ♂ ad., 3 ♀ ad. Kangean I., 4'; 11, Oldfield Thomas, 10.4.6.11-14.  
 sks.; skulls. 21 Nov. 1909 Esq. [P].  
 (*Guy C. Short-*  
*ridge.*) (10.4.6.11. ♂ ad., *Type* of subspecies.)  
 e. ♂ juv. al. Kangean I. (G. C. Oldfield Thomas, 10.4.6.73.  
 S.). Esq. [P].

## 2 e. *Cynopterus brachyotis ceylonensis*, Gray.

*Cynopterus marginatus* (pt.), Dobson, Cat. Chir. B. M. p. 81.

*Cynopterus marginatus* (*nec E. Geoff.*), Layard, J. R. As. Soc. (Ceylon), ii. p. 189 (pt.) (1849: S. and C. Ceylon); Kelaart, t. c. p. 316 (pt.) (1849: Ceylon); *id.*, P. Z. S. 1850, p. 156 (pt.); Blyth, J. A. S. B. xx. p. 155 (pt.) (1851: Ceylon, Kelaart coll.); *id.*, op. c. xxi. p. 345 (pt.) (1852: Ceylon, Kelaart coll.); Dobson, Cat. Chir. B. M. p. 81, specimens *k*, *l*, *m*, *x'* (1878: Ceylon); Trouessart, Rev. & Mag. Zool. (3) vi. p. 207, n. 321 (pt.) (1879); Blanford, Faun. B. Ind., Mamm. pt. ii. p. 263 (pt.) (1891: Ceylon); Trouessart, Cat. Mamm. i. p. 85, n. 456 (pt.) (1897).

*Cynopterus brevicaudatus* (*nec Is. Geoff.*), Peters, MB. Ak. Berlin, 1867, p. 866 (pt.) (Ceylon).

*Cynopterus marginatus* var. *ceylonensis*, Gray, Cat. Monk. &c. p. 122 (1870: Ceylon).

*Cynopterus sphinx* l. *ceylonensis*, Matschie, Megachir. p. 74 (1899: Ceylon). a. *ceylonensis*, Trouessart, Cat. Mamm., Suppl. p. 61 (1904).

*Differential characters.*—Like *C. b. brachyotis*, but cranial rostrum relatively longer, p<sub>3</sub> and p<sup>3</sup> averaging slightly heavier, tooth-rows longer. See table, p. 622.

Ceylon is inhabited by two forms of *Cynopterus*, *C. sphinx sphinx* and *C. b. ceylonensis*; the former is common to the Indian Peninsula and Ceylon, the latter a local representative of an otherwise exclusively Indo-Malayan species and so closely similar to *C. b. brachyotis* (Malay Peninsula, Sumatra, Borneo, etc.) as to differ only by trivial average characters. The rostrum of *ceylonensis* is very nearly equal to, in *brachyotis* usually decidedly less than, one-fourth of the total length of the skull; the dentition, particularly the third premolars

above and below, and the mandible average a little heavier, but in all other respects there appears to be no appreciable difference between these two geographically so widely separated races. From *C. s. sphinx* (forearm 66-73.5 mm.) the present form differs by its distinctly shorter rostrum and conspicuously smaller size (forearm 59-64 mm.).

*Measurements.* On pp. 635, 638, 641.

*Specimens examined.* Seven, viz. those catalogued below and two in the Berlin Museum (Cuming collection).

*Range.* Ceylon.

*Cotypes* (♂ ad. and ♀ ad.) in collection. Measurements (those of the female in parentheses): Skull, lambda to gnathion 28 (28.7), rostrum, orbit to nares 7 (7.1), mandible 21 (21.6), c-m<sup>1</sup> (crowns) 9.7 (9.7), forearm 59 (64), ear from orifice 16 (17) mm.

a, b. ♀ ad., ♂ ad. al.; skulls.	Ceylon ( <i>Thwaites</i> ).	Purchased (H. Cuming).	{ 52.2.19.1. 58.10.19.12. ( <i>Cotypes</i> of subspecies.)
c. ♂ ad. al.; skull.	Ceylon.	Purchased (H. Cuming).	59.5.31.61.
d. Ad. skeleton (mounted).	Ceylon.	Purchased (Gerrard).	66.2.13.5.
e. ♂ juv. al.	Punduloya, Ceylon; 15 Nov. 1897.	E. E. Green, Esq. [P.].	99.6.8.1.

## 2 f. *Cynopterus brachyotis minutus*, Miller.

*Cynopterus minutus*, Miller, *Proc. Biol. Soc. Wash.* xix, p. 63 (1 May, 1906: Nias); *id.*, *Fam. & Gen. Bats*, p. 21, fig. 1 (milk dentition) (1907); Lyon & Osgood, *Cat. Types Mamm. U.S. Nat. Mus.* p. 255 (1909).

*Differential characters.*—Smallest form of the species and genus; ears relatively a little shorter than in *C. b. brachyotis*.

This form differs from typical *brachyotis* only in the characters just referred to, and, as seen from the table below, there is even in these respects no absolutely sharp line between the two forms. Colour of fur, ears, and wings (only alcoholic specimens examined) as in *brachyotis*.

	<i>brachyotis</i> .	<i>minutus</i> .	<i>brachysoma</i> .	<i>schzereri</i> .	
	65 skulls,	5 skulls,	3 skulls,	2 skulls.	
	75 specim.	5 specim.	3 specim.	3 specim.	
Skull, lambda to gnathion ...	27 -30.7	25.8-28.7	28.5-31	31.2	mm.
„ condylo-basal length ...	25.8-29.5	24.7-27.2	27 -29.8	30.5	„
„ rostrum ...	6 - 7.4	5.7- 6.7	7.2- 7.8	7.7- 7.8	„
„ across m <sup>1</sup> -m <sup>1</sup> , crowns..	7.7- 9.2	7.8- 8.9	8 - 8.3	9.2- 9.5	„
Mandible .....	20.2-22.8	19.4-21	21 -23.2	23.3-23.5	„
c-m <sup>1</sup> , crowns .....	8.8-10.4	8.8- 9.5	10 -10.8	10.4-10.7	„
Forearm ...	57 -66	54.5-59	59 -66	69.5-70.5	„
Third metacarpal .....	35.5-42.5	34.5-37.5	40 -42	45.5-46.5	„
Ear from orifice .....	15 -17	13 -15	13 -15	15 -15	„
„ breadth .....	10.5-12.5	10 -11	10.5-12	9.5-11	„
Tibia .....	21 -25.5	19 -21.5	21 -24	25.5-26.5	„

*Measurements.* On pp. 635, 638, 641.

*Specimens examined.* Five paratypes (alcoholic, skulls extracted), U.S. National Museum, 141243, '44, '47, '50, '58.

*Range.* The island of Nias, off W. Sumatra. The only other species of *Cynopterus* known from the same island are the much larger *C. major* (a local representative of *C. brachyotis angulatus*; forearm 75.5–82 mm.) and *C. princeps* (a representative of the “*Niadius*” section; forearm 84.5–89.5 mm.).

*Type*, in the U.S. National Museum, skin and skull of an adult male (Reg. no. 141240).

## 2 g. *Cynopterus brachyotis brachysoma*, Dobson.

*Cynopterus brachysoma*, Dobson, Cat. Chir. B. M. p. 85.

*Cynopterus marginatus* (pt., *nec E. Geoff.*), Blyth, Mouat's Andam. Is. p. 354 (1863: Andamans); J. Anderson, Cat. Mamm. Ind. Mus. i. p. 104, nos. 97 *w-ad* (1881: cotypes of *C. andamanensis*).

*Cynopterus brachysoma*, Dobson, Proc. A. S. B. 1871, p. 105 (read 3 May, 1871: preliminary descr.); *id.*, J. A. S. B. xl. p. 260 (read 26 June, 1871: full descr., Andaman Is.); *id.*, J. A. S. B. xlii. p. 201, pl. xiv. fig. 7 (ear) (1873); *id.*, Cat. Chir. Ind. Mus. p. 4, n. 75 (1874: type); *id.*, Mon. As. Chir. p. 27, fig. (ear), p. 190, n. 75 (1876: type, S. Andaman I.); *id.*, Cat. Chir. B. M. p. 85 (1878: type); Trouessart, Rev. & Mag. Zool. (3) vi. p. 207, n. 324 (1879); J. Anderson, Cat. Mamm. Ind. Mus. i. p. 106 (1881: type); Robin, Ann. Sci. Nat. (6), Zool. xiii. Art. 2, pl. xii. fig. 1 (interfemoral) (1882); Theobald, Mason's Burma, i. p. 425 (1882); Blanford, Faun. B. Ind., Mamm. pt. ii. p. 264 (1891); Trouessart, Cat. Mamm. i. p. 86, n. 458 (1897); Miller, Proc. U.S. Nat. Mus. xxiv. p. 787 (1902).

*Cynopterus sphinx* 6. *brachysoma*, Matschie, Megachir. p. 75 (1899). c. *brachysoma*, Trouessart, Cat. Mamm., Suppl. p. 61 (1904).

*Cynopterus marginatus* var. *andamanensis*, Dobson, Proc. A. S. B. 1873, p. 148 (preliminary note, read 2 July, 1873: nom. nud.); *id.*, J. A. S. B. xlii. p. 201, pl. xiv. fig. 5 (ear) (description, read 5 July, 1873: Andamans).

*Cynopterus andamanensis*, Dobson, Cat. Chir. Ind. Mus. p. 4, nos. 66–74 (1874: Andamans).

*Cynopterus sphinx* 5. *andamanensis*, Matschie, Megachir. p. 75 (1899). d. *andamanensis*, Trouessart, Cat. Mamm., Suppl. p. 61 (1904).

*Cynopterus marginatus* subsp. *brachyotis* (*nec brachyotis*, S. Müller), Dobson, Mon. As. Chir. p. 26, fig. (ear) (1876).

*Cynopterus brachyotis*, Dobson, Mon. As. Chir. p. 26 (pt.) c. fig. (ear: copy from J. A. S. B. xlii. pl. xiv. fig. 5), p. 190, nos. 66–74 (1876: Andamans); Theobald, Mason's Burma, i. p. 425 (1882); Blanford, Faun. B. Ind., Mamm. pt. ii. p. 264 (pt.), fig. 77 B on p. 263 (ear) (1891). *brachyotis*, Miller, Proc. U.S. Nat. Mus. xxiv. p. 787 (1902).

*Differential characters.*—In general size similar to *C. b. brachyotis*, but cranial rostrum averaging relatively longer and slenderer (length subequal to one-fourth of total length of skull) and ears smaller. See table, p. 625.

The present form accords with *C. b. ceylonensis* (p. 624) in the relative length of the rostrum, but differs by its smaller ears. In the latter character it is similar to *C. b. minutus* (p. 625), but the rostrum is relatively longer and slenderer and, as shown in the

table p. 625, both the skull and external dimensions average conspicuously larger. The three specimens examined are faded in alcohol; ears margined with white.

*Measurements.* On pp. 635, 638, 641.

*Specimens examined.* The type of *C. brachysoma* and two cotypes of *C. marginatus* var. *andamanensis*.

*Range.* The Andaman Islands.

*Type*, in the Indian Museum, Calcutta, ♀ subad. al., skull extracted, obtained in the Andamans (?S. Andaman Island) by Dr. F. Stoliczka, no. 75 of Dobson's, no. 99 a of J. Anderson's Catalogues. Skull, lambda to gnathion 28.5, rostrum, orbit to nares 7.5, mandible 21.8, c-m<sup>1</sup> (crowns) 10, forearms broken, third metacarpal 40.5, ear from orifice 14.5, tibia 21 mm. Dobson's statement that *C. brachysoma* is at once distinguished by the "presence of a rounded lobe at the base of the outer margin" of the ear is erroneous; a distinct small antitragal lobe is present in all species of *Cynopterus*.

*Cynopterus marginatus* var. *andamanensis*, Dobson; 1873.—Type locality, Andaman Islands; cotypes, nine alcoholic specimens collected by Tytler (in 1864), J. Wood-Mason (1872), and J. Homfray (1872); seven (or six) of these are in the Indian Museum, Calcutta, two in the British Museum. Measurements of the two latter (those of the adult male without, those of the subadult female within, parentheses): Skull, lambda to gnathion 31 (28.5), rostrum 7.8 (7.2), mandible 23.2 (21), c-m<sup>1</sup> (crowns) 10.8 (10), forearm 66 (59), third metacarpal 42 (40), ear from orifice 15 (13), tibia 24 (21) mm. Dobson figures the ear of this form without any trace of antitragal lobe (J. A. S. B. xlii. pl. xiv. fig. 5, 1873; Mon. As. Chir. p. 26, 1876); in both of the cotypes in collection the lobe is well-developed. *C. m.* var. *andamanensis* was by Dobson in 1876 (*l. c.*) considered identical with *C. "brachyotus."* Neither of these names occur in his British Museum Catalogue (1878).

- a. ♀ subad. al.; skull. Andamans; 1864 (*Licut.*- Calcutta Museum\* 9.4.4.2.  
Col. Tytler). [P].  
(Cotype of *C. m.* var. *andamanensis*, Dobson.)  
b. ♂ ad. al.; skull. Andamans; 1872 (*J. Wood-* Calcutta Museum† 9.4.4.1.  
Mason). [P].  
(Cotype of *C. m.* var. *andamanensis*, Dobson.)

## 2h. *Cynopterus brachyotis scherzeri*, Zelebor.

*Cynopterus scherzeri*, Dobson, Cat. Chir. B. M. p. 84.

*Cynopterus marginatus* (nec E. Geoff.), Blyth, J. A. S. B. xv. p. 368 (1846: Nicobars); *id.*, Mouat's Andam. Is. p. 354 (pt.) (1863); Peters, MB. Ak. Berlin, 1867, p. 866 (pt.).

*Pachysoma scherzeri*, Fitzinger, SB. Ak. Wien, xlii. p. 290 (1861: Nicobars, Novara Exp.) (nom. nud.); *id.*, op. cit. lx. Abth. i. p. 621 (1870).

*Cynopterus marginatus* var. (*Pachysoma scherzeri*), Zelebor, Reise 'Novara,' Südg. p. 13 (1869: Car Nicobar, descr. princeps).

\* No. 68 of Dobson's, no. 97 y of J. Anderson's Catalogues of the Calcutta collection.

† No. 72 of Dobson's, no. 97 cc of J. Anderson's Catalogues.

*Cynopterus scherzeri*, Dobson, *Proc. A. S. B.* 1872, p. 148; *id.*, *J. A. S. B.* xlii, p. 201, pl. xiv. fig. 6 (ear) (1873: Car Nicobar); *id.*, *Cat. Chir. Ind. Mus.* p. 4, nos. 64, 65 (1874: Car Nicobar); *id.*, *Mon. As. Chir.* p. 26, fig. (ear), p. 190, nos. 64, 65 (1876: same specimens); *id.*, *Cat. Chir. B. M.* p. 84 (1878: Car Nicobar); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 207, n. 322 (1879); *J. Anderson, Cat. Mamm. Ind. Mus.* i. p. 106, n. 98 (1881: Car Nicobar); *Robin, Ann. Sci. Nat.* (6), *Zool.* xii. Art. 2, p. 4 & seq. (1881: anatomy); *Theobald, Mason's Burma*, p. 425 (1882); *Blanford, Faun. B. Ind.*, *Mamm.* pt. ii. p. 264 (pt.), fig. 77 C on p. 263 (ear) (1891); *Trouessart, Cat. Mamm.* i. p. 86, n. 457 (1897); *Miller, Proc. U.S. Nat. Mus.* xxiv. p. 788 (1902: Car Nicobar, ♀ ad., 25 Jan.); *id.*, *Fam. & Gen. Bats*, p. 49 (1907).

*Cynopterus sphinx* 4. *scherzeri*, Matschie, *Megachir.* p. 75 (1899: Nicobars). c. *scherzeri*, *Trouessart, Cat. Mamm., Suppl.* p. 61 (1904). *scherzeri*, *Toldt, Ann. Nat. Hofmus. Wien*, xxiv. pp. 238, 244 (1910: hair).

*Pachysoma, Scherzer, Reise 'Novara,' Beschreib. Th.* ii. p. 71 (1865: Car Nicobar; Great Nicobar).

*Differential characters.*—Similar to *C. b. brachysoma* in the relative length of the cranial rostrum and the size of the ears, but rostrum deeper and broader, skull heavier (compare measurements across crowns of  $m^1$ - $m^1$ , p. 625), and external dimensions averaging larger.

The short and narrow ears distinguish this form from all other races of *C. brachyotis*, except *brachysoma* (Andamans) and *minutus* (Nias). From the latter it is easily discriminated by its relatively longer rostrum (subequal to, not distinctly less than, one-fourth of skull) and larger size.

*Colour* (adult skin, probably female, topotype, January, 85.8.1.106).—General colour very similar to that of adult females of *C. b. angulatus*, decidedly darker than average specimens of *C. b. brachyotis*. Back brownish bistre (*i. e.* bistre somewhat washed with a warmer tinge of brown approaching Prout's or vandyck brown); head dark bistre; breast and belly olive hair-brown; sides of neck and fore-neck raw-umber. Metacarpals and phalanges whitish brown; ears narrowly margined with white.

*Measurements.* On pp. 635, 638, 641.

*Specimens examined.* Three, viz. those catalogued below and one alcoholic specimen in the Berlin Museum (2492, "Nicobars," Parreïs, ♀ ad.).

*Range.* The Nicobar Islands; so far recorded from Car Nicobar in the north and Great Nicobar in the south.

*Cotypes* (presumably in the Vienna Hofmuseum), "mehrere alte und junge Exemplare in Weingeist, zwei Exemplare in Bälgen und ein Skelet," collected "an den unteren Blattstielen der Kokospalme," at Car Nicobar, during the 'Novara' Expedition.

a. ♀ ad al.; skull.	Car Nicobar.	Surg.-Gen. G. E. Dobson [E.].	75.11.3.1.
b. [♀] ad. sk.;	Orong, Car Nicobar;	A. O. Hume, Esq. [P.].	85.8.1.106.
skull.	16 Jan. 1873 (H. Davison).		



3. *Cynopterus major*, Miller.

? *Cynopterus marginatus* (nec E. Geoff.), Modigliani, *Ann. Mus. Civ. Genova*, (2) vii. p. 241 (1889: Nias).

? *Cynopterus scherzeri* (nec Zelebor), Havitsch, *Ann. Rep. Raffles Libr. & Mus.* 1897, p. 11 (Nias).

*Cynopterus major*, Miller, *Proc. Biol. Soc. Wash.* xix. p. 62 (1 May, 1906: Nias); *id.*, *Fam. & Gen. Bats*, p. 49 (1907); Lyon & Osgood, *Cat. Types Mamm. U.S. N. M.* p. 255 (1909).

*Differential characters.*—Surface cusp of  $p_4$  and  $m_1$  small or absent; cranial rostrum slightly less than or at most equal to one-fourth of total length of skull; general size of animal large (forearm 75.5–82 mm.), but ears relatively short (16.5–18 mm.).

The large size of this species prevents its confusion with any other forms of *Cynopterus* s. str. (excl. “*Nyctius*”) than *C. s. gangeticus* and *tithæcheilus*. The table below shows the principal differential characters of these three forms. Note in *C. s. gangeticus* the relatively longer rostrum (a little more than one-fourth of total length of skull), the large ears; in *C. s. tithæcheilus* the large skull and large external dimensions, relatively shorter rostrum, large ears; in *C. major* the large external dimensions (forearm equal to that of *tithæcheilus*), but smaller skull, shorter ears, shorter tibiae.

	<i>s. gangeticus.</i>	<i>s. tithæcheilus.</i>	<i>major.</i>
	3 skulls,	15 skulls,	6 skulls.
	3 specim.	17 specim.	12 specim.
Skull, lambda to gnathion .....	33–36	35.5–38.5	34–35.8 mm.
„ condylo-basal length.....	32–34.6	34.2–37	32.7–34.5 „
„ rostrum.....	9–9.3	8.6–9.6	8–8.5 „
Mandible .....	25.5–27.8	27.8–30	26.5–27 „
c-m <sup>1</sup> , crowns .....	11.8–12.3	12.2–13	11.7–12.4 „
Forearm .....	73–78	74.5–83	75.5–82 „
Third metacarpal .....	46–51.5	47.5–53	47–51.5 „
Ear from orifice .....	20	18–20.5	16.5–18 „
Tibia .....	28.5–31	29–33	25.5–29 „

*Colour.*—Similar to that of *C. s. tithæcheilus* (p. 606), though with a distinct tendency of the colour of the back to shade into paler or darker russet rather than into raw-umber. Sexual colour difference as in *tithæcheilus*. Metacarpals and phalanges pale brownish or brownish white, not so sharply marked off against the dark membranes as usually in *C. b. angulatus*; ears narrowly margined with white (in some alcoholic specimens, e. g. 141263 and '64, in all the other specimens examined there is scarcely any trace of white ear-edgings).

*Measurements.* On pp. 636, 639, 642.

*Specimens examined.* Twelve paratypes (four skins) of the species (eight adult males, one subadult male, three adult females; skulls of six), U.S. National Museum, nos. 141234, '37–'39, '52, '54, '61, '63, '64, '72, '77, '78.

*Range.* Apparently confined to the island of Nias, off W. Sumatra.

*Type*, skin and skull of an adult male, U.S. National Museum, no. 141236.

*Remarks*.—This species appears to be a Nias representative of *C. brachyotis angulatus* (Assam to Sumatra), from which it differs only by its markedly larger size; but the difference in this respect is sufficiently well marked to allow *major* to stand as a distinct species. The large size of *C. major* might easily suggest the idea that it is more closely allied to *C. sphinx titthacheilus*, but the size is in reality the only character in which it approaches *titthacheilus*; the ears are perfectly similar to those of *brachyotis*, not nearly as large as in all known forms of the *sphinx* type.

#### 4. *Cynopterus horsfieldi*, Gray.

*Cynopterus marginatus* (pt.), Dobson, Cat. Chir. B. M. p. 81.

(Synonyms under the subspecies.)

*Differential characters*.—A well-developed surface cusp always present in  $p_1$  and  $m_1$ ; cheek-teeth broad, subrectangular in outline; forearm 64.5–77.5 mm.

Premolars and molars broader than in the foregoing species, a character conspicuous in all cheek-teeth, though more so in  $p^3$ ,  $p^1$ ,  $p_3$ , and  $p_4$  than in  $m^1$  and  $m_1$ ;  $p^1$ ,  $p_4$ , and  $m_1$  quite or nearly as broad anteriorly and posteriorly as at middle, outline of those teeth therefore subrectangular or subsquarish, not oval (see fig. 49, p. 589, dentition of *C. princeps*). Surface elevation of  $p_4$  and  $m_1$  usually conical, sometimes taking the shape of a short sharply defined longitudinal ridge. Cranial rostrum short, deep, and broad, less than one-fourth of total length of skull (as short as, or rather still a little shorter than, in the shortest-nosed of the foregoing forms). As consequences of the heavier dentition, zygomatic arches unusually flaring, coronoid process somewhat broader and more steeply ascending, angular process more prominent. External characters not peculiar (for an average difference in the colour of adult males see below).

*Colour*.—As in average specimens of *C. b. brachyotis*, but adult males usually distinguishable by the more saturated colour of the sides of the neck, foreneck, and sides of the breast.

Adult males (*C. h. horsfieldi*, four skins, November and December): Back brown lightened with russet or cinnamon or a tinge between cinnamon and wood-brown; head darker, more uniform olive. Breast and belly paler or darker drab or broccoli-brown, usually with a delicate touch of light tawny-olive or isabella. Sides of neck, foreneck, and sides of breast deep hazel or cinnamon-rufous, inclining to burnt sienna or chestnut, contrasting with colour of breast and belly. Ears broadly margined with white; metacarpals and phalanges brownish white.

Adult females (*C. h. horsfieldi*, four skins, November, December, January): Differing from males chiefly in the much paler colour of the sides of the neck, foreneck, and sides of breast. Back varying

from a nearly uniform brownish olive (darkest extreme), through the same colour conspicuously lightened with russet, to nearly uniform cinnamon wood-brown; head similar to back or darker. Breast and belly as in males. Sides of neck and foreneck varying from tawny-olive, through tawny, to nearly hazel; sides of breast scarcely differing from centre of breast.

Immature individuals (November): Uniform brownish slate or bistre above; underparts drab or drab-grey.

*Range.* Java (*C. h. horsfieldi*) and Sumatra (*C. h. minor*). The two races differ only in average size, that named "*minor*" being the larger.

#### 4 a. *Cynopterus horsfieldi horsfieldi*, Gray.

*Cynopterus horsfieldi*, Gray, *List Mamm. B. M.* p. 38, specimens *a, d* (1843: Java); *id.*, *Zool. 'Samarang,' Vert.* p. 12 (1849); *Horsfield, Cat. Mamm. Mus. E. Ind. Co.* p. 30 (1851); *Cooke, J. Quekett Micr. Cl. i.* pp. 8, 56, pl. i. figs. 6, 7 (1868-69; structure of hairs); *Thomas & Wroughton, P. Z. S.* 1909, p. 376 (pt.) (1909: Tasikmalaja; Tjilatjap; Kaliputjang).

*Pachysoma horsfieldi*, Fützing, *SB. Ak. Wien*, lx. Abth. i. p. 627 (1870).

*Cynopterus marginatus* var. *horsfieldi*, Gray, *Cat. Monk. Sc.* p. 123 (1870: Java).

*Cynopterus sphinx* 9. *horsfieldi*, Matschie, *Megachir.* p. 76 (pt.) (1899). *h. horsfieldi*, Trouessart, *Cat. Mamm., Suppl.* p. 62 (pt.) (1904).

*Cynopterus marginatus* (nec *E. Geoff.*), Blyth, *J. A. S. B.* xxi. p. 345 (pt.) (1852); *Peters, MB. Ak. Berlin*, 1867, p. 866 (pt.); *Dobson, Cat. Chir. B. M.* p. 81, specimens *x, y* (1878: cotypes); *Jentink, Cat. Ost. Mamm.* p. 264, skeletons *b, e* (1887: Buitenzorg); *id.*, *Cat. Syst. Mamm.* p. 153, specimens *g, r* (1888: Tjikao; "Java"); *Trouessart, Cat. Mamm.* i. p. 85, n. 456 (pt.) (1897).

*Pteropus* [*Pachysoma*] *marginatus*, Wagner, *Schreber's Säug., Suppl.* v. p. 609 (pt.) (1853-55).

*Differential characters.*—Averaging larger than *C. h. minor*. The following table shows the differences in size of the four forms of the "*Niadius*" section:—

	<i>h. horsfieldi.</i>	<i>h. minor.</i>	<i>harpax.</i>	<i>princeps.</i>
	16 skulls,	3 skulls,	Type.	3 skulls,
	15 specim.	3 specim.		3 specim.
Skull, lambda to gnathion.	30.5-33.3	33.5-35.8	?	38.2-39.3 mm.
Rostrum .....	6.2- 7.3	7 - 7.8	6.8	8.7- 9.2 "
Zygomatic breadth .....	20.8-22.2	22.7-23.8	?	5.3- ? "
Mandible .....	23 -25.3	25.5-26.8	?	28.8-30.5 "
e-m <sup>1</sup> , crowns .....	10.5-11.5	11 -12	11.2	13.2-13.5 "
m <sup>1</sup> , length .....	2.3- 2.7	2.6- 2.8	2.6	3 - 3.1 "
Forearm ..	64.5-71	71.5-77.5	72	81.5-89.5 "
Third metacarpal .....	42 -46	47 -51.5	46.5	55.5-57 "
Ear from orifice .....	17 -18	18	?	18 -18 "

*Measurements.* On pp. 636, 639, 642.

*Specimens examined.* Twenty-five, in the collections of the Leyden (four) and British Museums.

*Range.* Java, probably generally distributed (for localities see list of specimens below).

*Cotypes* (two) in collection. Skull, lambda to gnathion 32.7 and —, rostrum 6.8 and 6.7, zygomatic breadth — and 21.8, mandible 25.3 and 23.2, c-m<sup>1</sup> (crowns) 10.7 and 10.7, forearms incomplete, third metacarpal 45 and —.

<i>a.</i> Ad. sk.; skull.			?
<i>b, c.</i> [♂] ad., [♀] ad. sks.; skulls.	Java ( <i>Dr. Th. Horsfield</i> ).	Hon. East India Company [P.].	<i>d.</i>
		( <i>Cotypes</i> of species)	
<i>d.</i> ♀ ad. al.; no skull.	W. Java ( <i>Guy C. Shortridge</i> ).	W. E. Balston, Esq. [P.].	9.1.5.895.
<i>e.</i> ♀ ad. sk.; skull.	Tasikmalaja, 1145'; 28 Jan. 1908 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.87.
<i>f-n.</i> 4 ♂ ad., 1 ♂ juv., 3 ♀ ad., 1 ♀ imm. sks.; skulls.	Tjilatjap, sea-level; 11, 13, 26, 29, 30 Nov., 11, 18 Dec. 1908 ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.89-92, 94-98.
<i>o-t.</i> 1 ♂ ad., 3 ♀ ad., 2 ♀ imm. al.; skulls of	Tjilatjap, sea-level ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.888-893.
888-891.			
<i>u.</i> ♀ ad. al.; skull.	Kaliputjang, Tji-Tandui ( <i>G. C. S.</i> ).	W. E. Balston, Esq. [P.].	9.1.5.894.

#### 4 *b.* *Cynopterus horsfieldi minor*, *Lyon*.

*Cynopterus marginatus* (*nec E. Geoff.*), *Jentink, Cat. Ost. Mamm.* p. 264 (pt.) (1887: Sumatra); *id.*, *Cat. Syst. Mamm.* p. 153 (pt.) (1888: Priaman).

*Niadas* [*sic*] *minor*, *Lyon, Proc. U.S. Nat. Mus.* xxxiv. p. 665 (14 Sept. 1908: confluence of Gasip and Siak R., E. Sumatra).

*Differential characters.*—Similar to *C. h. horsfieldi* in all respects except its conspicuously larger average size (see table, p. 631).

*Measurements.* On pp. 636, 639, 642.

*Specimens examined.* Six (three in the Leyden Museum) and photographs of skull and dentition of type.

*Range.* Sumatra, probably generally distributed; so far recorded from Padang (Priaman and Pajo) and E. Sumatra (Siak River).

*Type*, in the U.S. National Museum, a nearly adult male in alcohol (skull 32.3, forearm 72 mm.), Reg. no. 144264.

<i>a.</i> ♂ ad. sk.; skull.	Pajo, Padang.	Herr Carl Bock [C.].	79.6.28.1.
<i>b, c.</i> ♂ ad., ♂ imm. al.; skulls.	Pajo.	Herr Carl Bock [C.].	79.7.2.1, 5.

# 5. *Cynopterus harpax*, Thos. & Wrought.

*Cynopterus* (*Niadius*) *harpax*, Thomas & Wroughton, *Ann. & Mag. N. H.* (8) iii. p. 439 (1 May, 1909: Semangko Pass); *id.*, *J. Fed. Mal. St. Mus.* iv. p. 108 (Dec. 1909).

*Differential characters.*—Similar to *C. h. minor*, but  $p_3$ ,  $p_1$ , and  $m_1$  considerably narrower posteriorly than anteriorly (not subquarish or subrectangular as in *C. horsfieldi*), a character most conspicuous in  $p_3$  and  $p_1$ , less so in  $m_1$ ; also  $p^3$  and  $p^4$  are distinctly less broadened posteriorly than in the related species. Colour of fur as in the other species of the "*Niadius*" section. Size as *C. h. minor* (see table, p. 631).

*Measurements.* On pp. 636, 639, 642.

*Specimens examined.* The type, in collection. [Four topotypes are in the Selangor Museum.]

*Range.* Malay Peninsula: known only from the Semangko Pass (3000 feet), Selangor-Pahang boundary.

a. ♂ subad. sk.:	Semangko Pass, Selangor-Pahang boundary, 3000';	Selangor Museum	8.7.20.7.
skull.	30 Jan. 1908.	[P.]	
		(Type of species.)	

# 6. *Cynopterus princeps*, Miller.

*Cynopterus princeps*, Miller, *Proc. Biol. Soc. Wash.* xix. p. 61 (1 May, 1906: Mojeja R., Nias); Lyon & Osgood, *Cat. Types Mamm. U.S. Nat. Mus.* p. 256 (1909).

*Niadius princeps*, Miller, *Proc. Biol. Soc. Wash.* xix. p. 83 (1906); *id.*, *Fam. & Gen. Bats*, p. 50, pl. vii. fig. 3, pl. viii. fig. 3 (teeth) (1907).

*Differential characters.*—Similar in all respects to *C. horsfieldi*, except in size, being much larger throughout (see table, p. 631); forearm 84.5–89.5 mm.

Characters of teeth and colour of fur as in *C. horsfieldi*; metacarpals and phalanges pale brownish or whitish brown: ears narrowly margined with white (in specimen 141274; in the second specimen examined and, according to Miller, in the type the ears are unmarked, no doubt owing solely to post-mortem disappearance of the white colour).

*Measurements.* On pp. 636, 639, 642.

*Specimens examined.* Two paratypes (♂ ad., ♀ ad. al., with skulls), U.S. National Museum, 141274, 75.

*Range.* The island of Nias, off W. Sumatra.

*Type*, in the U.S. National Museum, skin and skull of an adult female (no. 141235). Measurements, according to Miller: Skull, greatest length 38.2, zygomatic breadth 25.4, mandible 28.8, c-m<sup>1</sup> (alveoli) 12.2, forearm 84.4 mm. The two paratypes are slightly larger.



## Cynopterus: External measurements (II.).

	<i>C. b. javanicus.</i> 17 ad.		<i>C. b. insularum.</i> 6 ad.		<i>C. b. ceylouensis.</i> 6 ad.		<i>C. b. minutus.</i> 5 ad. paratypes.		<i>C. b. brachysoma.</i> 3 ad.		<i>C. b. scherzeri.</i> 3 ad.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Forearm .....	61.5	68	66.5	69.5	59	64	54.5	59	69.5	70.5	69.5	70.5
Pollex, total length, c. u. ....	22	25	23	27.5	23	25	20	23.5	27	28	27	28
" metacarpal .....	7	8.5	7.5	8.5	6.5	7.5	6.5	7	8	9	8	9
" 1st phalanx .....	12	13.5	12	14.5	12	13	10.5	12.5	13	15	13	15
2nd digit, metacarpal .....	25.5	29.5	28.5	33.5	23	25	22	25.5	27.5	31	29	31
" 1st phalanx .....	7	9	7.5	9.5	6.5	8	6.5	7.5	8.5	9	8.5	9
" 2nd-3rd phalanx, c. u. ....	7	8.5	7.5	8.5	6.5	8.5	6	7.5	7	8	7.5	8
3rd digit, metacarpal .....	38	42	42	46.5	37	41	34.5	37.5	40	42	45.5	46.5
" 1st phalanx .....	27	29.5	29.5	32	24.5	28	23	24.5	27	28	31.5	33
" 2nd phalanx .....	35	38	40	43.5	36.5	38	30	33	37	40	41	42
4th digit, metacarpal .....	36	40	39.5	43	35	38.5	32	35	37	38.5	41	42
" 1st phalanx .....	19	22.5	21	24	18.5	21	16.5	19	20.5	21.5	23.5	25
" 2nd phalanx .....	22.5	26	25.5	28	22	24	19	22	23	24.5	27	28.5
5th digit, metacarpal .....	38	42	41.5	45.5	36	39.5	34.5	36	38.5	40.5	42.5	44.5
" 1st phalanx .....	18.5	21	20.5	22.5	17.5	19	15	18	18	19.5	22	23
" 2nd phalanx .....	19	23	23	25	19.5	21.5	17	20	20.5	22.5	23	24
Ear, length from orifice .....	...	...	16.5	17	16	17	13	15	15	15	15	15
" greatest breadth, flattened .....	...	...	12	12.5	11.5	12.5	10	11	10.5	11	9.5	11
Anterior canthus to tip of muzzle .....	...	...	11.5	10	10	10	8	9.5	10.5	11	11.5	10.5
Posterior canthus to base of ear .....	...	...	12	9.5	9.5	10	9	10	10	10	10.5	11.5
Tail .....	...	...	14	10.5	7.5	10.5	7	9	6	9	11	11.5
Tibia .....	...	...	25.5	21	23	19	21.5	21	24	25.5	25.5	26.5
Foot, c. u. ....	14	16.5	16	16	12.5	14	11	12.5	13	13.5	15	17
Calc. ....	...	...	7.5	6	6	6.5	4	6	4.5	5.5	6.5	7

## Cynopterus: External measurements (III.).

	<i>C. major</i> , 12 ad. paratypes.		<i>C. h. horsfieldi</i> , 15 ad.		<i>C. h. minor</i> , 3 ad.		<i>C. harpax</i> , Type.		<i>C. princeps</i> , 2 ad. paratypes.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	mm.		MIN.	MAX.
Forearm .....	75.5	82	64.5	71	71.5	77.5	72		mm.	mm.
Pollex, total length, c. u. ....	58.5	32	24	27.5	27.5	29.5	26.5		87*	89.5
" metacarpal .....	9	10	7.5	8.5	8.5	8.5	8		34.5	35
" 1st phalanx.....	14	17	12	14.5	14.5	15.5	13.5		11.5	11.1
2nd digit, metacarpal .....	30	34.5	28	31	31	34.5	29.5		17	18
" 1st phalanx .....	8	10	7.5	9.5	8	8	8		37	38.5
" 2nd-3rd phalanx, c. u. ....	8	10	7.5	9	8.5	8.5	8		10.5	11
3rd digit, metacarpal .....	47	51.5	42	46	47	51.5	46.5		9.5	10
" 1st phalanx .....	32	35	27.5	30.5	31.5	33.5	31		55.5	57
" 2nd phalanx .....	42.5	46	38	43	42	45	40		37.5	39.5
4th digit, metacarpal .....	44.5	48.5	39	42	44	48	43.5		47	50.5
" 1st phalanx .....	24.5	26.5	21	23	24.5	26.5	24		52.5	53.5
" 2nd phalanx .....	27.5	31	23	26.5	24.5	26.5	26		28.5	29.5
5th digit, metacarpal .....	46	51	41	44	45.5	50.5	...		31	32
" 1st phalanx .....	22.5	24.5	19.5	22	23.5	24.5	...		55.5	57
" 2nd phalanx .....	25	27.5	20.5	23.5	24	24	22.5		27	27
Ear, length from orifice .....	16.5	18	17	18	...	18	...		27	28
" greatest breadth, flattened .....	12	13	11.5	13	...	13	...		18	18
Anterior canthus to tip of muzzle .....	11.5	12	11	12	...	...	...		13	13
Posterior canthus to base of ear .....	11	12	12	13	...	...	...		...	...
Tail .....	12.5	15	8.5	10	...	11.5	...		...	13
Tibia .....	25.5	29	21	24.5	...	26	...		11.5	31.5
Foot, c. u. ....	17.5	19	14.5	17	...	...	16.5		19.5	20.5
Calcaneus .....	6	7.5	6	6.5	...	6	...		6.5	7.5

\* Forearm of type of *C. princeps*, according to Miller, 84.4 mm.



## Cynopterus: Measurements of skulls and tooth-rows (I.).

	<i>C. s. sphinx</i> , 17 ad.		<i>C. s. gangeticus</i> , 3 ad.		<i>C. s. tilthæchilus</i> , 15 ad.		<i>C. b. angulatus</i> , 34 ad.		<i>C. b. brachyotis</i> , 65 ad.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Skull, lambda to gnathion .....	31.5	34.5	33	36	35.5	38.5	30.5	33.2	27	30.7
" condylo-basal length .....	30.5	33.6	32	34.6	34.2	37	29.5	32	25.8	29.5
" palation to incisive foramina .....	14.7	16	15.5	17	16	17.7	13.3	14.8	11.2	13.7
" palation to basion .....	11.8	13.2	11.7	13.7	12.8	14.2	11	12.8	10	12.7
" rostrum, orbit to nares .....	8	9.1	9	9.3	8.6	9.6	6.5	8.2	6	7.4
" width of brain-case at zygomatica .....	13.8	15	...	15.5	14.2	15.8	13.2	14.2	12	13.6
" zygomatic width .....	20	22.8	...	...	22.8	24.5	19.8	21.8	17.8	20
" across crowns of m <sup>1</sup> , externally .....	9.5	11	...	10.8	9.8	10.8	8.5	9.9	7.7	9.2
" lachrymal width .....	6.7	8	7.3	7.8	7.8	9	6.2	7.6	7.8	9.2
" across crowns of canines, externally .....	6	7	...	6.8	5.8	6.7	5.8	7.5	5.6	7
" postorbital width .....	6.2	7.4	6.8	7.7	6	7	5.7	7.2	5.5	7.2
" interorbital width .....	4.6	5	4.7	5	4.5	5.2	3.8	5	3.7	4.7
" mesopterygoid fossa, width .....	5.8	6.8	...	7	6.8	7.7	5.6	6.6	4.8	5.8
" between p <sup>1</sup> -p <sup>4</sup> .....	3	4	3.4	3.8	3.2	4.6	2.8	3.8	2.7	3.8
" between bases of canines .....	8	8.7	8.2	8.5	8.7	9.2	7.6	8.7	7	8
" orbital diameter .....	24.5	27.2	25.5	27.8	27.8	30	22.8	25.5	20.2	22.8
" coronoid height .....	12	14.2	13.5	14	13.8	16.8	11.2	13.3	10	12.5
Upper teeth, c-m <sup>1</sup> , crowns .....	10.8	12.2	11.8	12.3	12.2	13	10.2	11.3	8.8	10.4
Lower teeth, c-m <sup>2</sup> , crowns .....	11.9	13.6	12.8	13.8	13.5	14.5	11.1	12.8	9.7	11.5

## Cynopterus: Measurements of skulls and tooth-rows (II.).

	<i>C. b. javanicus</i> , 16 ad.		<i>C. b. insularum</i> , 6 ad.		<i>C. b. ceylonensis</i> , 4 ad.		<i>C. b. minutus</i> , 5 ad. paratypes.		<i>C. b. brachysoma</i> , 3 ad.		<i>C. b. scherzeri</i> , 2 ad.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Skull, lambda to gnathion .....	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
condylo-basal length .....	28.3	30.8	29.5	31.2	28	30.8	25.8	28.7	31	31.2	...	31.2
" palation to incisive foramina .....	27	29.2	28	29.6	27	29.8	24.7	27.2	28.5	29.8	...	30.5
" palation to basion .....	12	13.8	13	13.8	12.7	14.2	11.2	...	13	14.5	...	14
" rostrum, orbit to nares .....	10.7	11.8	11	11.8	10.5	11.2	9.7	9.8	10.5	10.8	...	11.8
" width of brain-case at zygomatica ..	12.2	13.5	13.2	13.8	12.5	14	11	12.2	11.7	13.6	...	13
" zygomatic width .....	18.2	20.3	19.2	20	18	20.2	16	18	16.7	18.6	...	19.5
" across crowns of m <sup>1</sup> , externally ..	8.5	9.7	8.8	9.5	8	9.5	7.8	8.9	8	8.3	...	9.5
" lachrymal width .....	8.5	9.5	8.8	9.2	7.8	9	7.5	8.7	8	9	...	9.5
" across crowns of canines, externally	6	7	6.4	7	6.1	6.8	5.6	6.2	5.7	6.8	...	7
" postorbital width .....	6	6.7	6.2	7	5.7	7	6	7.1	5.8	6.7	...	6.7
" mesopterygoid fossa, width .....	5.5	6.7	6	7	5.7	6.7	4.8	6.2	5.8	6.5	...	7
" between p <sup>1</sup> -p <sup>4</sup> .....	3.8	4.7	4	4.5	3.8	4.3	3.8	4	3.5	4.2	...	4
" between bases of canines .....	5.2	6.2	5.2	5.8	4.9	6	4.8	6	4.6	5	...	5.8
" orbital diameter .....	3	3.7	3	3.3	2.8	3.2	2.6	3	2.6	3.7	...	3
" orbital diameter .....	7.2	8	7.5	7.8	7.2	8	7.2	7.8	6.7	7.3	...	7.5
Mandible, length from condyle .....	21.5	23	22	23.5	21	24	19.4	21	21	23.2	...	23.5
" coronoid height .....	10.2	12	11.6	12.3	10.5	11.8	9.7	10.8	11.2	12	...	12.5
Upper teeth, c-m <sup>1</sup> , crowns .....	9.5	10.5	9.8	10.6	9.7	11	8.8	9.5	10	10.8	...	10.7
Lower teeth, c-m <sub>2</sub> , crowns .....	10	11.2	11.2	11.7	10.7	11.8	9.7	10.5	10.7	11.7	...	11.5

## Cynopterus: Measurements of skulls and tooth-rows (III.).

	<i>C. major</i> 6 ad. paratypes.		<i>C. h. horsfieldi</i> 16 ad.		<i>C. h. minor</i> 3 ad.		<i>C. harpax</i> Type.	<i>C. princeps</i> 2 ad. paratypes.	
	Min.	Max.	Min.	Max.	Min.	Max.		Min.	Max.
Skull, lambda to gnathion .....	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
" condylo-basal length .....	34	35.8	30.5	33.3	33.5	35.8	...	38.5	39.3
" palation to incisive foramina .....	32.7	34.5	29.5	31.5	31.8	34	...	36.2	37.2
" palation to basion .....	14.7	15.8	13.5	14.8	15.3	...	15.2	17	18
" rostrum, orbit to nares .....	13	13.7	11.5	12.6	12	13	...	14.1	14.2
" width of brain-case at zygomatica .....	8	8.5	6.2	7.3	7	7.8	6.8	8.7	9.2
" zygomatic width .....	14	15.5	12.7	14	15	15.5	...	15.8	16
" across crowns of m <sup>1</sup> , externally .....	22.8	24.2	20.8	22.2	22.7	23.8	...	25.3	...
" lacrymal width .....	9.8	10.8	9.1	10.5	10	10.8	11	11.7	12
" across crowns of canines, externally .....	10	10.2	8.5	9.8	9.5	11	10.2	10.8	...
" postorbital width .....	7.6	8	5.8	7.5	7.5	7.8	...	8.2	8.7
" interorbital width .....	6.8	6.8	5.2	6.2	5.8	6.5	5.7	6	6.5
" mesopterygoid fossa, width .....	6.8	7.5	5.6	6.7	5.6	6.8	5.8	7	...
" between p <sup>1</sup> -p <sup>4</sup> .....	4.5	5	3.8	4.2	4.2	4.8	4.5	4.8	5
" between bases of canines .....	6.2	6.8	5.2	6.5	6.2	6.8	...	7.1	7.5
" orbital diameter .....	3.6	3.8	3	3.8	3.5	3.8	...	3.5	3.7
" Mandible, length from condyle .....	8.2	8.7	7.8	8.7	8.7	9	9.5	9	9.5
" " coronoid height .....	26.5	27	23	25.3	25.5	26.8	...	29	30.5
" " coronoid height .....	14	14.5	12	13.2	13.7	14.5	...	16.8	16.8
Upper teeth, c-m <sup>1</sup> , crowns .....	11.7	12.4	10.5	11.5	11	12	11.2	13.2	13.5
Lower teeth, c-m <sub>2</sub> , crowns .....	12.7	13.5	11.7	12.4	12.4	13.3	...	14.4	14.8

## Cynopterus: Measurements of teeth (L.).

	<i>C. s. sphinx</i> , 21 skulls.		<i>C. s. gangeticus</i> , 3 skulls.		<i>C. s. titthaechilus</i> , 24 skulls.		<i>C. h. angulatus</i> , 49 skulls.		<i>C. h. brachyotis</i> , 64 skulls.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
p <sup>3</sup> , length .....	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
" width .....	2.2	2.8	2.5	2.8	2.6	2.8	2	2.7	1.8	2.4
p <sup>4</sup> , length .....	1.5	1.9	1.6	1.8	1.9	2.1	1.7	1.9	1.5	1.8
" width .....	2.2	2.7	2.5	2.7	2.5	2.9	2	2.6	1.8	2.5
m <sup>1</sup> , length .....	1.5	2	1.6	1.8	1.8	2	1.7	2	1.5	1.8
" width .....	2.2	2.9	2.3	...	2.6	2.9	2.1	2.6	1.8	2.2
p <sub>1</sub> , length .....	1.5	1.9	1.6	...	1.8	2	1.4	1.8	1.1	1.6
" width .....	0.9	1.5	1.1	1.2	0.9	1.2	0.9	1.2	0.8	1.1
p <sub>2</sub> , length .....	1	1.6	1.3	1.3	1.3	1.7	1.1	1.6	1	1.3
" width .....	2.1	2.7	2.2	2.5	2.5	2.8	2	2.6	1.8	2.2
p <sub>3</sub> , length .....	1.5	1.8	1.6	1.7	1.8	2.1	1.5	1.8	1.2	1.7
" width .....	2.1	2.8	2.5	2.5	2.6	2.9	2.1	2.6	1.9	2.5
m <sub>1</sub> , length .....	1.6	2	1.7	1.8	1.9	2	1.6	1.9	1.4	1.8
" width .....	2.2	2.8	2.5	2.6	2.6	2.9	2.1	2.7	1.9	2.5
m <sub>2</sub> , length .....	1.5	1.8	1.5	1.7	1.8	2	1.5	1.8	1.2	1.7
" width .....	1.4	1.8	1.5	1.5	1.5	2	1.2	1.7	1	1.3
" width .....	1	1.3	1	1.2	1.2	1.5	0.8	1.2	0.7	1.1

## Cynopterus: Measurements of teeth (II.).

	<i>C. b. javanicus</i> , 20 skulls.		<i>C. b. insularum</i> , 6 skulls.		<i>C. b. ceylonensis</i> , 4 skulls.		<i>C. b. minutus</i> , 6 paratypes.		<i>C. b. brachysoma</i> , 3 skulls.		<i>C. b. scherzeri</i> , 2 skulls.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
$p^3$ , length ..	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
" width ..	2	2.3	2.1	2.5	2.1	2.5	1.8	2.1	2.1	2.2	2.2	2.6
$p^4$ , length ..	1.5	1.8	1.6	1.8	1.6	1.7	1.5	1.6	2.1	2.2	1.7	1.8
" width ..	2	2.2	2.2	2.5	2	2.3	1.9	2.1	2.1	2.2	2.1	2.3
$m^1$ , length ..	1.5	1.8	1.7	1.8	1.6	1.7	1.5	1.6	1.6	1.8	1.8	1.8
" width ..	1.9	2.2	2	2.3	2	2.2	1.9	2.1	2.2	2.5	2.3	2.5
$m^2$ , length ..	1.4	1.7	1.5	1.7	1.3	1.5	1.3	1.5	1.4	1.6	1.7	1.7
" width ..	0.8	1	1	1	1	1.1	0.8	1	1.1	1.1	1	1
$p_1$ , length ..	0.9	1.2	1.2	1.2	1.1	1.2	1	1.1	1.1	1.2	1.2	1.3
" width ..	1.8	2.1	2.1	2.2	1.9	2.5	1.8	2	2	2.2	2.2	2.3
$p_2$ , length ..	1.5	1.8	1.5	1.7	1.6	1.7	1.5	1.6	1.5	1.7	1.5	1.7
" width ..	2	2.3	2.2	2.5	2.1	2.6	2	2.1	2.3	2.5	2.4	2.5
$p_3$ , length ..	1.5	1.8	1.7	1.8	1.7	1.8	1.5	1.6	1.6	1.7	1.7	1.8
" width ..	2	2.3	2.3	2.6	2.1	2.3	2	2.1	2.2	2.5	2.5	2.5
$m_1$ , length ..	1.3	1.7	1.6	1.7	1.5	1.5	1.4	1.5	1.4	1.5	1.6	1.7
" width ..	1	1.5	1.2	1.5	1.1	1.3	1.2	1.3	1.3	1.6	1.3	1.4
$m_2$ , length ..	0.8	1.1	1	1.1	0.8	1.1	0.8	1	1	1	1.1	1.1
" width ..												

## Cynopterus: Measurements of teeth (III.).

	<i>C. major</i> , 6 paratypes.		<i>C. h. horsfieldi</i> , 15 skulls.		<i>C. h. minor</i> , 3 skulls.		<i>C. harpar</i> , Type.	<i>C. princeps</i> , 2 paratypes.	
	Min.	Max.	Min.	Max.	Min.	Max.		Min.	Max.
p <sup>3</sup> , length .....	2.6	2.8	2.2	2.7	2.5	2.6	mm.	2.8	mm.
" width .....	1.8	2	1.7	2	1.8	2	2.5	3	3
p <sup>4</sup> , length .....	2.6	2.7	2.2	2.7	2.5	2.6	1.8	2.2	2.3
" width .....	1.9	2	1.8	2	1.9	2	2.2	2.8	3
m <sup>1</sup> , length .....	2.4	2.7	2.3	2.7	2.6	2.8	2	2.2	2.3
" width .....	1.7	1.8	1.6	1.9	1.8	1.9	2.6	3	3.1
p <sup>1</sup> , length .....	1	1.1	0.7	1.1	1	1.2	2	2	2.2
" width .....	1.2	1.6	1.1	1.7	1.7	1.7	...	1.2	1.2
p <sup>3</sup> , length .....	2.2	2.6	2	2.5	2.2	2.3	2.3	1.7	1.8
" width .....	1.8	1.8	1.7	2	1.8	2	1.8	2.5	2.8
p <sup>4</sup> , length .....	2.7	2.8	2.2	2.7	2.5	2.7	2.6	2.3	2.3
" width .....	1.9	2	1.8	2	1.8	2	2	2.8	3
m <sub>1</sub> , length .....	2.7	2.8	2.5	2.8	2.7	2.8	2.8	2.3	2.3
" width .....	1.7	1.8	1.7	2	1.8	1.8	1.9	2.9	3
m <sub>2</sub> , length .....	1.5	1.7	1.6	1.9	1.6	1.8	1.5	2.1	2.2
" width .....	1	1.1	1	1.6	1.2	1.4	1.2	1.8	1.7

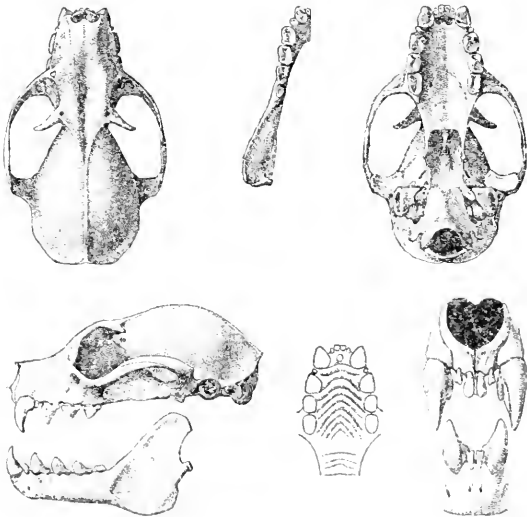
19. PTENOCHIRUS, *Pet.**Cynopterus* (pt.), Dobson, Cat. Chir. B. M. p. 80.

Type.

1861. *Ptenochirus*, *Peters, MB. Ak. Berlin*, 1861 (25 July),  
p. 707 ..... Pt. jagori.

*Ptenochirus*, *Peters, l. s. c.* (1861: subg. of *Pachysoma*); *id.*, *MB. Ak. Berlin*, 1865, p. 256 (subg. of *Cynopterus*); *id.*, *op. c.* 1867, p. 867 (genus); *Dobson, Mon. As. Chir.* pp. 23, 28 (1876: subg. of *Cynopterus*); *id.*, *Cat. Chir. B. M.* pp. 81, 87 (1878: subg. of *Cynopterus*); *id.*, *Ann. & Mag. N. H.* (5) vi. p. 164 (pt.) (1880: subg. of *Cynopterus* = *Ptenochirus* + *Penthetor*); *Matschie, Megachir.* p. 77 (pt.) (1899: genus divided into two subgenera, *Ptenochirus* (= *Ptenochirus* + *Penthetor*) and *Megarops*); *Miller, Fam. & Gen. Bats*, p. 51 (pt.) (1907: genus = *Ptenochirus* + *Penthetor*).

*Differential characters.*—Like *Cynopterus*, but with only one pair of lower incisors (i<sub>1</sub> absent), with the outer upper incisor (i<sup>2</sup>) considerably reduced, and with a distinct vertical groove on the antero-medial surface of the upper canines. Forearm about 80–87 mm. [One species. *Hab.* The Philippine Islands.]



TERZI~

Fig. 51.—*Ptenochirus jagori*, ♂, type of species. ♀, with front view ♀.  
From drawings by Franz Wagner for Peters, *Chiropt. Mus. Zool. Berol.* pl. 3;  
by permission of the publisher, Herr Georg Reimer, Berlin.)

*Skull* (fig. 51).—Similar in all respects to that of *Cynopterus*  
2 r 2

*princeps* (even placed side by side the skulls of *C. princeps* and *Pt. jagori* are difficult to distinguish from each other, apart from dental differences of course). Rostrum short and broad, orbit to nares less than one-fourth of total length of skull. Premaxillæ in simple contact anteriorly, alveolar branches a little heavier than in *Cynopterus*. *Postorbital foramina large* (compare *Penthetor*, p. 667). Mandible deep posteriorly, coronoid height much more than length of  $c-m_2$  (as in *C. princeps*).

$$\text{Dentition (fig. 51).—} \frac{i^1 i^2 c p^1 p^3 p^4 m^1}{i_2 c p_1 p_3 p_4 m_1 m_2} \times 2 = 28.$$

$i^1$  with narrowly chisel-shaped crown (very different from perfectly styliform  $i^1$  of *Penthetor*), cutting-edge in front view flatly rounded off (not needle-sharp, nor triangularly pointed);  $i^2$  only half the height of  $i^1$ , but essentially similar in general shape.  $i_1$  entirely absent;  $i_2$  with distinctly bilobed cutting-edge. Upper canine with a well-marked secondary cusp at middle of inner edge, produced by a prolongation of cingulum (in one of the skulls examined, n. 5102, a distinct trace of a secondary cusp on external edge of canine, below middle of crown); a rather deep vertical groove on antero-medial surface of upper canine, not extending to tip nor quite to base of crown. Lower canine *Cynopterine*, with a small and somewhat ill-defined cingulum cusp on inner edge at level of tip of lower incisor. Premolars and molars, tooth for tooth, quite similar in outline to those of *Cynopterus princeps* (very different from broadened cheek-teeth of *Thoopterus* and *Penthetor*, compare particularly  $p_4$  and  $m_1$  of those genera);  $m_1$  in type skull of *Pt. jagori* with a small, in skull 5102 without trace of, surface cusp.

*Palate-ridges* (fig. 51).—As in *Cynopterus* (fig. 50, p. 591).

*External characters*.—Not differing in any important point from those of *Cynopterus*. Antitragal lobe obsolescent; no white edgings to ears. Tail about half the length of hind foot with claws, connected with interfemoral by its dorsal integument, tip freely projecting. Calcar between one-half and one-third of hind foot with claws. Membranes inserted on first phalanx of first toe. Wing-indices (upper row in table below, calculated from three specimens) practically similar to those of *Cynopterus* (lower row). Neck-tufts (ruff) well-developed (present even in single female examined).

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	410	427	127	131	645	436	594	604	339	373	628	309	337
1000	389	428	121	119	610	429	568	599	326	378	625	305	336

*Affinities*.—*Ptenochirus* is undoubtedly the Philippine repre-



sentative of the "*Niadius*" section of *Cynopterus*. Its resemblance to "*Niadius*" in the skull, premolars, molars, and all external characters is perfect, and its only claim to stand as a distinct genus is the disappearance of  $i_1$ , the shortening of  $i_2$ , and the grooved upper canines.

*History in literature.*—By its first describer (Peters, 1861) *Ptenochirus* was put down as a subgenus of *Pachysoma* (= *Cynopterus*), and later writers either accepted Peters's view or considered it a distinct genus. But its true characters and affinities have hitherto been largely obscured and misunderstood by confusion with those of the bat described by Dobson, in 1880, as "*Cynopterus* (*Ptenochirus*) *lucasi*." As pointed out above, *Ptenochirus jagori* is in reality closely allied to *Cynopterus*, whereas *lucasi* represents an entirely different genus (*Penthetor*, see p. 665) related to *Theophrus*.

### 1. *Ptenochirus jagori*, *Pet.*

*Cynopterus jagori*, Dobson, Cat. Chir. B. M. p. 87.

*Pachysoma* (*Ptenochirus*) *jagori*, *Peters, MB. Ak. Berlin*, 1861 (25 July), p. 707 (Daraga, Albay, Luzon).

*Ptenochirus jagori*, *Peters, MB. Ak. Berlin*, 1867, p. 867; *Leche, Lunds Univ. Årsskr.* xiv. p. 23 (1878: dentition); *Elera, Cat. Sist. F. Filip.* i. p. 7 (1895: Luzon, the provinces Ilocos, Pangasinan, Pampanga, Nueva-Écija); *Matschie, Megachir.* p. 79 (1899: Luzon; Mindoro); *Trouessart, Cat. Mamm., Suppl.* p. 63, n. 547 (1904); *Miller, Fann. & Gen. Bats*, p. 51 (1907).

*Cynopterus* [*Ptenochirus*] *jagori*, *Dobson, Mon. As. Chir.* p. 28 (1876); *id.*, *Cat. Chir. B. M.* p. 87 (1878); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 207, n. 326 (1879); *Robin, Ann. Sci. Nat.* (6) *Zool.* xii. Art. 2, pp. 4 & seq., pl. v. figs. 31, 32 (anatomy) (1881); *Trouessart, Cat. Mamm.* i. p. 86, n. 462 (1897); *Matschie, Megachir.* pl. xii. (animal; skull; palate-ridges) (1899).

*Cynopterus jagori*, *Hoffmann, Abh. Mus. Dresden*, 1886-87, n. 3, p. 24 (1887: S. Mindanao); *Sanchez, An. Soc. Esp. H. N.* xxix. pp. 276, 288 (1900: Luzon; Mindanao).

*Fur.*—Distribution, quality, and length of fur as in *Cynopterus* (p. 592).

*Colour.*—♂ ad. in al., teeth worn, Camiguin, N. Luzon: Upper-side apparently dark brown, darkest on head; underparts broccoli-brown sprinkled with light greyish hairs; sides of neck (neck-tufts) dark chestnut.—♀ ad. skin, Mindoro: Upperside a very dark shade of brown approaching seal-brown; underparts dark olive-hairbrown; sides of neck between walnut and burnt-umber, somewhat contrasting with surrounding dull colours. Ears and membranes unmarked.

*Measurements.* On pp. 675, 677, 679.

*Specimens examined.* Three, in the collections of the Berlin Museum, viz. the type of the species, one adult male from Camiguin, N. Luzon (alcoholic, skull not extracted, Dr. Semper coll., n. 3788), and one adult female from Calapan, Mindoro (skin and skull, Dr. Platen coll., n. 5102).

*Range.* The Philippines, generally. Thus far known from Luzon (the provinces of Albay, Ilocos, Pangasinan, Pampanga, Nueva-Ecija), Mindoro (Calapan), and Mindanao.

*Type*, a subadult male (skull with no distinct sign of immaturity, but epiphyses of metacarpals separate), preserved in alcohol, collected by Jagor at Daraga, province of Albay, Luzon, Berlin Museum n. 2523. For measurements see pp. 675, 677, 679.

## 20. MEGÆROPS, *Pet.*

*Cynopterus* (pt.), Dobson, *Cat. Chir. B. M.* p. 80.

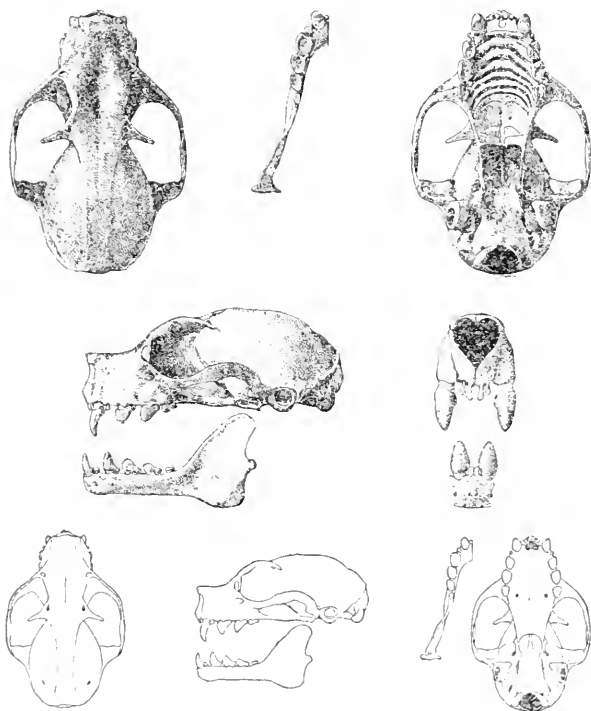
Type.

1841. Megera, *Temminck, Mon. Mamm.* ii. p. 274 (pre-occupied by *Megara*, Wagler, 1830, a genus of Reptilia, and by *Megæra*, Robineau-Desvoidy, 1830, a genus of Diptera) ..... *M. ecaudatus*.
- 1865.\* *Megærops*, *Peters, MB. Ak. Berlin*, 1865 (22 May), p. 256 ..... *M. ecaudatus*.
- Pachysoma* (pt., *nec E. Geoff.*), *Temminck, Mon. Mamm.* ii. pp. 50, 91 (1837: genus = *Cynopterus* + *Megærops* + *Chironax*); *Wagner, Schreber's Säug., Suppl.* i. p. 362 (1839: subg. of *Pteropus* = *Cynopterus* pt. + *Megærops* + *Chironax*).
- Megara* (misspelling, for *Megæra*), *Temminck, Mon. Mamm.* ii. p. 274 (1841); *Lesson, N. Tabl. R. An., Mamm.* p. 15, n. 45 (1842); *Gervais, Hist. Nat. Mamm.* i. p. 191 (1854).
- Megara* (preoccupied). *Temminck, Mon. Mamm.* ii. p. 357 (1841: description reprinted in *L'Echo du Monde Savant*, viii. no. 654, p. 452, 7 Aug. 1841); *Gray, List Mamm. B. M.* p. xix (1843); *id.*, *Voy. 'Sulphur,' Zool.* i. p. 29 (1844); *id.*, *Zool. 'Samarang,' Vert.* p. 12 (1849); *Wagner, Schreber's Säug., Suppl.* v. p. 611 (1853-55: subg. of *Pteropus*); *Gray, P. Z. S.* 1866, p. 64; *id.*, *Cat. Monk. Sc.* p. 123 (1870).
- Megærops*, *Peters, l. s. c.* (1865); *id.*, *MB. Ak. Berlin*, 1867, p. 867; *Dobson, Mon. As. Chir.* pp. 24, 29 (1876: subg. of *Cynopterus*); *id.*, *Cat. Chir. B. M.* pp. 81, 87 (1878: subg. of *Cynopterus*); *Leche, Lunds Univ. Årsskr.* xiv. pp. 25, 34 (1878: dentition); *Matschie, Megachir.* p. 79 (1899: subg. of *Ptenochirus*); *Miller, Fam. & Gen. Bats.* p. 51 (1907: characters).
- Cynopterus* (*nec E. Geoff.*), *Fitzinger, SB. Ak. Wien*, ix. Abth. i. p. 640 (1870: single species, *C. ecaudatus*; true *Cynopterus* styled *Pachysoma*).

\* Palmer (*Ind. Gen. Mamm.* p. 404: 1904) dates the name *Megærops* from 1863, on the basis of the following reference: "Handb. Zool. I. 5ter Bogen, [p.] 67, Mar., 1863 (unpublished?)." This evidently refers to Peters, Carus, and Gerstäcker, *Handbuch der Zoologie*. In the 'Vorwort' to the first volume of that book it is intimated that Peters was to have worked out the Class of Vertebrates, but withdrew from the collaboration, whereupon the Vertebrates were taken over by Carus and issued, somewhat delayed, in 1868-75. It appears highly probable that Peters, prior to his withdrawal in 1863, had started working out the Mammalia for the 'Handbuch,' and even had several sheets printed, but, so far as can be seen from the lists of published books of that period, nothing of Peters's work was distributed to the subscribers to the *Handbuch*.

*Differential characters.*—Similar to *Cynopterus*, but rostrum much deeper anteriorly, only one pair of lower incisors ( $i_1$  absent), outer upper incisor ( $i_2$ ) reduced in length, no external tail. Forearm about 54–57 mm. [One species. *Hab.* Malay Peninsula, Sumatra, and Borneo.]

*Skull* (fig. 52).—Height of rostrum at front of alveolus of canine



TERTI-

Fig. 52.—*Megalopteropos ecaudatus*, ♀. Bidor, S. Perak, Malay Peninsula.  
No. 3.26.82.

Shaded figures  $\frac{2}{3}$  (linear) (except front view, which is  $\frac{1}{2}$ ), outlines  $\frac{1}{2}$ .

subequal to (in *Cynopterus* much less than) height at  $p^3$ ; height at canine subequal to (in *Cynopterus* much less than) greatest breadth across external surfaces of crowns of upper canines; nasals produced forward to a point in front of (in *Cynopterus* not extending beyond) alveoli of canines; alveolar branches of premaxillæ somewhat deeper than in *Cynopterus*, nasal branches of same more conspicuously tapering above and, in consequence of the greater

depth of the rostrum anteriorly and the lengthening of the nasals, much more vertical in position. Palate relatively broader, greatest breadth across external surfaces of maxillary tooth-rows subequal to (in *Cynopterus* distinctly less than)  $c-m^1$ ; maxillary tooth-row forming a curved (in *Cynopterus* a quite or very nearly straight) line from  $c-m^1$ . Other cranial characters unmodified *Cynopterine*; postorbital foramina large; foramen rotundum and ovale fused.

*Dentition* (fig. 52).— $\frac{i^1 i^2 e p^1 p^3 p^4 m^1}{i_2 c p_1 p_3 p_4 m_1 m_2} \times 2 = 28$ .

Upper incisors *Cynopterine* in general shape, but  $i^2$  shorter, about two-thirds or one-half the length (height) of  $i^1$ .  $i_1$  absent, and lower canines more closely approximated;  $i_2$  unmodified in shape and size. Canines relatively shorter than in *Cynopterus*, particularly those in lower jaw; external and anterior surfaces of upper canines without trace of vertical groove (as in *Cynopterus*); as a rule no trace of secondary cusp in canines (in one skull, 3.2.6.82, a distinct indication of such cusp in upper canines, above middle of inner edge, homologous with the cingulum cusp always present in *Cynopterus*). Premolars and molars rather shorter and broader than in *Cynopterus* (broadening particularly conspicuous in  $p_3$  and  $p_4$ ),  $m^1$  distinctly reduced, smaller than  $p^4$ , and also  $m_1$  relatively slightly smaller than in the related genus.

*Palate-ridges* (fig. 52).—Not differing essentially from those of *Cynopterus* (fig. 50, p. 591).

*External characters*.—Muzzle considerably deeper anteriorly than in *Cynopterus*; nostrils slightly more subcylindrical. No external tail; interfemoral undeveloped or extremely narrow in centre, well-developed along tibia. Other characters essentially as in *Cynopterus*; odontoid papillae on inner side of lips exactly as in the related genus; antebrachial membrane not extending beyond basal third of first phalanx of pollex; lateral membranes inserted on first toe (near distal extremity of first phalanx); vertical fasciæ of mesopatagium (those crossed by the internal cutaneous line) about 14 (one specimen only); all digits, particularly third and fourth, a little longer than in *Cynopterus*, owing chiefly to a slight lengthening of the metacarpals and proximal phalanges (see table below, showing in upper row the wing-indices of *Megarops*, calculated from three specimens, in lower row those of *Cynopterus*); calcar about one-half of hind foot with claws. Distribution of fur of single species known as in *Cynopterus*, except that the tibiae are more distinctly hairy above; colour of fur of upperside a tinge of pale brown not exactly matched by any species of *Cynopterus*.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st. ph.	2-3 ph. c. u.	Mtc.	1st. ph.	2nd ph.	Mtc.	1st. ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	389	462	118	118	658	467	585	620	357	375	643	313	321
1000	389	428	121	119	640	429	568	599	326	378	625	305	336

*Affinities.*—In its origin *Megærops* is probably more intimately connected with *Cynopterus* than with any other genus. It has the large postorbital foramina characteristic of *Cynopterus* and *Ptenochirus* (and of the large majority of Megachiroptera), in contradistinction to *Thoopterus*, *Penthetor*, and their allies; the foramen rotundum and ovale are united into one, as usually in *Cynopterus* and *Ptenochirus*, the upper canines ungrooved as in *Cynopterus*, and the general outline of the cheek-teeth nearest that of *Cynopterus*, though in the broadening of the lower teeth there may be some slight leaning to the *Thoopterus-Penthetor* pattern. Its peculiar characters, as compared with *Cynopterus*, are chiefly those given in the brief diagnosis of the genus, viz. the increased depth of the rostrum, the loss of  $i_1$ , shortening of  $i_2^*$ , and the absence of an external tail rudiment. In the deepening of the rostrum and the rather more "tubular" nostrils (the former character very likely to some extent dependent on the latter) *Megærops* exhibits an initial stage of tendencies which reach a climax in the highly peculiar Cynopterine genus *Nyctimene*.

*History in literature.*—*Megærops* has generally been considered either a subgenus of *Cynopterus* or a distinct genus. By Matschie it was placed as a subgenus under "*Ptenochirus*," evidently owing to the absence of  $i_1$  in both genera.

### 1. *Megærops ecaudatus*, Temm.

*Cynopterus ecaudatus*, Dobson, Cat. Chir. B. M. p. 87.

*Pachysoma ecaudatum*, Temminck, Mon. Mamm. ii. p. 94 (1837: Padang); Macgillivray, Cuvier's An. Kingd. ii. p. 12 (1840).

*Megæra ecaudata*, Temminck, Mon. Mamm. ii. p. 274, footnote † (1841); *id.*, t. c. p. 359, pl. lxxix. (animal; head; skull) (1841); S. Müller, Temminck's Nat. Gesch. Ned. Ov. Bez., Zool. pp. 21, 58 (1841-44: W. coast of Sumatra); Lesson, N. Tabl. R. An., Mamm. p. 15, n. 201 † (1842); Gray, Zool. 'Samarang,' Vert. p. 12 (1849); Gervais, Hist. Nat. Mamm. i. p. 191 † (1854); [Anonymous], Mém. Quadr. & Chér. Arch. Ind. p. 117 (1864); Gray, P. Z. S. 1866, p. 64; *id.*, Cat. Monk. &c. p. 124 (1870).

*Pteropus ecaudatus*, Schinz, Syst. Verz. Säug. i. p. 134, n. 36 (1844); Giebel, Säug. p. 1002 (1855).

*Pteropus* [*Megæra*] *ecaudatus*, Wagner, Schreber's Säug., Suppl. v. p. 611 (1853-55).

*Megærops ecaudatus*, Peters, MB. Ak. Berlin, 1867, p. 868 (external measurements of type); Willink, Nat. Tijd. Ned. Ind. lxx.

\* The suppression of the inner pair of lower incisors, which in the Cynopterine group of genera is always combined with a shortening of the outer pair of upper incisors, is a character cropping up independently in different branches of the group. In *Cynopterus*  $i_1$  is present and  $i_2$  normal, but in the very closely related *Ptenochirus*  $i_1$  is absent and  $i_2$  shortened; in *Thoopterus*  $i_1$  is present and  $i_2$  normal, in the very closely related *Penthetor*  $i_1$  is absent and  $i_2$  shortened; in *Chironax*  $i_1$  is present and  $i_2$  normal, but in its closest relative, *Balionycteris*,  $i_1$  is absent and  $i_2$  shortened. It is perfectly clear, therefore, that a natural arrangement of the Cynopterine genera cannot be based primarily on the presence or absence of  $i_1$ .

† Generic name misspelt *Megæra*.

- p. 277 (1905); *Miller, Fam. & Gen. Bats*, p. 52 (1907); *Kloss, J. Fed. Mal. St. Mus.* ii. p. 153 (1908).  
*Cynocephalus ecaudatus*, *Fitzinger, SB. Ak. Wien*, lx. Abth. i. p. 641 (1870); *Jentink, Cat. Ost. Mamm.* p. 266 (1887: type skull); *id.*, *Cat. Syst. Mamm.* p. 155 (1888: type); *Thomas, P. Z. S.* 1889, p. 229 (Kina Balu, 3000'); *Everett, P. Z. S.* 1893, p. 494; *Hose, Mamm. Borneo*, p. 39 (1893); *Jentink, Notes Leyd. Mus.* xix. p. 50 (1897: Smitau, Kapuas R., W. Borneo); *Seabra, J. Sc. Math. Lisboa*, (2) v. p. 170 (1898); *Bonhote, Fasc. Mal., Zool.* i. p. 15 (1903: Bidor, S. Perak).  
*Cynocephalus* [*Megacerops*] *ecaudatus*, *Dobson, Mon. As. Chir.* p. 29 (1876); *id.*, *Cat. Chir. B. M.* p. 87 (1878); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 207, n. 327 (1879); *id.*, *Cat. Mamm.* i. p. 86, n. 464 (1897).  
*Ptenochirus* (*Megacerops*) *ecaudatus*, *Matschie, Megachir.* p. 79, pl. viii. fig. 5 (skull of type) (1899: Lah Datu, Darvel Bay); *Trouessart, Cat. Mamm., Suppl.* p. 63, n. 549 (1904).

*Colour*.—♀ ad. skin, teeth unworn, Kina Balu, March: Back a tinge of uniform pale brown approaching pale café-au-lait (very similar to that predominant in *Epomophorus*); base of fur drab-grey slightly washed with ceru-drab. Nape of neck pale drab-grey, contrasting with brown of back; head similar to nape but somewhat darkened with brownish. Breast and belly pale drab-grey with a slight silvery gloss; flanks darker, more typical drab. No white edgings to ears; metacarpals and phalanges brown, like membranes.—An alcoholic specimen (♀ ad., Bidor, January) is darker brown and somewhat tinged with raw-umber above, and more uniform ashy-drab below.—The type was described by Temminck as “brun bistre” on back and head, “gris-pâle” on nape and sides of neck, “gris-cendré” on underparts.

*Measurements*. On pp. 675, 677, 679.

*Specimens examined*. The type of the species, and the two specimens catalogued below.

*Range*. Malay Peninsula (Bidor, S. Perak, “shot under the eaves of the rest-house”); Sumatra (Padang district); Borneo (Kina Balu, 3000 feet; Lah Datu, Darvel Bay; Smitau, Kapuas R.).

*Type*, in the Leyden Museum, an adult female (by no means “très vieille” as said by Temminck, the teeth being only slightly worn), mounted (when described by Temminck the specimen was preserved in alcohol), obtained “sur les rochers qui bordent la plage dans le district de Padang,” W. Sumatra, by Salomon Müller; colour of fur much faded; skull separate, mandible wanting (but this figured by Temminck and Peters, *l. c.*; Temminck rightly describes the type as having only one pair of lower incisors and even bases his new genus “*Meyera*” on this fact, but his figure shows four lower incisors and i<sup>2</sup> equal in length to i<sup>1</sup>: Peters’s figure of the type skull gives the characters correctly). For measurements of type see pp. 675, 677, 679.

- a. ♀ ad. al.; skull. Bidor, S. Perak, Malay Messrs. Robinson 3.2.6.82.  
 Pen.; Jan. 1902. & Annandale [P].  
 b. ♀ ad. sk.; skull. Kina Balu, B. N. Borneo, Oldfield Thomas, 95.10.4.1.  
 3000'; 29 Mar. 1888 Esq. [P].  
*(f. Whitehead).*

21. **DYACOPTERUS**\*, gen. n.Type: *D. spadiceus*.*Cynopterus* (pt., nec *F. Cuv.*), *Thomas, Ann. & Mag. N. H.* II. (6) v. p. 235 (1890).*Balionycteris* (pt.), *Matschie, Megachir.* p. 80 (1899).*Thoopterus* (pt., nec *Matschie*), *Miller, Fam. & Gen. Bats*, p. 50 (1907).

*Differential characters*.—Similar to *Cynopterus*, but premaxillæ broadly and solidly united anteriorly, postdental palate much shortened, postorbital foramina very small, upper canines deeply grooved and without secondary cusp,  $p^1$  absent (or deciduous), cheek-teeth subquadrate in outline, membranes from second toe. Forearm about 77 mm. [One species. *Hab.* Borneo.]

*Skull* (fig. 53).—Short and broad, with deeper rostrum, and the

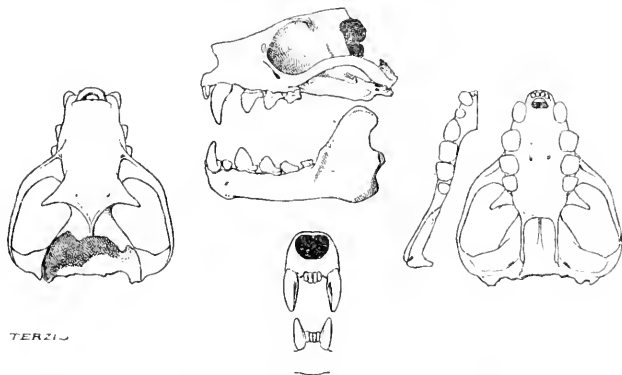


Fig. 53.—*Dyacopterus spadiceus*, ♀, type of species. 1.

zygomata standing much more widely out than in *Cynopterus*. Premaxillæ unusually broad, solidly united in front, without trace of suture, and produced forward considerably in front of canines (row of upper incisors wholly in front of a line between fronts of crowns of canines); nasals considerably broader anteriorly than usual; profile of lateral margins of nares, from tip of nasal to front of premaxillæ, therefore a deeply concave line. Postdental palate only about one-fourth (in *Cynopterus* equal to, or more than, one-third) of median palatal length (palation to incisive foramina). Front of orbit above front of  $p^1$ . Postorbital foramina present, but much smaller than in *Cynopterus*. Foramen rotundum and ovale fused (in single specimen known). Sagittal crest well developed. (Parietal and occipital regions of skull unknown.)

\* *Dyacopterus*, a winged *Dyak*.

*Dentition* (figs. 53, 54).  $\frac{i^1 i^2 c \quad p^3 p^4 m^1}{i_1 i_2 c \quad p_1 p_3 p_4 m_1 m_2} \times 2 = 28$ . The only genus of *Cynopterine* bats with  $p^1$  absent (or deciduous).

Upper and lower incisors as in *Cynopterus*. Canines considerably longer; upper canine with a deep vertical groove along antero-medial surface, extending nearly from base to tip of crown, no trace of secondary cusp; cingulum of lower canine thickened at inner edge, but not forming a well-defined cusp.  $p^1$  absent (no trace of alveoli; all teeth nearly unworn);  $p_1$  unmodified.  $p^3$ - $m^1$  and  $p_3$ - $m_1$  shorter and much broader than in *Cynopterus*,  $p^4$ ,  $m^1$ ,  $p_4$ , and  $m_1$  subsquarish in outline. Outer and inner ridges of pre-molars and molars sharply defined, separated in all cheek-teeth ( $p^3$  and  $p_3$  not excepted), though connected by a prominent transverse commissure in  $p^3$ ,  $p^4$ , and  $p_3$ .  $m^1$  and  $m_1$  somewhat reduced in

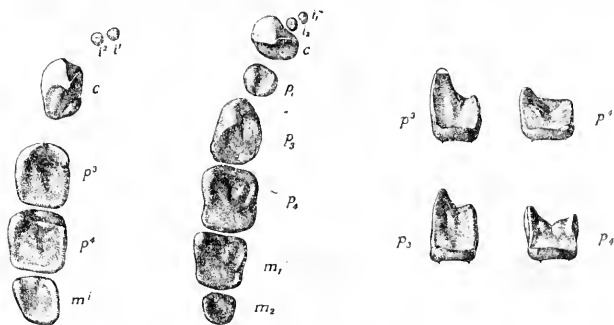


Fig. 54.—*Dyacopterus spadiceus* (type of species), upper right and lower left tooth-row; right  $p^3$ ,  $p^4$ , and left  $p_3$ ,  $p_4$ , viewed from behind.  $\frac{1}{2}$  (linear).

size, as compared with corresponding teeth of *Cynopterus*,  $m^1$  being considerably smaller than (in *Cynopterus* subequal to)  $p^4$ ,  $m_1$  slightly smaller than (in *Cynopterus* equal to or slightly larger than)  $p_4$ . A rounded surface tubercle in  $p_4$  and  $m_1$ , larger in the former than in the latter, situated close to, and partly confluent with, inner ridges of these teeth (homologous with surface cusp in corresponding teeth of *Cynopterus* and *Ptenochirus*).

*Palate-ridges*.—Unknown.

*External characters*.—Tail and calcar as in *Cynopterus*. Wings from base of first phalanx of second toe (in *Cynopterus* from first toe). Pollex much shorter than in *Cynopterus*, third and fourth digits considerably, second and fifth slightly longer (owing to a lengthening of the metacarpals of all of these digits and of the proximal phalanx of the third and fourth, whereas the terminal phalanx of the third, fourth, and fifth digits are distinctly shortened; compare table below: in upper row wing-indices of *Dyacopterus*, based on



one specimen, in lower row those of *Cynopterus*). Fur of single species known unusually short and closely adpressed, tibia naked above.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	303	458	110	123	703	452	548	677	394	335	690	303	290
1005	389	428	121	119	640	429	568	599	326	378	625	305	336

*Affinities.*—The single species of this genus, "*Cynopterus*" *spadicus*, was by Miller (1907) placed in *Thoopterus*, which thus included two species, *Th. nigrescens* (type of genus) and *Th. spadicus*. But whatever may be the real affinities of *spadicus*, it is in many and important characters so different from *nigrescens* that it cannot be admitted into the same genus. In *Thoopterus*, if restricted to the species *nigrescens*, the rostrum is typical Cynopterine, in *Dyacopterus* peculiarly modified (deep, premaxillæ broad, completely fused, and produced forward in front of canines, nasals broadened); in *Thoopterus* the postorbital foramina are absent, in *Dyacopterus* present; in *Thoopterus* the inner ridge of the large premolars and molars is extremely low or even perfectly obsolete, in *Dyacopterus* well-developed or even stronger than usual; in *Thoopterus* the outer and inner cusps of  $p_3$  are completely fused, in *Dyacopterus* separate; both genera possess surface cusps in  $p_4$  and  $m_1$ , but these cusps differ noticeably in position, being in *Dyacopterus* situated close to, and partly confluent with, the inner ridge, in *Thoopterus* quite or nearly central and freely projecting; in *Thoopterus*  $p^1$  is present, in *Dyacopterus* absent or at least deciduous (only one specimen is known); in *Thoopterus* the tail is reduced to a minute spicule, in *Dyacopterus* unmodified Cynopterine; in *Thoopterus* the fur is unusually long and the tibia densely furred above, in *Dyacopterus* the fur is extremely short and adpressed and the tibia naked above. *Dyacopterus* might be roughly described as a "*Cynopterus*" with the peculiar cranial characters referred to above, but with the dentition essentially unmodified, except for the long grooved upper canines without secondary cusp (compare grooved upper canines in *Ptenochirus*, which undoubtedly is very closely allied to *Cynopterus* with ungrooved canines), the broader cheek-teeth (compare broadening of cheek-teeth in *Ptenochirus* and the "*Nidius*" section of *Cynopterus*), and absence or deciduousness of  $p^1$ . On the other hand, the remarkably small size of the postorbital foramina may indicate leanings toward *Balionycteris*, *Chironax*, *Thoopterus*, and *Penthetor*, in all of which these foramina are entirely absent, the shortening of the palate may point toward *Thoopterus* and *Penthetor*, while the slight reduction of  $m^1$  and  $m$ , recalls the much stronger reduction of the same teeth in *Balionycteris* and *Chironax*. There

can be no doubt that *Dyacopterus* is as fully entitled to stand as a distinct genus as any of the other *Cynopterine* genera admitted by modern systematists, and, for the present at least, it would seem to find its proper place in the vicinity of those genera (*Cynopterus*, *Ptenochirus*, *Megacerops*) in which the postorbital foramina are present and well-developed.

### 1. *Dyacopterus spadiceus*, Thos.

*Cynopterus spadiceus*, Thomas, *Ann. & Mag. N. H.* (6) v. p. 235 (1 March, 1890: Baram); *id.*, *P. Z. S.* 1892, p. 227; Everett, *P. Z. S.* 1893, p. 494; Hose, *Mamm. Borneo*, p. 38 (1893).

*Balionycteris maculata* (pt., nec Thos.), Matschie, *Megachir.* p. 80 (1899); Trouessart, *Cat. Mamm., Suppl.* p. 63, n. 550 (1904).

*Thoopterus spadiceus*, Müller, *Fam. & Gen. Bats*, p. 50 (1907).

*Fur.*—Shorter and more closely adpressed than in any other *Cynopterine* bat; length of hairs of back and belly about 2–3 mm.; tibia naked above; foreneck (at least in females) so thinly clothed as to appear semi-naked.

*Colour* (type).—Back between Prout's brown and vandyck-brown; crown similar, but rather darker; nape of neck much lightened with pale silvery hairs. Foreneck and centre of breast and belly pale silvery, gradually darkening on sides of breast and belly and on flanks to brownish drab. Neck-tufts (female) clay, not strongly contrasting with surrounding colour of neck. Metacarpals and phalanges (dried) brown, membranes unmarked.

*Measurements.* On pp. 675, 677, 679.

*Specimen examined.* The type, in collection, is the only specimen on record.

*Range.* Borneo; so far known only from Baram, Sarawak.

a. ♀ ad. sk.; skull. Baram, Sarawak. Dr. Ch. Hose [C.]. 90.1.28.4.  
(Type of species.)

### 22. *BALIONYCTERIS*, Matschie.

Type.

1899. *Balionycteris*, Matschie, *Megachir.* pp. 72, 80 . . . . *B. maculata*.

*Cynopterus* (pt., nec F. Cuv.), Thomas, *Ann. & Mag. N. H.* (6) xi. p. 341 (1893).

*Megacerops* (pt., nec Pet.), Trouessart, *Cat. Mamm.* i. p. 86 (1897: subg. of *Cynopterus* = *Megacerops* + *Chironax* + *Balionycteris*).

*Balionycteris*, Matschie, *l. s. c.* (pt.) (1899); Müller, *Fam. & Gen. Bats*, p. 52 (1907: characters).

*Diagnosis.*—*Cynopterine* group. No trace of postorbital foramina; incisors  $\frac{2}{1} - \frac{2}{1}$  ( $i_1$  absent),  $i_2$  much shorter than  $i_1$ , upper canine with deep vertical groove, cheek-teeth  $\frac{5}{5}$  (a minute  $m^2$  present),  $p^3$  with large antero-external basal lobe,  $m^1$ ,  $m_1$ , and  $m_2$  conspicuously reduced in size. No tail; wings much longer than

in *Cynopterus*, membranes spotted. Size very small, forearm 39–42 mm. [One species. *Hab.* Borneo.]

*Skull* (fig. 55).—Differing from that of *Cynopterus* chiefly by the complete absence of postorbital foramina and in having the foramen rotundum and ovale widely separated. Premaxillæ in simple contact anteriorly (not solidly united: compare *Chironax*); maxillary tooth-row extending beyond ventral margin of orbit ( $m^2$  situated entirely behind this margin).

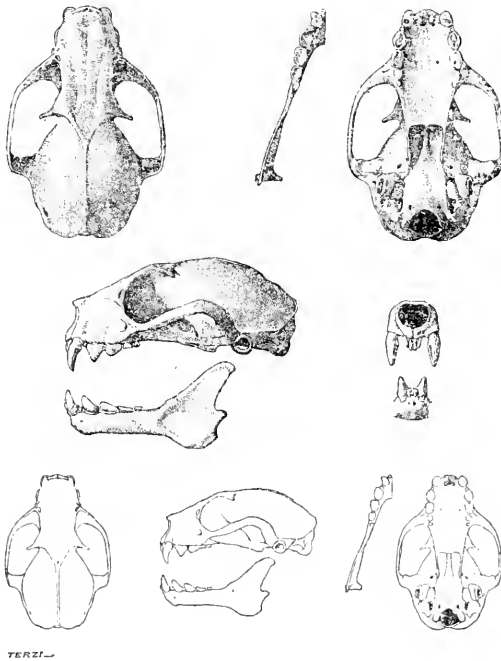


Fig. 55.—*Balionycteris maculata*, ♂, type of species.  
Shaded figures  $\frac{3}{2}$  (linear), outlines  $\frac{1}{2}$ .

*Dentition* (fig. 55).— $\frac{i^1 i^2 c p^1 p^3 p^4 m^1 m^2}{i_2 c p_1 p_3 p_4 m_1 m_2} \times 2 = 30$ . The same. dental formula occurs only in one other genus of Fruit-bats, *Styloctenium* (allied to *Pteropus*, see p. 443).

Upper incisors terete;  $i^2$  reduced to two-thirds or one-half the length (height) of  $i^1$ ;  $i_1$  absent and lower canines more closely approximated than in *Cynopterus*; cutting-edge of  $i_2$  faintly bilobed (inner lobe much the larger). Upper canine with a deep vertical groove on antero-medial surface, not reaching to tip nor quite to

base of crown; no trace of a secondary cusp; lower canine with inner edge somewhat thickened in lower half, but not forming a distinct cusp.  $p^3$ ,  $p^1$ ,  $p_3$ ,  $p_4$ , and  $m_1$  rather broader than in *Cynopteris*, but not nearly broadened to the same extent as in *Thoopteris* and *Penthetor*. Outer ridge of  $p^3$ , in front of main cusp, developed into a large basal lobe; external profile of  $p^3$  therefore an isosceles triangle, with tip of outer main cusp nearly exactly below middle of base (in *Cynopteris* below anterior extremity of tooth).  $m^1$  considerably reduced, only about half the bulk of  $p^1$  (in *Cynopteris* usually a trifle narrower but scarcely shorter than  $p^1$ ).  $m^2$  rudimentary, subequal to  $p^1$ .  $m_1$  conspicuously smaller than (about two-thirds of, in *Cynopteris* subequal to)  $p_4$ .  $m_2$  only one-third to one-fifth of  $m_1$ , equal to or only slightly larger than  $p_1$ .

*Palate-ridges*.—As in *Cynopteris* (fig. 50, p. 591).

*External characters*.—Principal differences from *Cynopteris*:—(1) no external tail (and probably no tail vertebrae: compare the closely allied *Chironax*); (2) all digits much longer as compared with the forearm, index of second digit 755 (in *Cynopteris* 668), third 1847 (1637), fourth 1485 (1303), fifth 1403 (1266), but all parts of the digits not lengthened to the same degree, the metacarpals by 12–17 per cent., the proximal phalanx of the third and fourth digits by 19–24, that of the fifth digit by 14, the distal phalanx of the third, fourth, and fifth digits only by 2–8 per cent. (see table below, showing in upper row the wing-indices of *Balionycteris* calculated from measurements of three adult individuals, in lower row those of *Cynopteris* for comparison).—Ears small, scarcely reaching hinder canthus of eye, broadly rounded off above; antitragal lobe small, triangularly rounded. Interfemoral undeveloped or extremely narrow in centre, well-developed along tibia; calcar about one-half of hind foot with claws. Pollex included in membrane for its basal third or half; fasciae of mesopatagium as in *Cynopteris*; membranes inserted posteriorly on first toe (tip of metacarpal or base of first phalanx). Distribution of fur (in single species known) as in *Cynopteris*; colour unusually dark above; membranes spotted; a light spot always present on front margin of ear near its base.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	406	562	118	135	719	512	616	697	404	384	714	347	342
1000	389	428	121	119	640	429	568	599	326	378	625	305	336

*Sexual differentiation*.—Hair of foreneck in adult males brighter in colour than, in adult females scarcely differing from, that of breast and belly.

*Affinities*.—In having a small  $m^2$  *Balionycteris* is more primitive than any other genus of the Cynopterine group, except *Myonycteris*.

In other respects it is peculiarly specialized, viz. in the complete disappearance of the postorbital foramina (as in *Chironax*, *Thoopterus*, *Penthetor*, and *Sphaerius*), the suppression of  $i_1$  and shortening of  $i^2$  (characters developed independently in different Cynopterine genera, see p. 649, footnote), the reduction of  $m^1$ ,  $m_1$ , and  $m_2$  (as in *Chironax*), the development of an antero-external basal lobe in  $p^3$  (represented by a cusp in *Chironax*), the absence of a tail (as in *Chironax*), and the unusually large wings (character present, to a less degree, in *Chironax*). Its closest known relative is the Javan *Chironax*. *Balionycteris* and *Nyctimene* are the only Fruit-bats with sharply-defined yellow spots on the membranes.

### 1. *Balionycteris maculata*, Thos.

*Cynopterus maculatus*, Thomas, *Ann. & Mag. N. H.* (6) xi. p. 341 (1st May, 1893: Sarawak); Everett, *P. Z. S.* 1893, p. 494; Hose, *Mamm. Borneo*, p. 39 (1893); Jentink, *Notes Leyd. Mus.* xix. p. 51 (1897: Mt. Kenepai, Kapuas R., W. Borneo); Willink, *Nat. Tijds. Ned. Ind.* lxx. p. 277 (1905).  
*Cynopterus* [Megarops] *maculatus*, Trouessart, *Cat. Mamm.* i. p. 87, n. 466 (1897).

*Balionycteris maculata*, Matschie, *Megachir.* p. 80 (pt.) (1899); Trouessart, *Cat. Mamm., Suppl.* p. 63, n. 550 (1904); Miller, *Fam. & Gen. Bats*, p. 53 (1907).

*Fur*.—A little shorter than in *Cynopterus*, but not so short as in *Penthetor*; length, back 4.5 (general mass of hairs) and 5.5 (longest hairs), sides of breast 4.5 and 5.5 mm. Tibia naked above.

*Colour*.—♂ ad. skin, Mt. Dulit, April: Back sooty brown, somewhat tinged with Prout's brown posteriorly (on rump); head and nape of neck deep blackish, contrasting with back; breast and belly dark drab (in type and paratypes of species, preserved in or skinned from alcohol, uniform dark grey); foreneck raw umber. Ears and membranes in dried condition brownish black; a small yellowish spot always present on anterior margin of ear near its base; finger joints always yellowish; numerous small yellowish spots on wing-membranes varying in number and position from individual to individual. Adult females differ in having the foreneck similar in colour to the underparts.

*Measurements*. On pp. 675, 677, 679.

*Specimens examined*. Those catalogued below and one topotype in private possession.

*Range*. Borneo; in British Borneo known from Sarawak (Mt. Dulit, 2000'), in W. Dutch Borneo from Mt. Kenepai, Kapuas River.

*Type* and three paratypes in collection. Type, skull (lambda to gnathion) 23.3, rostrum (orbit to nares) 5.5, c-m<sup>2</sup> (crowns) 7.7, forearm 40.5, ear from orifice 9, tibia 13 mm.

- |                       |                      |                                   |               |
|-----------------------|----------------------|-----------------------------------|---------------|
| a-c. 1 ♂ ad., 2 ♀ ad. | Sarawak; June, 1892. | A. Everett [C.].                  | 93.4.1.24-26. |
| al.; skulls of        |                      | (♂ ad., no. 24, Type of species.) |               |
| nos. 24, 26.          |                      |                                   |               |
| d. ♀ ad. sk.; skull.  | Sarawak; June, 1892. | A. Everett [C.].                  | 93.4.1.27.    |
| e. ♂ ad. sk.; skull.  | Mt. Dulit, Sarawak,  | Dr. Ch. Hose                      | 94.9.29.3.    |
|                       | 2000'; April, 1894.  | [C.].                             |               |

## 23. CHIRONAX\*, gen. n.

*Cynopterus* (pt.), Dobson, Cat. Chir. B. M. p. 80.

Type: *Ch. melanocephalus*.

*Pteropus* (pt.), *Temminck, Mon. Mamm.* i. p. 166 (1825: genus *Pteropus*, part of first section, p. 172); *Desmarest, Dict. Sci. Nat.* xvi. p. 358 (1827: genus *Pteropus*, part of first section, "Roussettes sans queue"); *J. B. Fischer, Syn. Mamm.* p. 87 (1829: genus *Pteropus*, part of section ††, "Pachysomata").

*Pachysoma* (pt., nec *E. Geoff.*), *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 703 (Sept. 1828: = *Cynopterus*+*Chironax*); *id.*, *Ann. Sci. Nat.* xv. pp. 192, 203 ("Oct. 1828": = *Cynopterus*+*Chironax*); *Lesson, Hist. Nat. Mamm. (Compl. Buffon)*, v. p. 61 (1836: = *Cynopterus*+*Chironax*); *Temminck, Mon. Mamm.* ii. pp. 50, 91 (1837: = *Cynopterus*+*Megærops*+*Chironax*); *Wagner, Schreber's Säug., Suppl.* i. p. 362 (1839: subg. of *Pteropus* = *Cynopterus*+*Megærops*+*Chironax*); *Lesson, N. Tabl. R. An., Mamm.* p. 14, n. 44 (1842: = *Cynopterus*+*Chironax*); *Wagner, Schreber's Säug., Suppl.* v. p. 605 (1853-55: subg. of *Pteropus* = *Epomophorus*+*Cynopterus*+*Chironax*).

*Cynopterus* (pt., nec *F. Cuv.*), *Gray, Mag. Zool. & Bot.* ii. p. 503 (1838: = *Cynopterus*+*Chironax*); *Peters, MB. Ak. Berlin*, 1865, p. 256; *Gray, P. Z. S.* 1866, p. 64; *Peters, MB. Ak. Berlin*, 1867, p. 866 (= *Cynopterus*+*Chironax*); *Dobson, Mon. As. Chir.* pp. 14, 23 (genus), pp. 23, 24 (subg. = *Cynopterus*+*Chironax*) (1876); *id.*, *Cat. Chir. B. M.* p. 80 (genus), p. 81 (subg. = *Cynopterus*+*Chironax*+*Theopterus*) (1878); *Miller, Fam. & Gen. Bats*, p. 47 (1907: = *Cynopterus* pt.+*Chironax*).

*Megærops* (pt., nec *Temm.*), *Trouessart, Cat. Mamm.* i. p. 86 (1897: subg. of *Cynopterus* = *Megærops*+*Chironax*+*Balionycteris*).

*Theopterus* (pt.), *Matschie, Megachir.* pp. 72, 77 (1899: subg. of *Cynopterus* = *Theopterus*+*Chironax*+*Sphaerius*).

*Differential characters*.—Similar to *Balionycteris*, but premaxillæ solidly united anteriorly, incisors  $\frac{2}{2}$ - $\frac{2}{2}$ ,  $i^2$  subequal to  $i^1$ , cheek-teeth  $\frac{4}{5}$ ,  $p^3$  with a well-defined antero-external basal cusp. Wings not spotted. Size very small, forearm about 43-45 mm. [One species. *Hab.* Java.]

*Skull*.—Similar in all respects to that of *Balionycteris*, except in having the premaxillæ completely fused anteriorly, and the maxillary tooth-row not extending beyond the ventral margin of the orbit. Postorbital foramina absent; foramen rotundum and ovale separated.

*Dentition*.—
$$\frac{i^1 i^2 c p^1 p^3 p^4 m^1}{i_1 i_2 e p_1 p_3 p_4 m_1 m_2} \times 2 = 30$$
 (as in *Cynopterus*).

Dentition differing from that of *Balionycteris* as follows:—(1) Incisors above and below normal in number ( $i_1$  present) and size ( $i^2$  not shortened); (2) 4-4, not 5-5, upper cheek-teeth (the minute

\* Χειρωναξ, one who is master of his hands (ἄραξ τῶν χερῶν).

$m^2$  lost); (3) the antero-external lobe of  $p^3$  in *Balionycteris* is in the present genus represented by a small but well-defined cusp.  $p^1$  perhaps deciduous (present in cotype skulls "a" and "c," apparently absent in "b"). All other dental characters as in *Balionycteris* (upper canines with deep vertical groove, and without secondary cusps;  $m^1$ ,  $m_1$ , and  $m_2$  reduced quite as in *Balionycteris*,  $m^1$  in section about half the size of  $p^1$ ,  $m_1$  two-thirds of  $p_1$ ,  $m_2$  one-fourth to one-fifth of  $m_1$ ; no trace of surface cusps in any cheek-tooth).

*Palate-ridges*.—Unknown (probably not differing from those of *Balionycteris*).

*External characters*.—Differences from *Balionycteris*: (1) wings conspicuously larger than in *Cynopterus*, but not nearly so large as in *Balionycteris*; index of third digit in *Cynopterus* 1637, in *Chironax* 1757, in *Balionycteris* 1847, of fourth digit respectively 1303, 1393, and 1485, of fifth digit 1266, 1310, and 1403; third, fourth, and fifth metacarpals exactly as in *Cynopterus* (considerably lengthened in *Balionycteris*), but phalanges of third and fourth digits lengthened by 11–15, those of fifth digit by 4–8 per cent.; in consequence of these modifications, second phalanx of third digit subequal to (in *Cynopterus* and *Balionycteris* much shorter than) its metacarpal, and second phalanges of fourth and fifth digits slightly but distinctly longer (in *Balionycteris* rather shorter) than first phalanges of same digits; compare table below (upper row, wing-indices of *Chironax*, based on two adult specimens, middle row those of *Balionycteris*, lower row those of *Cynopterus*): (2) membranes apparently inserted on second, instead of on first, toe (evidence not quite clear enough from the available material): (3) ears and membranes unspotted: (4) tibia (in single species known) clothed above quite or nearly to ankle. Other characters as in *Balionycteris*: tail absent, caudal vertebrae none (one skeleton examined), interfemoral undeveloped or extremely narrow in centre, unmodified along tibia, calcar present.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	?	432	102	132	636	489	632	598	375	420	632	330	348
1000	406	502	118	135	719	512	616	697	404	381	714	347	342
1000	389	428	121	119	640	429	568	599	326	373	625	305	336

*Affinities*.—Owing to the scarcity of specimens in collections (the cotypes obtained about 90 years ago being thus far the only specimens on record) the characters and affinities of the single species of this genus, Temminck's *Pteropus melanocephalus*, have hitherto been very imperfectly known. By the large majority of authors it has been considered, apparently without hesitation, a

genuine *Cynopterus* (or "*Pachysoma*"), even by those recent writers (e. g. Miller, 1907) who take the genus *Cynopterus* in its most restricted sense; the reason is, no doubt, that its dental formula is exactly the same as that of *Cynopterus*; on the other hand, the presence of an antero-external cusp in  $p^3$  and the complete suppression of the tail (both of which facts were mentioned by Temminck) might have aroused some suspicion as to its real affinities. By Trouessart (1897) it was placed in the subgenus *Megacerops* under *Cynopterus*, presumably owing to the absence of a tail, and by Matschie (1899), probably for the same reason, together with *Thoopterus nigrescens* and *Sphaerias blanfordi* in the subgenus *Thoopterus* under *Cynopterus*. The only author who has hinted at the possibility of a closer relationship between "*Pteropus*" *melanocephalus* and "*Cynopterus*" [i. e. *Balionycteris*] *maculatus* is Oldfield Thomas (Ann. & Mag. N. H. (6) xi. p. 342, 1893).—*Chironax melanocephalus* differs from any species of *Cynopterus* in the following series of characters:—(1) absence of postorbital foramina, (2) fusion of premaxillæ, (3) separation of foramen rotundum and ovale (character not absolutely constant), (4) presence of vertical groove on upper canines, (5) absence of secondary (cingulum) cusp in canines, (6) presence of antero-external basal cusp in  $p^4$ , (7) great reduction of  $m^1$ ,  $m_1$ , and  $m_2$ , (8) absence of tail and reduction of central interfemoral, (9) enlargement of wings, (10) small size and broadly rounded extremity of ears, (11) black cap contrasting with paler back, (12) unusually small size of animal. All of these characters, except (2), reoccur, unaltered or (6 and 9) somewhat modified, in *Balionycteris*. That *Chironax* is very closely related to this latter genus, in fact scarcely more than its Javan representative, is beyond all doubt; on the other hand its differences from *Balionycteris*, as summed up above (p. 658) under the heading "Differential characters," are obviously too important to allow it to be included in that genus. In having lost the posterior upper molar ( $m^2$ ) and in having the premaxillæ solidly united anteriorly, it stands on a slightly higher level than its relative, but it is less specialized (i. e. nearer *Cynopterus*) in the unmodified condition of the incisors.

### 1. *Chironax melanocephalus*, Temm.

*Cynopterus melanocephalus*, Dobson, Cat. Chir. B. M. p. 85.

*Pteropus melanocephalus*, Temminck, Mon. Mamm. i. p. 190, pl. xii. (animal), pl. xvi. figs. 3, 4 (skeleton; incisors) (1825; Bantam); Lesson, Man. Mamm. p. 112, n. 290 (1827); Desmarest, Dict. Sci. Nat. xvi. p. 366 (1827); J. B. Fischer, Syn. Mamm. p. 88, n. 23 (1829); G. Cuvier, R. An., 3 ed. i. p. 138, footnote (1836); Schinz, Syst. Verz. Säug. i. p. 134, n. 37 (1844); Giebel, Säug. p. 1002 (1855).

*Pachysoma melanocephalum*, Is. Geoffroy, Dict. Class. d'Hist. Nat. xiv. p. 704 (1828); id., Ann. Sci. Nat. xv. p. 204 (1828); id., Bélanger's Voy. Ind.-Orient., Zool. p. 96 (1831); Lesson, Hist.



- Nat. Mamm.* (*Conpl. Buffon*), v. p. 61 (1836); *Temminck, Mon. Mamm.* ii. p. 82, pl. xxxv. fig. 10 (head), pl. xxxvi. figs. 22, 23 (skull) (1837); *Macgillivray, Cuvier's An. Kingd.* ii. p. 12, pl. vii. B, fig. 5 (head: copy from Temminck) (1840); *S. Müller, Temminck's Nat. Gesch. Ned. Ov. Bez., Zoogd.* pp. 21, 58 (1841-44); *Lesson, N. Tabl. R. An., Mamm.* p. 14, n. 196 (1842); [*Anonymous*], *Mém. Quadr. & Chéir. Arch. Ind.* p. 115 (1864); *Fitzinger, SB. Ak. Wien*, lx. Abth. i. p. 639 (1870).
- Cynopterus melanocephalus*, *Gray, Mag. Zool. & Bot.* ii. p. 504 (1838); *Peters, MB. Ak. Berlin*, 1867, p. 867 (external measurements of a cotype); *Dobson, Cat. Chir. B. M.* p. 85 (1878); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 207, n. 323 (1879); *Jentink, Cat. Ost. Mamm.* p. 266 (1887: cotypes); *id., Cat. Syst. Mamm.* p. 155 (1888: cotypes); *Willink, Nat. Tijds. Ned. Ind.* lxx. p. 277 (1905); *Müller, Fam. & Gen. Bats*, p. 49 (1907).
- Pteropus* [*Pachysoma*] *melanocephalus*, *Wagner, Schreber's Säug., Suppl.* i. p. 365 (1839); *id., op. c., Suppl.* v. p. 610 (1853-55).
- Cynopterus* [*Megerops*] *melanocephalus*, *Trouessart, Cat. Mamm.* i. p. 87, n. 465 (1897).
- Cynopterus* [*Thoopterus*] *melanocephalus*, *Matschie, Megachir.* p. 77 (1899); *Trouessart, Cat. Mamm., Suppl.* p. 63, n. 545 (1904).

*Fur*.—Tibia clothed above quite or nearly to ankle; distribution of fur otherwise as in *Buliongeteris*.

*Colour*.—Cotypes so faded as to be unsuitable for description. Temminck, in 1825 (*l. c.*), described the colours as follows: "Les poils du dos de deux couleurs, d'un blanc jaunâtre à la base et d'un cendré noirâtre à la pointe; nuque, sommet de la tête et museau noirs; des poils divergens d'un centre commun sur les côtés du cou, servant probablement à couvrir un appareil dont suinte une humeur odorante. Toutes les autres parties inférieures d'un blanc jaunâtre et terne; système cutané d'un brun foncé."

*Measurements*. On pp. 676, 678, 680.

*Specimens examined*. The cotypes of the species (the only examples known).

*Range*. Java; thus far known only from Bantam, Java.

*Cotypes*. Species based on "des individus montés et le squelette," obtained by Van Hasselt "dans les régions montueuses du district de Bantam"; only a few individuals were found, suspended from a tree. The following specimens, all of which must be considered cotypes, are in the Leyden Museum: (1-2) two mounted adult females, "a" and "b," skull of "a" extracted (marked "b"), skull of "b" in situ; (3) the skeleton of an adult female, "a"; and (4) an odd skull, "c." The mounted female "b" is figured in *Mon. Mamm.* i. pl. xii., the skeleton, *ibid.* pl. xvi. fig. 3; the original of pl. xxxv. fig. 10 (head in profile) is uncertain. The mounted specimens are rather well-preserved, except for the fading of the colours; the skeleton tolerably complete; of the skulls, that of the skeleton is nearly complete, the two others more or less defective.

24. THOOPTERUS, *Matschie*.

*Cynopterus* (pt.), Dobson, Cat. Chir. B. M. p. 80.

1899. *Thoopterus*, *Matschie*, *Megachir*. pp. 72, 77 . . . . Type.  
Th. *nigrescens*.

*Cynopterus* (pt., *nec F. Cuv.*), Gray, Cat. Monk. &c. p. 121 (1870 : = *Cynopterus* + *Thoopterus* + *Myonycteris*); Dobson, Cat. Chir. B. M. p. 80 (genus), p. 81 (subg. = *Cynopterus* + *Chironax* + *Thoopterus*) (1878).

*Thoopterus* (pt.), *Matschie*, l. s. c. (1899: subg. of *Cynopterus* = *Thoopterus* + *Chironax* + *Sphærias*); Müller, Fam. & Gen. Bats, p. 50 (1907: genus = *Thoopterus* + *Dyacopterus*).

*Diagnosis*.—Cynopterine group. No postorbital foramina; incisors  $\frac{2}{2}$ — $\frac{2}{2}$ , upper canine grooved, cheek-teeth  $\frac{4}{5}$ ,  $p_4$  and  $m_1$  extremely broad, quadrate, with large surface cusps, and the inner ridge quite obsolete. Tail rudimentary, membranes from second toe. Forearm about 73 mm. [One species. *Hab.* Moluccas and Celebes.]

*Skull* (fig. 56).—General shape as in *Cynopterus*. Rostrum unmodified; premaxillæ slender, tapering above, in simple contact



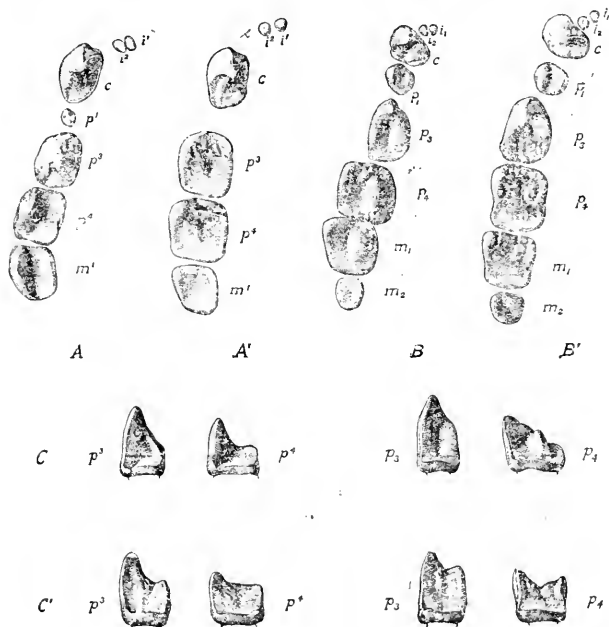
Fig. 56.—*Thoopterus nigrescens*, ♀, type of species.  $\frac{1}{2}$ .

anteriorly; row of upper incisors in sharp profile of rostrum (one canine covering the other) partly hidden between canines. Front of orbit above back of  $p_4$ ; maxillary tooth-row not extending beyond ventral margin of orbit. Postorbital foramina entirely absent. Zygomata thin, not more divergent posteriorly than in *Cynopterus*; sagittal crest fully developed, but low. (Posterior portion of skull unknown.)

*Dentition* (figs. 56, 57).—Dental formula as in *Cynopterus*:—  

$$\frac{i^1 i^2 c p^1 p^3 p^4 m^1}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2} \times 2 = 30^*.$$

Upper and lower incisors subterete,  $i^2$  slightly shorter than  $i^1$ . Upper canine with a broad and deep vertical groove on antero-medial surface, extending to base but not quite to tip of crown; no secondary (cingulum) cusp; cingulum of lower canine forming a thickened cusp-like lobule at inner base of tooth ending abruptly at level of tips of incisors.  $p^1$  small, slightly heavier in section



TERZ.

Fig. 57.—A, B, C. *Thoopterus nigrescens* (type of species).

A', B', C'. *Dyacopterus spadiceus* (type of species).

A, A', upper right, B, B', lower left tooth-rows.

C, C', right  $p^3$ ,  $p^4$ , and left  $p_3$ ,  $p_4$ , viewed from behind.

$\frac{1}{2}$  (linear).

than an upper incisor;  $p_1$  unmodified.  $p^3$ — $m^1$  and  $p_3$ — $m_1$  short and very broad, the increased breadth particularly conspicuous in  $p_4$  and  $m_1$ , which are even much broader than ramus of mandible at

\* The type skull of *Th. nigrescens* has three lower incisors, without any space left for the missing one, which is apparently the left  $i_2$  (see fig. 56 front view).

their alveoli. Inner cusp of  $p^3$  absent (or fused with outer), that of  $p_3$  completely fused with outer (see fig. 57). Inner ridges of  $p^4$  and  $m^1$  very low, those of  $p_4$  and  $m_1$  perfectly obsolete, the inner edge of these teeth being even on a lower level than the crushing surface (fig. 57).  $p_4$  and  $m_1$  with a large, central, freely projecting surface tubercle (or rather longitudinal ridge).  $m^1$  and  $m_1$  nearly as large as, respectively,  $p^4$  and  $p_4$ .  $m_2$  similar in size to  $p_1$ .

*Palate-ridges*.—Unknown (probably not differing essentially from those of *Penthetor*).

*External characters*.—Tail reduced to a rudiment more easily discovered by the touch than by the eye. Calcar unmodified. Wings from first phalanx of second toe. Pollex slightly shorter than in *Cynopterus*; all other digits conspicuously longer, owing to an increase in the length of all metacarpals, of both phalanges of third digit and proximal phalanx of fourth, whereas the proximal phalanx of the fifth is unmodified in length, the distal phalanx of same digit even a little shorter than in *Cynopterus* (see table below, showing in upper row the wing-indices of *Thoopterus* based on one specimen, in lower row those of *Cynopterus*). Fur of single species known longer than usual in *Cynopterine* bats and extending thickly on upperside of tibia and metatarsus.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1900	361	476	109	122	691	510	585	660	394	?	680	306	306
1000	389	428	121	119	640	429	568	599	326	378	625	305	336

*Affinities*.—The absence of postorbital foramina, the grooved upper canines without cingulum cusps, the peculiar structure of the check-teeth, the greatly increased breadth of  $p_1$  and  $m_1$ , the reduction of the tail to a mere spicule, and the different insertion of the membranes on the hind feet are the principal characters distinguishing this genus from *Cynopterus*. In Indo-Malaya it is represented by the genus *Penthetor*, and phylogenetically both genera are probably more closely connected with *Balionycteris* and *Chironax* (no postorbital foramina) than they are with *Cynopterus* (large postorbital foramina).

*History in literature*.—As originally described by Matschie (1899), *Thoopterus* formed a subgenus under *Cynopterus*, numbering three species, *nigrescens* (type), [*Chironax*] *melanocephalus*, and [*Sphaerias*] *blanfordi*. Miller (1907) removed *melanocephalus* and *blanfordi* from *Thoopterus* (placing the former in *Cynopterus*, the latter in a distinct genus, *Sphaerias*), but included "*Cynopterus*" *spadiceus*. As pointed out elsewhere (p. 653), *spadiceus* must be generically separated from *Thoopterus*, leaving *nigrescens* as the only known species of this genus.

1. *Thoopterus nigrescens*, Gray.

*Cynopterus latidens*, Dobson, Cat. Chir. B. M. p. 86.

*Cynopterus marginatus* var. *nigrescens*, Gray, Cat. Monk. &c. p. 123 (1870: Morotai).

*Cynopterus* [*Thoopterus*] *nigrescens*, Matschie, Megachir. p. 77 (1899: Menado); Trouessart, Cat. Mamm., Suppl. p. 62, n. 544 (1904).

*Cynopterus nigrescens*, Willink, Nat. Tijds. Ned. Ind. lxx. p. 277 (1905).

*Thoopterus nigrescens*, Miller, Fam. & Gen. Bats, p. 50 (1907).

*Cynopterus latidens*, Dobson, Cat. Chir. B. M. p. 86, pl. v. fig. 3 (teeth) (June, 1878: Morotai); Trouessart, Rev. & Mag. Zool. (3) vi. p. 207, n. 325 (1879); Jentink, Cat. Syst. Mamm. p. 155 (1888: Menado); ? Elera, Cat. Sist. F. Filip. p. 7 (1895: Luzon, the provinces Laguna and Batangas); Trouessart, Cat. Mamm. i. p. 86, n. 459 (1897); A. B. Meyer, Abh. Mus. Dresden, vii. n. 7, p. 7 (1899: Minahassa).

*Fur*.—Much longer than in *Cynopterus*, length on centre of back 9 mm., on belly 8 mm. Tibia and metatarsus densely clothed above.

*Colour* (type, female).—Back warm Prout's brown, underfur pale drab-grey; head similar, but slightly darker, nape of neck paler. Underparts, from chin to interfemoral, hair-brown, slightly shaded with a warmer brown on flanks and sides of breast and belly. Ears and membranes unmarked; metacarpals and phalanges (dried) dark brown.

*Measurements*. On pp. 676, 678, 680.

*Specimens examined*. Three, viz. the type, one mounted adult female from Menado in the Berlin Museum (Faber coll., skull out, much broken), and one mounted subadult male in the Leyden Museum (same locality and collector, skull in).

*Range*. Known with certainty from the Gilolo group (Morotai) and Celebes (Menado and Minahassa). Recorded in literature (Elera, l. c.) also from the provinces of Laguna and Batangas, island of Luzon.

*Type* in collection.

a. ♀ ad. sk.; skull. Morotai. Dr. A. R. Wallace [C.]. 62.10.21.6.  
(Type of species and of *C. latidens*, Dobson.)

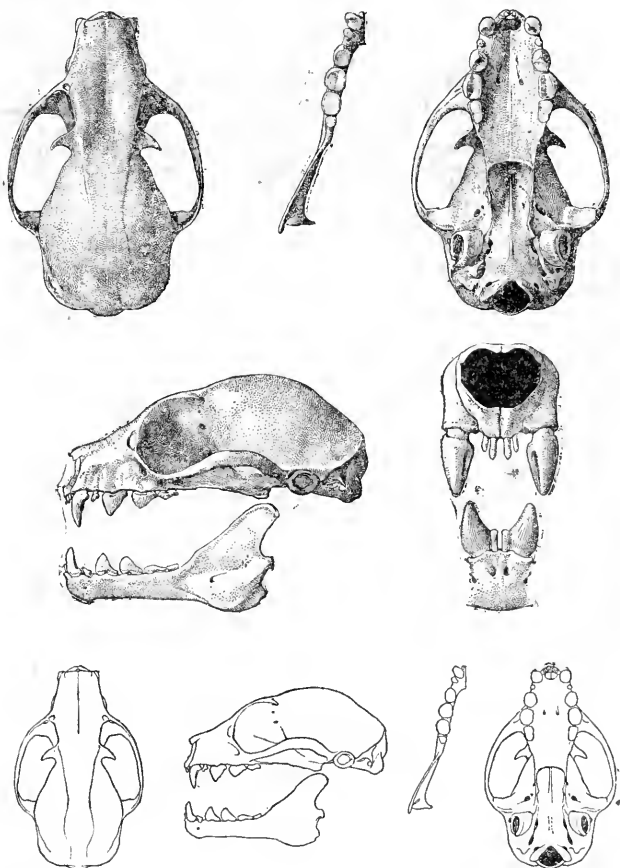
25. *PENTHETOR*\*, gen. n.

Type: *P. lucasi*.

*Ptenochirus* (pt., nec *Pet.*), Dobson, Ann. & Mag. N. II. (5) vi. p. 164 (1880: subg. of *Cynopterus* = *Ptenochirus* + *Penthetor*); Matschie, Megachir. p. 77 (1899: genus, divided into two subgenera, *Ptenochirus* (= *Ptenochirus* + *Penthetor*) and *Megacerops*); Miller, Fam. & Gen. Bats, p. 51 (1907: = *Ptenochirus* + *Penthetor*).

\* Πενθήτωρ, a mourner; in allusion to the general dark colour of the fur of the single species, and the absence of brighter-coloured neck-tufts in either sex.

*Differential characters.*—Similar to *Thoopterus*, but with only one pair of lower incisors ( $i_1$  absent), outer upper incisor reduced to half the length of inner,  $p_4$  and  $m_1$  without surface cusps, tail similar in length to that of *Cynopterus*, membranes from first toe. Forearm 58–63 mm. [One species. *Hab.* Borneo and Malay Peninsula.]



TERZ.

Fig. 58.—*Penthetor lucasi*, ♂. Singapore. No. 94.6.19.4.  
Shaded figures  $\frac{2}{3}$  (linear) (except front view, which is  $\frac{3}{4}$ ), outlines  $\frac{1}{2}$ .

*Skull* (fig. 58).—General shape quite as in *Cynopterus*, except

for the relatively distinctly longer brain-case (compare fig. 58 with fig. 48, p. 588). Rostrum relatively shorter than in *Thoopterus*, front of orbit above front (in *Thoopterus* above back) of  $p^1$ ; premaxillæ narrow, in simple contact anteriorly. Maxillary tooth-rows extending considerably behind ventral margin of orbit (*i. e.* posterior margin of zygomatic process of maxillary), the anterior point of that margin being opposite the anterior third or fourth of  $m^1$  (in *Cynopterus* and *Thoopterus* opposite back of  $m^1$ ); postdental palate somewhat less than one-third of median palatal length (thus shorter than in *Cynopterus*; in reality both the bony palate as a whole and that portion of the palate which is situated behind the zygomatic processes are in *Penthetor* exactly of the same relative length as in *Cynopterus*, and the shorter postdental palate in the former genus is due only to the tooth-rows extending further backward). Postorbital foramina entirely absent; foramen rotundum and ovale usually separated (fused in three skulls, 97.9.5.2, 9.4.1.62, and 9.4.1.66, of twenty examined). Zygomata thinner than in *Cynopterus*, supraorbital processes shorter, temporal ridges sometimes closely approximated but never fused to form a sagittal crest, coronoid process narrow antero-posteriorly, more sloping than in *Thoopterus*, but scarcely more so than in *Cynopterus brachyotis*.—As evident from the above and from a comparison of the skull figures 58 and 48, the *Penthetor* skull differs from that of *Cynopterus* chiefly by the absence of supra-orbital foramina, the shorter and broader nasals, by having the upper tooth-rows extending further backward, and the foramen ovale and rotundum usually separated; from that of *Thoopterus* (which is, however, only imperfectly known) by the rather shorter rostrum and more backwardly extending upper tooth-rows.

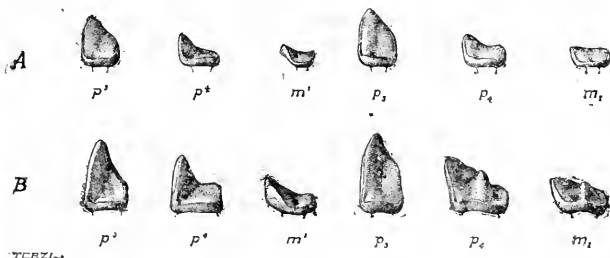


Fig. 59.—Right  $p^3$ ,  $p^4$ ,  $m^1$ , and left  $p_3$ ,  $p_4$ ,  $m_1$ , viewed from behind, of  
A, *Penthetor lucasi* (type of species), and  
B, *Thoopterus nigrescens* (type of species).  
‡ (linear).

Dentition (figs. 58, 59).—Dental formula as in *Ptenochirus* and

$$\text{Megacerops:—} \frac{i^1 i^2 c p^1 p^3 p^4 m^1}{i_2 c p_1 p_3 p_4 m_1 m_2} \times 2 = 28.$$

Dental characters closely similar to those of *Thoopterus*, but all incisors narrower and more sharply pointed,  $i^2$  reduced to about half the length of  $i^1$ ,  $i_1$  entirely absent, canines without trace of cingulum cusps (inner edge of lower canines often slightly thickened at base), and  $p_1$  and  $m_1$  without surface elevations. Upper canines with a vertical groove on antero-medial surface, but the groove shallower than in *Thoopterus*;  $p^3-m^1$  and  $p_3-m_1$  shortened and broadened to quite or very nearly the same extent as in *Thoopterus*;  $p^3$  and  $p_3$  unicuspid; inner ridge of  $p^4$ ,  $m^1$ , and  $p_1$  and both outer and inner ridge of  $m_1$  very low or practically obsolete, the crushing surface of  $m_1$  therefore nearly perfectly flat.

*Palate-ridges*.—Not differing essentially in number and arrangement from those of *Cynopterus* (fig. 50, p. 591).

*External characters*.—Odontoid papillæ on inner side of lips as in *Cynopterus* (*Thoopterus* unknown in this respect, but probably not differing). Ear broadly rounded off above as in *Thoopterus*; antitragal lobe distinct but small. Tibia unusually long, little less than one-half (in all the foregoing Cynopterine genera little more than one-third) of forearm. Tail very thin, length rather more than half of hind foot with claws, thus apparently not quite so much reduced as in *Thoopterus* (of which, however, only skins have been examined). Calcar unmodified. Membranes inserted on tip of first metatarsal (as in *Cynopterus*; in *Thoopterus* on second toe); vertical fasciæ of mesopatagium numerous and crowded (in *Cynopterus* much fewer and more spaced). Pollex and second digit distinctly shorter than in *Cynopterus*, third and fourth digits somewhat longer (chiefly owing to a lengthening of the distal phalanges), fifth slightly shorter (see table below, the upper row of which shows the wing-indices of *Penthetor*, calculated from twenty specimens, the second row those of *Cynopterus*, the third those of *Thoopterus* for comparison). Fur of single species known much shorter and more closely adpressed than in *Thoopterus*.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	357	456	97	109	650	423	602	609	331	398	617	278	327
1000	389	428	121	119	640	429	563	599	326	378	625	305	336
1000	361	476	109	122	694	510	585	660	394	?	680	306	306

*Secondary sexual characters*.—None (males and females without neck tufts and not differing in size nor in colour).

*Affinities*.—*Penthetor* is, without doubt, the Indo-Malayan representative of the Austro-Malayan *Thoopterus*. As evident from the description above, its principal claim to stand as a genus distinct from *Thoopterus* is the absence of  $i_1$  and shortening of  $i^2$ . In addition to this, the tooth-rows extend further backward, the



incisors are more sharply needle-pointed, the premolars and molars, though in outline and characters otherwise very similar to those of *Thoopterus*, lack all trace of the surface cusps so conspicuous in that genus, the tail is not reduced to a mere spicule, the insertion of the membranes on the hind feet is different, the digits considerably shorter, and the tibia unusually long.

*History in literature.*—The single species of the present genus was named by Dobson (1880) "*Cynopterus (Ptenochirus) lucasi*"; he classed it as a *Ptenochirus*, evidently because it, like *Ptenochirus jagori*, has only one pair of lower incisors; but he probably knew *Pt. jagori* only or chiefly from Peters's brief description. Matschie (1899), on the other hand, knew *Pt. jagori* from personal inspection, but had not seen *lucasi*; he left the latter, therefore, where it was placed by Dobson. Miller (1907) was well-acquainted with *lucasi*, but *jagori* he knew only from figures and descriptions; thus he, like his predecessors, allowed the two species to stand together in *Ptenochirus*. The fact is, however, that, in spite of the number of lower incisors being the same in *jagori* and *lucasi*, they represent widely different branches of Cynopterine bats, *Ptenochirus jagori* being very closely allied to *Cynopterus*, *Penthetor lucasi* to *Thoopterus*. Systematists desirous of reducing the large number of monotypic genera within the Cynopterine section of Fruit-bats might conceivably propose to consider *Ptenochirus (jagori)* a subgenus of *Cynopterus*, and *Penthetor (lucasi)* a subgenus of *Thoopterus*; from the point of view of a natural classification of these bats there would, in fact, be no very serious objection to such proposal; but it would be impossible to place *jagori* and *lucasi* together in one genus, except on condition that all Cynopterine bats (except *Nyctimene*), irrespective of cranial, dental, and external differences, are considered congeneric.

### 1. *Penthetor lucasi*, Dobson.

- Cynopterus (Ptenochirus) lucasi*, Dobson, *Ann. & Mag. N. H.* (5) vi. p. 163 (1 Aug. 1880: Sarawak); Trouessart, *Cat. Mamm.* i. p. 86, n. 463 (1897).  
*Cynopterus lucasi*, Everett, *P. Z. S.* 1893, p. 494; Hose, *Mamm. Borneo*, p. 38 (1893); Jentink, *Notes Leyd. Mus.* xix. p. 50 (1897: Ruma Manual and Gunong Dadap, Kapuas R., W. Borneo); Hanitsch, *Ann. Rep. Raffles Libr. & Mus.* 1897, p. 11 (1898: Selangor); Thomas, *Ann. & Mag. N. H.* (7) i. p. 361 (1898: Singapore); S. S. Flower, *P. Z. S.* 1900, p. 341 (Selangor: Singapore); Bonhote, *P. Z. S.* 1900, p. 875 (1901: Ulu Selama, Perak); Willink, *Nat. Tijd. Ned. Ind.* lxxv. p. 277\* (1905).  
*Ptenochirus lucasi*, Matschie, *Megachir.* p. 79 (1899); Trouessart, *Cat. Mamm., Suppl.* p. 63, n. 548 (1904); Miller, *Fam. & Gen. Bats*, p. 51 (1907); Elliot, *Cat. Mamm. Field Col. Mus.* p. 495, n. 873 (1907: Borneo); Kloss, *J. Fed. Mal. St. Mus.* ii. p. 153 (1908); G. M. Allen, *Bull. Mus. Comp. Zool. Harv. Coll.* lii. n. 3, p. 27 (1908: Sarawak)

\* Misspelt *C. lucassii*.

*Fur*.—Shorter and more closely adpressed than in *Cynopterus* (but not quite so short and thinly spread as in *Dyacopterus spadiceus*); length on back 4-5, on belly 3-4 mm. Neck much more thinly haired than back; upperside of forearms clothed for proximal third, tibiae naked above.

*Colour*.—The whole series of adult skins in collection (specimens from Borneo and the Malay Peninsula are precisely alike in colour, nor is there any appreciable sexual colour-difference): Back as a rule a rather dark, sooty tinge of brown, in some individuals distinctly brighter, more approaching typical vandyck-brown; head similar to back or darker. Underparts varying from hair-brown to drab-grey, always rather paler along middle of breast and belly, and more tinged with pale brown on sides of breast and belly and flanks. Nape of neck similar to back but much lightened by admixture of pale greyish hairs; sides of neck and foreneck similar to centre of breast. Ears and membranes unmarked; metacarpals and phalanges (dried) blackish.

Immature individuals are darker above and below (though the difference from the darkest-coloured adults is small): Back and head nearly blackish brown, underparts hair-brown suffused with a warmer brown on sides of breast and belly and flanks; nape of neck similar to back but much lightened with greyish; sides of neck and foreneck similar to underparts or slightly lighter.

*Measurements*. On pp. 676, 678, 680.

*Specimens examined*. Thirty-two (twenty-one skins, twenty-two skulls), from the following localities:—Singapore (twelve); Bintang (four); "Borneo" (one); Sarawak (one); Mt. Mulu, Sarawak (eight); Barito River, C. Borneo (three),—all in collection (three duplicates).

*Range*. Malay Peninsula (Selangor; Perak; Singapore); Rhio Archipelago (Bintang); British Borneo (Sarawak); Dutch Borneo (Kapas R.; Barito R.).

*Type* in collection. Skull (lambda to gnathion) 29.3, rostrum (orbit to nares) 7, c-m<sup>1</sup> (crowns) 10.3, forearm 59.5, third metacarpal 39.5, ear from orifice 14.5, tibia 28.5 mm.

a. ♂ ad. al.	Singapore.	H. N. Ridley, Esq. [P.].	96.4.15.3.
b-g. 3 ♂ ad., 1 ♀ ad., 2 ♀ imm. sks.; skulls.	Singapore.	H. N. Ridley, Esq. [P.].	97.9.5.1-6.
h, i. ♂ ad., ♀ ad. al.; skull of no. 4.	Bukit Timah, Singapore; 24 Sept. 1893 (H. N. Ridley).	Singapore Museum [E.].	94.6.19.4, 5.
j-l. 2 ♂ ad., 1 ♀ ad. sks.; skulls.	Bukit Timah, Singapore, 500'; Aug. 1908 (H. N. Ridley).	Government, Federated Malay States [P.].	9.4.1.60-62.
m-p. 2 ♂ ad., 2 ♀ ad. sks.; skulls.	Tanjong Tombah, Bintang, 5, 6 June, 1908 (H. C. Robinson & E. Scimund).	Government, Federated Malay States [P.].	9.4.1.63-66.
q. ♂ ad. al.; skull.	Borneo.	Purchased (Low).	47.12.30.4.

r. ♂ subad. al.; skull.	Sarawak (F. A. Lucas).	Surg.-Gen. G. E. Dobson [E.].	80.8.13.1.
s. t. ♂ ad., ♀ subad. sks.; skulls.	Mt. Mulu, Sarawak, 2000'; Oct. 1893.	Dr. Ch. Hose [C.].	(Type of species.) 94.9.29.1, 2.
u-w. ♂ ad., ♂ pull., ♀ ad. al.; skull of no. 11.	Mt. Mulu, Sarawak.	Dr. Ch. Hose [C.].	94.9.29.11-13.
x-z. 2 ♂ ad., 1 ♂ juv. al.	Upper Sarawak.	C. J. Brooks, Esq. [P.].	11.1.18.1-3.
a <sup>2</sup> -c <sup>2</sup> . 1 ♂ ad., 2 ♀ ad. sks.; skulls.	Puruk Tjahu, Barito R., C. Borneo, 115'; 3 Sept. 1909 (Guy C. Shortridge).	Oldfield Thomas, Esq. [P.].	10.4.5.44-46.

## 26. SPHÆRIAS, Miller.

1906. Sphærias, Miller, *Proc. Biol. Soc. Wash.* xix. p. 83 (4 June, 1906) ..... Type. S. blanfordi.
- Cynopterus (pt., nec F. Cuv.), Thomas, *Ann. Mus. Civ. Genova*, (2) xxx. p. 884 (1891).
- Thoopterus (pt.), Matschie, *Megachir.* pp. 72, 77 (1899: subg. of *Cynopterus* = *Thoopterus* + *Chironax* + *Sphærias*).
- Sphærias, Miller, *l. s. c.* (1906); *id.*, *Fam. & Gen. Bats*, p. 53 (1907).

*Diagnosis*.—Cynopterine group. Cranial rostrum somewhat longer and much lower than usual, premaxillæ directed obliquely forward, postorbital foramina absent, brain-case distinctly deflected. Incisors  $\frac{2}{2}$  -  $\frac{2}{2}$ , cheek-teeth  $\frac{4}{5}$ ; incisors slanted forward, canines outward; crowns of incisors peculiarly differentiated, triangularly pointed; premolars and molars narrower than usual. Interfemoral not extending beyond upper half of tibia; tail and calcar absent. Forearm about 50 mm. [One species. *Hab.* Burma.]

*Skull* (fig. 60).—Rostrum longer and much lower than in *Cynopterus*; front of orbit above front of m<sup>1</sup>; distance from orbit to tip of internasal suture slightly more (in *Cynopterus* less) than breadth across lower edges of lachrymal foramina; orbit to nares slightly (in *Cynopterus* much) less than same breadth; depth of rostrum, from internasal suture to alveolus of i<sup>2</sup>, only subequal to (in *Cynopterus* nearly twice) the breadth of the whole row of upper incisors; supraorbital margin much less inflated than in *Cynopterus*. Premaxillæ directed obliquely anteriorly (not chiefly downward, as in *Cynopterus*), in simple contact below; row of upper incisors situated entirely in front of a line connecting fronts of canines. Postorbital foramina absent. Postorbital processes very short; zygomata thin, only very slightly curved upward posteriorly; temporal fossa narrow; no sagittal crest. Brain-case distinctly deflected, alveolar line if projected backward passing slightly above (in *Cynopterus* considerably below) glenoid fossa of squamosal. Palate essentially unmodified; maxillary tooth-rows extending backward nearly to ventral margin of orbital cavity.

Foramen rotundum and ovale separated. Tympanics unmodified. Occipital region unknown. Horizontal rami of mandible low, coronoid low, narrow, and much sloping (coronoid height of mandible much less than  $c-m_2$ ), angular process less prominent than in *Cynopterus*, condyle below level of alveolar line.

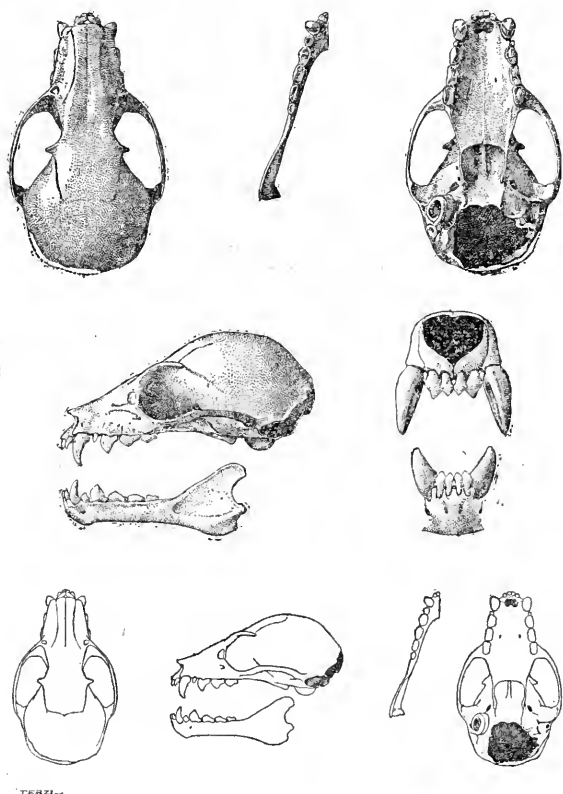


Fig. 60.—*Sphærias blanfordi*, ♀ subad., cotype of species (90.4.7.6). Shaded figures  $\frac{2}{3}$  (linear) (except front view, which is  $\frac{1}{2}$ ), outlines  $\frac{1}{2}$ .

*Dentition* (fig. 60).—Dental formula unmodified Cynopterine:—  

$$\frac{i^1 i^2 c p^1 p^3 p^4 m^1}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2} \times 2 = 30.$$

Upper and lower incisors proclivous; crowns highly differentiated, triangularly pointed, very different from the simple

subterete incisors of other Cynopterine bats. Canines above and below slanted considerably outward (see figure of front view of skull), cingulum narrow, without secondary cusp; a deep vertical groove on antero-medial surface of upper canines extending nearly from base to tip of crown. Premolars and molars unmodified in structure, but narrower than usual,  $p^4$ ,  $m^1$ ,  $p_4$  and  $m_1$  nearly twice as long as broad.

*Palate-ridges* unknown.

*External characters*.—Odontoid papillæ on inner side of lips few and small (as in *Rousettus* and *Megachiroptera* in general), very different from the numerous, large, and crowded papillæ of other Cynopterine bats. Ears similar in size and shape to those of *Cynopterus*, somewhat narrowly rounded off above, with posterior margin slightly concave below tip (anterior margin narrowly edged with white in single species known, as in *Cynopterus*); antitragal lobe small, triangular. Tail entirely absent. Interfemoral reduced to a narrow rim along femur and upper half of tibia; calcar absent. Membranes inserted on first toe, as in *Cynopterus*, but further backward, on distal half of first phalanx; vertical fasciæ of mesopatagium (those crossing internal cutaneous line) about ten, rather fewer and more widely spaced than in *Cynopterus*. Third and fourth digits distinctly longer than in *Cynopterus* (in upper row of subjoined table wing-indices of *Sphærias*, from type, a slightly immature specimen; in lower row those of *Cynopterus*). Fur long and dense, with hind limb thickly clothed above to claws.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	376	406	149	129	683	116	584	624	356	416	624	297	347
1000	389	425	121	119	640	129	568	599	326	378	625	305	336

*Affinities*.—This genus stands in many respects perfectly isolated among the Cynopterine Fruit-bats. It must use its incisors in a way different from that of its relatives, as clearly shown by their remarkably proclivous position and peculiarly modified shape; probably as consequences of the modified use, direction, and form of the incisors, the premaxillæ also are proclivous, and the rostrum somewhat lengthened and very low anteriorly [in the forward slant of the premaxillæ and incisors, the outward slant of the canines, and the general form of the facial portion of the skull *Sphærias* rather strongly recalls the Macroglossine genus *Syconycteris*]. On the other hand, the premolars and molars are evidently less energetically used, hence conspicuously narrower than usual, and, in consequence of this, the temporal muscle weak, the temporal fossa narrow, the postorbital processes very small, the zygomata thin and nearly horizontal, the sagittal crest undeveloped, the coronoid

process low, narrow, and much sloping, and the basicranial deflected against the facial axis; also the great decrease in size and number of the odontoid lip papillæ (otherwise so characteristic of the Cynopterine bats) may come under this category of interdependent modifications. The complete suppression of the tail is a character exhibited by several other Cynopterine genera, but *Sphærias* is unique in this group of genera in having the interfemoral reduced to a narrow rim along the femur and the upper part of the tibia (parallels or approximations are found in a few unrelated genera, e. g., *Plerotes* among Epomophorine, *Syconycteris* among MacroGLOSSINE bats); the absence of the calcar is, of course, due to the fact that the interfemoral terminates far above the ankle.

### 1. *Sphærias blanfordi*, Thos.

*Cynopterus blanfordi*, Thomas, *Ann. Mus. Civ. Genova*, (2) x. p. 884 (25 June, 1891: Karin Hills); *Blanford, Faun. B. Ind., Mamm.* pt. ii. p. 265 (1891); Thomas, *Ann. Mus. Civ. Genova*, (2) x. p. 921, pl. xi. figs. 1, 2 (interfemoral; ear) (1892: Leito, Cheba, Karin Hills, 1000 m.); Trouessart, *Cat. Mamm.* i. p. 86, n. 469 (1897). *Cynopterus* [Thoopterus] *blanfordi*, Matschie, *Megachir.* p. 77 (1899); Trouessart, *Cat. Mamm., Suppl.* p. 63, n. 546 (1904). *Sphærias blanfordi*, Miller, *Proc. Biol. Soc. Wash.* xix. p. 83 (1906); *id.*, *Fam. & Gen. Bats*, p. 53 (1907).

*Fur*.—Longer and denser than in *Cynopterus*; longest hairs on back 10–11, on breast and belly 6–7 mm. Fur of upper surface extending thickly on basal third or half of forearm, on membrane just outside the latter, on membrane between elbow and ankle, and on the whole of the hind limb to the bases of the claws.

*Colour* (type, a slightly immature female, alcoholic).—Nape of neck, back, rump, and tibiæ dull greyish hair-brown, suffused with a warmer (Prout's) brown on nape, spinal region, and along membranes; occiput slightly paler than back; crown and interocular region a little browner. Underparts uniform dull greyish hair-brown, faintly duller than back. Ears narrowly edged with white anteriorly; metacarpals brownish, membranes unmarked.—The colour of fully adult individuals may differ in some details.

*Measurements*. On pp. 676, 678, 680.

*Specimen examined*. The cotype catalogued below.

*Range*. Known only from the type locality, Karin Hills. Burma.

*Cotype* in collection; a second cotype (male, "forearm 50 mm.," Thomas, *l. c.*) and a paratype are in the Genoa Museum; these three being the only specimens on record (March, 1911).

*a.* ♀ subadult: skull. Leito, Cheba, Karin Hills, Genoa Museum 90.4.7.6. 1000 m. (*L. Fea*). [P.]. (Cotype of species.)

## Ptenochirus, Megarops, Dyacopterus, and Balionycteris: External measurements.

<i>Pl. jayori.</i>			<i>M. caudatus.</i>			<i>D. spadiceus.</i>	<i>B. maculata.</i> 5 ad.	
♂ ad. Type. mm.	♂ ad. Cunningham. mm.	♀ ad. Mindoro. mm.	♀ ad. Type. mm.	♀ ad. Bidor. mm.	♀ ad. Kina Balu. mm.	♀ ad. Type. mm.	Min. mm.	Max. mm.
Forearm .....	81	84.5	80	56.5	54	55	39	41.5
Pollex, total length, c. u. ....	34	34.5	33	...	21.5	...	16	17
" metacarpal .....	10.5	11	11	...	6	6.5	5	5.5
1st phalanx .....	19	18.5	16.5	...	12	12.5	12	7.5
2nd digit, metacarpal .....	34.5	35	36	...	24	...	35.5	19.5
" 1st phalanx .....	11	10.5	10	7.5	5.5	...	8.5	4.5
2nd 3rd phalanx c. u. ....	11.5	10.5	10.5	7	6	...	9.5	5
3rd digit, metacarpal .....	50.5	56	53	37.5	35	...	54.5	5.5
" 1st phalanx .....	34.5	38	35.5	26.5	24.5	26.5	35	29.5
" 2nd phalanx .....	47	51	49	33.5	31	...	42.5	21.5
" 1st phalanx .....	48.5	52	49	35.5	33	...	52.5	25.5
" 2nd phalanx .....	26.5	29.5	28	20.5	18	20.5	27.5	28.5
" 2nd phalanx .....	30.5	32.5	29.5	21.5	19	21.5	15.5	17
" 5th digit, metacarpal .....	50.5	53.5	51.5	37.5	33.5	35.5	53.5	15
" 1st phalanx .....	24.5	26.5	24.5	17.5	16.5	18	23.5	16.5
" 2nd phalanx .....	27.5	30	26	18.5	16.5	18	22.5	14
Ear, length from orifice .....	18	18.5	...	...	13	...	13.5	14.5
" greatest breadth, flattened ..	12	13	...	...	11	...	9	9.5
Tail .....	11.5	11	...	...	0	...	7	7.5
Tibia .....	32	31.5	30	...	19.5	...	...	0
Foot, c. u. ....	21	20.5	...	...	12	...	27	13
Calcaneal .....	8.5	8.5	...	...	5.5	...	8.5	9
							4.5	4.5

## Chironax, Thoopterus, Penthetor, and Sphaerias: External measurements.

	<i>Ch. melanocephalus.</i>		<i>Th. nigrescens.</i>	<i>P. lucasi.</i> 23 ad.		<i>S. blanfordi.</i>
	♀ ad. Cotype. mm.	♀ ad. Cotype. mm.	♀ ad. Type. mm.	Min. mm.	Max. mm.	♀ subad. Cotype. mm.
Forearm .....	43	45	73.5	58	63	50.5
Pollex, total length, c. u. ....	...	...	26.5	20	23	19
" metacarpal .....	...	...	8.5	7	8	5
" 1st phalanx .....	...	...	14.5	9	11	9
2nd digit, metacarpal .....	19.5	18.5	35	24	28	20.5
" 1st phalanx .....	4.5	4.5	8	5	6.5	7.5
" 2nd-3rd phalanx, c. u. ....	5.5	6	9	6	7	6.5
3rd digit, metacarpal .....	27.5	28.5	51	37	41	34.5
" 1st phalanx .....	21	22	37.5	24	27.5	22.5
" 2nd phalanx .....	27.5	28	43	34	38	29.5
4th digit, metacarpal .....	26.5	26	48.5	34.5	39	31.5
" 1st phalanx .....	16	17	29	19	22	18
" 2nd phalanx .....	18	19	...	23	25.5	21
5th digit, metacarpal .....	27.5	28	50	35	39	31.5
" 1st phalanx .....	14.5	14.5	22.5	15	18	15
" 2nd phalanx .....	15	15.5	22.5	19	22	17.5
Ear, length from orifice .....	...	...	...	13.5	15	15
" greatest breadth, flattened .....	...	...	...	11	12	11
Tail .....	0	0	...	8	10	0
Tibia .....	?15	?16	?26.6	27.5	29.5	17.5
Foot, c. u. ....	...	...	20	13	15	12
Calcaneal .....	...	...	...	3.5	5	0



## Ptenochirus, Megarops, Dyacopterus, and Balionycteris: Measurements of skulls and tooth-rows.

	<i>Pt. jagori.</i>	<i>M. ecaudatus.</i>				<i>D. spadiceus.</i>	<i>B. maculata.</i> 4 ad.	
	♂ ad. Type, mm.	♀ ad. Mindoro, mm.	♂ ad. Type, mm.	♀ ad. Bidor, Kina Balu, mm.	♀ ad. Type, mm.	Min. mm.	Max. mm.	
Skull, lambda to gnathion .....	37	...	...	26.5	...	21.5	23.3	
" condylo-basal length.....	35	...	...	25.5	...	20.7	22.2	
" palation to incisive foramina .....	16.2	...	12.6	11.7	11.2	9	10.1	
" palation to basion .....	14.2	...	...	10.4	...	...	8.8	
" rostrum, length orbit to nares .....	8.5	8.5	7.2	6.4	6.7	4.6	5.5	
" rostrum, height at alv. of canine.....	...	...	...	5.7	5.8	...	...	
" width of brain-case at zygomatica .....	16	14.8	...	11.7	...	10	10.8	
" zygomatic width .....	24.8	24	...	17.8	...	14.5	15.8	
" across crowns of m <sup>1</sup> , externally .....	11.2	10.8	8.7	8.5	...	6.5	6.8	
" across crowns of p <sup>1</sup> , externally .....	11.7	11.2	...	...	...	6.8	7.1	
" lachrymal width .....	10	10.5	9.7	8.2	9	6.5	6.9	
" across crowns of canines, externally .....	8	8.5	6.2	6	6	5	5.2	
" premaxillae, depth at symphysis .....	...	...	...	...	...	...	...	
" postorbital width .....	7.2	6.8	6.8	6.5	6.2	4.8	5.7	
" interorbital width .....	6.8	7.2	6.2	5.5	...	4.8	5.2	
" mesopterygoid fossa, width. ....	4.7	...	...	3.8	4	2.8	3.2	
" between p <sup>1</sup> -p <sup>1</sup> .....	6.6	6.7	5.5	5.6	...	4.1	4.5	
" between bases of canines .....	3	3.2	3	2.8	2.7	2.2	2.7	
" orbital diameter .....	9.5	9.8	8.5	7.8	7.9	5.8	6.5	
" Mandible, length from condyle .....	28.5	28.8	...	19	19.7	15.8	17	
" coronoid height .....	16.7	16.2	...	9.8	10.2	8	...	
Upper teeth, c-m <sup>1</sup> (or m <sup>2</sup> ), crowns .....	13	13	9.1	8.7	8.8	7.5	7.8	
Lower teeth, c-m <sub>2</sub> , crowns .....	14.2	14.5	...	9.2	9.5	7.9	8.1	

## Chironax, Thoapterus, Penthetor, and Spharicus: Measurements of skulls and tooth rows.

	<i>Ch. melanocephalus</i> , 3 ad. cotypes.			<i>Th. nigrescens</i>			<i>P. lucasi</i> , 20 ad.			<i>S. blanfordi</i> .	
	Mus.	Max.		♀ ad. Type.	Min.	Max.		Min.	Max.		♀ subad. Cotype.
	mm.	mm.		mm.	mm.	mm.		mm.	mm.		mm.
skull, lambda to gnathion .....	22.5	...		...	28.6	31.2		...	...		...
" condylo-basal length.....	21	10		...	27.5	30		...	...		...
" palation to incisive foramina .....	9.5	...		...	11.8	13.7		...	...		11
" palation to basion.....	8.2	5.3		...	10.8	11.8		...	...		...
" rostrum length orbit to nares.....	5	...		9.1	6.2	7.3		...	...		6.8
" width of brain-case at zygomatic .....	10.2	...		...	12.7	14		...	...		12
" zygomatic width .....	14.2	...		...	18.2	20.3		...	...		15.5
" across crowns of m <sup>1</sup> , externally .....	...	...		12.8	7.8	9.2		...	...		8.2
" across crowns of p <sup>4</sup> , externally .....	6.9	7.2		...	8.3	10		...	...		...
" lachrymal width .....	6.1	6.5		9.2	7.8	9		...	...		7.3
" across crowns of canines, externally .....	4.8	5		8	5.2	6.3		...	...		6.3
" postorbital width .....	4.8	5		7.7	6.2	7.5		...	...		7.5
" interorbital width .....	4.5	4.8		8.7	5.2	6.2		...	...		5
" mesopterygoid fossa, width .....	2.8	3.2		...	3.7	4.5		...	...		4.2
" between p <sup>4</sup> -p <sup>4</sup> .....	4	4.2		7	4.8	5.6		...	...		5.5
" between bases of canines .....	2	2.3		3.7	2.3	3		...	...		3.1
" orbital diameter.....	5.6	5.9		8.5	7.5	8.5		...	...		6.2
" Mandible, length from condyle .....	16	16.8		27.8	20.5	22.8		...	...		19.8
" " coronoid height .....	7.8	8.7		14.5	10	12		...	...		7.5
" Upper teeth, c-m <sup>1</sup> , crowns .....	6.8	7.1		13	9.5	11.2		...	...		8.5
" Lower teeth, c-m <sub>2</sub> , crowns .....	7.6	7.8		14.5	10.2	11.8		...	...		9.7

## Ptenochirus, Megarops, Dyacopterus, and Balionycteris: Measurements of teeth.

	<i>Pt. jagori.</i>		<i>M. caudatus.</i>			<i>D. spadiceus.</i>	<i>B. maculata.</i> 4 skulls.	
	♂ ad. Type. mm.	♀ ad. Mindoro. mm.	♀ ad. Type. mm.	♀ ad. Bidor. mm.	♀ ad. Kina Balu. mm.	♀ ad. Type. mm.	Min. mm.	Max. mm.
p <sup>3</sup> , length .....	2.9	2.8	2	1.9	2	3.2	1.9	2
" width .....	2.3	2.5	1.7	1.7	1.8	2.8	1.5	1.7
p <sup>4</sup> , length .....	2.9	2.6	2.1	2	2	3	1.7	1.8
" width .....	2.3	2.3	1.6	1.7	1.6	2.8	1.5	1.5
m <sup>1</sup> , length .....	3.2	3	2	1.8	1.8	2.7	1.1	1.2
" width .....	2.1	1.8	1.2	1.3	1.2	2.5	0.9	1
m <sup>2</sup> , length .....	...	...	...	...	...	...	0.6	0.7
" width .....	...	...	...	...	...	...	0.4	0.4
p <sub>1</sub> , length .....	1.2	1.5	...	0.8	0.8	1.8	0.5	0.5
" width .....	1.5	1.7	...	1	1	1.6	0.5	0.5
p <sub>3</sub> , length .....	2.7	2.8	...	1.9	1.9	3.8	1.8	1.8
" width .....	2.2	2.4	...	1.6	1.8	2.2	1.3	1.5
p <sub>4</sub> , length .....	3	3	...	2	2	3.5	1.8	1.8
" width .....	2.2	2.3	...	1.7	1.8	2.8	1.4	1.5
m <sub>1</sub> , length .....	3.2	3	...	1.9	1.9	2.8	1.5	1.5
" width .....	2	2	...	1.3	1.5	2.7	1.1	1.2
m <sub>2</sub> , length .....	1.8	1.9	...	1	1.1	1.8	0.7	0.8
" width .....	1.3	1.5	...	0.8	0.9	1.8	0.5	0.8

## Chironax, Thoopteris, Penthetor, and Spharias: Measurements of teeth.

	<i>Ch. melanoccephalus.</i> 3 cotypes.		<i>Th. nigrescens.</i>	<i>P. facus.</i> 20 skulls.		<i>S. blanfordi.</i>
	Max.	Max.		Mix.	Max.	♀ subad. Cotype.
p <sup>3</sup> , length .....	1.9	2	♀ ad. Type. mm.	mm.	mm.	mm.
" width .....	1.5	1.5	2.9	2	2.5	2
p <sup>4</sup> , length .....	1.7	1.9	2.3	1.7	2	1.3
" width .....	1.4	1.4	2.9	2.1	2.6	2.1
m <sup>1</sup> , length .....	1.1	1.2	2.8	1.9	2.2	1.2
" width .....	1	1.1	2.7	2	2.6	1.8
p <sub>1</sub> , length .....	0.5	0.8	1.7	1.5	1.7	1.1
" width .....	0.5	0.7	1.4	1	1.2	1.1
p <sub>2</sub> , length .....	1.9	2	1.7	1	1.2	1
" width .....	1.3	1.4	3	2	2.5	1.9
p <sub>1</sub> , length .....	1.8	2	2.3	1.7	1.9	1.3
" width .....	1.4	1.6	3	2	2.5	2.1
m <sub>1</sub> , length .....	1.5	1.5	3.1	1.9	2.2	1.2
" width .....	1.1	1.1	2.8	2	2.3	2
m <sub>2</sub> , length .....	0.7	0.8	2.9	1.7	1.9	1
" width .....	0.5	0.7	1.7	1	1.4	1.2
			1.5	0.8	1.1	0.9

27. NYCTIMENE, Borkhausen.

*Harpyia*, Dobson, Cat. Chir. B. M. p. 88.

- |   |                |
|---|----------------|
|   | Type.          |
| 1797. Nyctimene, Borkhausen, <i>Deutsche Fauna</i> , i. p. 86 .   | N. cephalotes. |
| 1810. Cephalotes, E. Geoffroy, <i>Ann. Mus. d'Hist. Nat.</i><br>xv. p. 104 . . . . .  | N. cephalotes. |
| 1811. Harpyia, Illiger, <i>Prodr. Syst. Mamm.</i> p. 118 (nec<br>Harpyia, Ochsenheimer, 1810, a genus of Lepido-<br>ptera) . . . . .  | N. cephalotes. |
| 1837. Gelasinus, Temminck, <i>Mon. Mamm.</i> ii. p. 100 (nec<br>Gelasinus, Van der Hoeven, 1827, a variant of<br><i>Gelasinus</i> , Latreille, 1817, a genus of Crustacea). . . . . | N. cephalotes. |
| 1863. Uronycteris (subgenus of <i>Cynopterus</i> ), Gray,<br><i>P. Z. S.</i> 1862, p. 262 . . . . .   | N. albiventer. |
| 1899. Bdelygma (subgenus of <i>Gelasinus</i> ), Matschie,<br><i>Megaohir.</i> pp. 82, 84 . . . . .  | N. major.      |

Vespertilio (pt.), Pallas, *Spic. Zool.* fasc. 10, p. 10 (1767); Schreber, *Saug.* i. p. 172 (1774: section VI.); Erxleben, *Syst. R. An.* p. 152 (1777: genus *Vespertilio*, section e); Boddaert, *Elench. An.* i. p. 70 (1785: part of section a); Gmelin, *Syst. Nat.* i. p. 50 (1788: section \*\*\*\*\*); Kerr, *An. Kingd.* i. pp. xviii, 98 (1792: section F).

Céphalotte (sic), Buffon, *Hist. Nat., Suppl.* iii. p. 263 (1776).

Nyctimene, Borkhausen, *l. s. c.* (1797; diagnosis: "In der obern Kinnlade Schneidezähne, in der untern keine"; the post-Linnean compilers usually divided the genus *Vespertilio* into a series of sections according to the number of incisors; thus, one section (the fifth of Erxleben, the sixth of Schreber, Gmelin, and Kerr), with the single species *V. cephalotes*, was characterized by having two incisors above, none below; and this section it was for which Borkhausen proposed the generic name *Nyctimene*); E.-A., *Der Zoologe*, II. v-viii. p. 60 (1797); Bechstein, *Pennant's Vierfüßs. Th.* ii. p. 615, footnote † (1800); *id.*, *Gemeinnütz. Naturg. Deutschl.*, 2 ed. i. p. 213 (1801); Oken, *Lehrb. Naturg.* iii. Abth. 2, p. 937 (1816); Thomas, *Proc. Biol. Soc. Wash.* xv. p. 198 (1902: name revived); Sherborn, *Ind. An.* p. lix † (*cf.* pp. 192, 1149) (1902); Thomas, *Ann. & Mag. N. H.* (7) xiv. p. 196 † (1904); *id.*, *P. Z. S.* 1904, ii. p. 188 † (1905); Miller, *Fam. & Gen. Bats*, p. 75 † (1907: distinct subfamily); Elliot, *Cat. Mamm. Field Col. Mus.* p. 494 (pt.) (1907: = *Nyctimene* pt. + *Dobsonia*).

Pteropus (pt.), E. Geoffroy, *Cat. Mamm. Mus. Nation. d'Hist. Nat.* p. 49 (1803); Tiedemann, *Zool.* i. p. 535 (1808).

Cephalotes, E. Geoffroy, *l. s. c.* (pt.) (1810: two species, "*C. peroni*," i. e. *Dobsonia peroni*, and "*C. pallasi*," i. e. *N. cephalotes*); G. Fischer, *Zoogn.* iii. p. 550 (pt.) (1814: no change); Rafinesque, *Anal. Nat.* p. 54 (pt.) (1815: no change); Desmarest, *Mamm.* p. 112, n. 26 (pt.) (1820: no change); Schinz, *Naturg. u. Abb. Säug.* i. p. 70 (1824: no change); Temminck, *Mon. Mamm.* i.

† Misspelt *Nyctymena*.

‡ Misspelt *Nyctimene*.

- pp. xvii, 169 (pt.) (1825: no change); *Gray, Griffith's An. Kingd.* v. p. 59 (1827: no change); *E. Geoffroy, Cours Hist. Nat. Mamm.*, 13 leçon, p. 28 (1828: name to stand for "*C. pallasi*" only, "*C. peroni*" separated in new genus *Hypodermna*); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 706 (1828: as *E. Geoffroy*, 1828); *id.*, *Ann. Sci. Nat.* xv. pp. 192, 205 (1828: as *E. Geoffroy*, 1828); *J. B. Fischer, Syn. Mamm.* p. 88 (pt.) (1829: essentially as *E. Geoffroy*, 1810); *Palmer, Proc. Biol. Soc. Wash.* xii. p. 112 (1898: name revived as restricted by *E. Geoffroy*, 1828); *Trouessart, Cat. Mamm.* ii. p. 1277 (1899: as *Palmer*); *Thomas, Ann. & Mag. N. H.* (7) v. pp. 210, 217 (1900: as *Palmer*); *id.*, *Proc. Biol. Soc. Wash.* xv. p. 198 (1902: a synonym of *Nyctimene*).
- Harpyia*, *Illiger, l. s. c.* (1811); *id.*, *Abh. Ak. Berlin*, 1804-11, pp. 90\*, 98, 155\*, 158 (1815); *F. Cuvier, Dents Mamm.* p. 248 (cf. p. 40) (1824); *Gray, Ann. Philos.* x. p. 339 (1825); *Lesson, Man. Mamm.* p. 114† (1827); *Desmarest, Dict. Sci. Nat.* xlv. p. 373 (1827); *Burnett, Quart. J. Sci. Lit. Art.*, Apr.-June, 1829, p. 269 (1829); *Wagler, Syst. Amphib.* p. 9 (pt.) (1830: section *a*; section *β*=*Dobsonia*); *Lesson, Hist. Nat. Mamm.* (*Compl. Buffon*), v. p. 67† (1836); *Temminck, Mon. Mamm.* ii. pp. 50, 98 (1837); *Gray, Mag. Zool. & Bot.* ii. p. 504 (1838); *Wagner, Schreber's Säug., Suppl.* i. p. 370 (1839); *S. Müller, Temminck's Nat. Gesch. Ned. Ov. Bez., Zoogd.* p. 21 (1841-44: food); *Lesson, N. Tabl. R. An., Mamm.* p. 15, n. 48† (1842); *Gloger, Hand- u. Hilfsbuch Naturg.* i. pp. xxviii, 49\* (1842); *Gray, List Mamm. B. M.* p. xix (1843); *id.*, *Voy. 'Sulphur,' Zool.* i. p. 29 (1844); *id.*, *Zool. Samarang, Vert.* p. 12 (1849); *Wagner, Schreber's Säug., Suppl.* v. p. 611 (1853-55); *Peters, MB. Ak. Berlin*, 1865, p. 256; *Gray, P. Z. S.* 1866, p. 64; *Peters, MB. Ak. Berlin*, 1867, p. 868; *Gray, Cat. Monk. &c.* p. 120 (1870); *Fitzinger, SB. Ak. Wien*, ix. Abth. i. p. 642 (1870); *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 519 (1873: structure of hairs); *Dobson, Ann. & Mag. N. H.* (4) xvi. p. 354 (1875); *id.*, *Mon. As. Chir.* p. 14 (1876); *id.*, *Cat. Chir. B. M.* p. 88 (1878); *Leche, Lunds Univ. Årsskr.* xiv. pp. 22 & seq. (1878: dentition); *Robin, Ann. Sci. Nat.* (6) Zool. xii. Art. 2, pp. 4 & seq. (1881: visceral anatomy; distinct subfamily); *Flower & Lydekker, Mamm.* p. 653 (1891); *Winge, E Mus. Lundii*, ii. pt. 1, pp. 24, 27, 28, 56 (1892: dental formula; affinities); *Heude, Mém. II. N. Emp. Chin.* iii. p. 176† (1896: dentition); *Trouessart, Cat. Mamm.* i. p. 87 (1897).
- Gelasinus*, *Temminck, l. s. c.* (1837); *Matschie, Megachir.* p. 81 (genus), p. 83 (subgenus) (1899: name revived); *id.*, *Abh. Senck. nat. Ges.* xxv. H. 2, p. 272, footnote (1900); *Trouessart, Cat. Mamm., Suppl.* p. 63 (1904); *Toldt, Ann. Nat. Hofmus. Wien*, xxiv. pp. 238, 244 (1910: hair).
- Uronyxteris*, *Gray, l. s. c.* (1863); [*id.*, *Cat. Monk. &c.* p. 120 (1870: a synonym of "*Harpyia*")]; *Ogilby, Cat. Austr. Mamm.* p. 81 (1892); *Thomas, Nov. Zool.* ii. p. 163 (1895: replacing the preoccupied "*Harpyia*")]; *id.*, *Ann. Mus. Civ. Genova*, (2) xviii. p. C08 (1897); *A. B. Meyer, Abh. Mus. Dresden*, vii. no. 7, p. 8 (1899).

\* Misspelt *Harpyja*.† Misspelt *Harpya*.

*Bdelygma*, Matschie, l. s. c. (1899); *Thomas, Ann. & Mag. N. H.* (7) v. p. 217 (1900: inseparable from *Nyctimene*); *Matschie, Abh. Senck. nat. Ges.* xxv. H. 2, p. 272 (1900); *Trouessart, Cat. Mamm., Suppl.* p. 64 (1904); *Jentink, Notes Leyd. Mus.* xxviii. p. 165 (1906); *Elliot, Cat. Mamm. Field Col. Mus.* p. 495 (1907).

*Summary of characters.*—Cynopterine group. Rostrum unusually deep anteriorly; premaxillæ ankylosed together in front, their ascending branches short, not reaching nasals (character observable only in immature skulls); mesopterygoid fossa broad and deep; postdental palate constricted at middle. Incisors  $\frac{1}{0} - \frac{1}{0}$ ; lower canines at anterior extremity of jaw, quite or nearly in contact; cheek-teeth  $\frac{4}{5}$ . Tongue with four circumvallate papillæ; inner surface of lips densely fringed all round with odontoid papillæ; nostrils projecting as cylindrical tubes from upper surface of muzzle; tail subequal in length to tibia; wings always spotted with yellow. [Stated to be partly, if not entirely, insectivorous.] Forearm 50–85.5 mm. [12 species. *Hab.* The Austro-Malayan subregion, south-west to Timor, south-east to Queensland.]

Few genera of Fruit-bats are more easily identified than *Nyctimene*. It is at once distinguished from all other Fruit-bats (and indeed from all other Bats, except *Murina* and *Harpiocephalus*) by its tubular nostrils. No other known bat has four circumvallate papillæ (three, two, or none being the numbers known elsewhere in the Order). It is the only genus of Fruit-bats combining these two dental characters, viz. incisors  $\frac{1}{0} - \frac{1}{0}$ , cheek-teeth  $\frac{4}{5}$ , or these two external characters, viz. sharply-defined yellow wing-spots, tail present (in the only other Megachiropteran genus with equally well-marked yellow wing-spots, *Balionycteris*, the tail is absent; more or less obscurely-defined spots on the membranes are not infrequently observed in some other genera, e. g. *Eonycteris*). Any Fruit-bat with a well-marked dark spinal stripe may, by that character alone, be safely identified as a *Nyctimene* (but the stripe is obsolescent in a few species of the genus).

*Skull* (fig. 61).—General shape essentially Cynopterine (fig. 48, p. 588), but with peculiar modifications of the rostrum and of the floor and lateral walls of the posterior nasal passage. Rostrum even shorter than in *Cynopterus*, extremely deep, and conspicuously compressed laterally, the breadth of the interdental palate being, if anything, rather less than in *Cynopterus*: length of rostrum (orbit to nares) between  $\frac{1}{5}$  and  $\frac{1}{8}$  (in *Cynopterus* from slightly more to somewhat less than  $\frac{1}{4}$ ) of total length of skull; height of rostrum above  $p^4$  equal to or rather more than (in *Cynopterus* only  $\frac{3}{4}$  of) breadth across external surfaces of  $p^4$ – $p^4$ . Extremity of nasals V-shaped (practically square-cut in *Cynopterus* and Megachiroptera in general), the median projection produced forward and downward and firmly united with the extremity of the cartilaginous nasal septum. Premaxillæ very deep vertically and solidly coalesced in front without trace of suture (the inter-

premaxillary suture is in this genus even one of the earliest cranial sutures to disappear, see fig. 61 F-I, *N. papuanus*); anterior surface of united premaxillæ sometimes distinctly proclivous (*N. aëlo*, fig. 64, p. 715), as a rule however practically vertical or even retroclivous in its upper half; nasal branches of

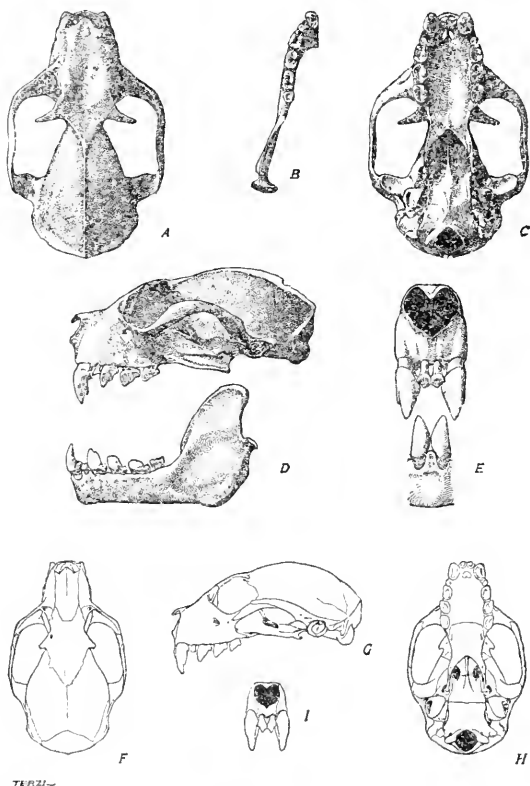


Fig. 61.—A, B, C, D, E. *Nyctimene scitululus*, ♀ ad., type of species.

F, G, H, I. *Nyctimene papuanus*, ♂ subad., Key Islands; no. 99.12.4.1 (note short ascending rami of premaxillæ (G, I), and absence of inter-premaxillary suture (I), although most other cranial sutures are unobliterated).

E  $\frac{3}{4}$  (linear), all other figures  $\frac{1}{4}$ .

premaxillæ extremely short (fig. 61 G), not nearly reaching nasals (in *Cynopterus* and *Megachiroptera* in general extending upward to meet extremity of nasals). Postdental palate distinctly con-



stricted at middle (pandurate), making lateral margins concave (in *Cynopterus* straightly converging antero-posteriorly); mesopterygoid fossa unusually broad and deep, breadth between hamuli subequal to breadth between  $m^1$ - $m^1$ , and lateral walls of fossa (pterygoids and posterior prolongations of palatines) expanded vertically in conformance to greater depth of fossa. Postorbital foramina generally entirely absent (faint traces on one or both sides observed in a few skulls of *N. cephalotes* and *papuanus*; in one skull of *N. papuanus*, 99.12.4.1, the foramen is quite distinct on the left side, closed above but open below on the right; in one skull of *N. cephalotes*, 9.1.4.8, distinct on both sides). Zygomatic heavy, strongly curved upward; sagittal crest always fully developed; postorbital processes relatively strong; masseteric surface of zygomatic process of maxillary sometimes confined almost entirely to inferior surface of that bone, but usually extending upward on external surface, often nearly to its upper margin; angular process of mandible usually (in larger species always) bent more or less strongly outward; coronoid process high, often broad, and (particularly in the large species of the *N. geminus* type) with front margin conspicuously expanded inferiorly. Tympanics narrow, annular (narrower than in *Cynopterus*). Basiscranial axis only slightly deflected (as in *Cynopterus*).

Dentition (fig. 61).—
$$\frac{i^1 c p^1 p^3 p^4 m^1}{c p_1 p_3 p_4 m_1 m_2} \times 2 = 24^*.$$
 Number

and homologies of premolars and molars quite as in *Cynopterus*; but, owing to disappearance of all incisors except upper inner pair, total number of teeth less than in any other genus of Megachiroptera (minimum in other genera 28).

Upper incisors relatively large, crown well-differentiated, in front view subtriangular; posterior ledge large, making antero-posterior subequal to transverse diameter of crown; cutting-edge bilobed, outer lobe much narrower and shorter than inner. Upper canines slightly shorter and less acutely pointed than in *Cynopterus*; front face of crown perfectly smooth (no vertical groove), cingulum well-marked; often a more or less well-defined secondary cusp from outer edge (see next paragraph). Lower canines moved forward to

\* In *Ptenochirus*, *Megarops*, *Balionycteris*, and *Penthetor*  $i^2$  is reduced to about half the length of  $i^1$ ; in the other *Cynopterine* genera  $i^2$  is slightly but quite distinctly weaker than  $i^1$ . Thus, throughout the whole group there is a more or less pronounced tendency toward a degeneration of  $i^2$ . Inasmuch as *Nyctimene* is undoubtedly a genus of the *Cynopterine* group, the upper incisor permanently lost is therefore here supposed to be  $i^2$ , not  $i^1$ . Specimens of *Nyctimene* with milk-teeth have not been available for examination by the writer; according to Leche (l. c. 1878), even the milk dentition exhibits only one pair of upper incisors. [The only genera of Megachiroptera with the upper incisors permanently reduced in number are *Boneia*, *Dobsonia*, *Nyctimene*, and *Harpyionycteris*; in *Boneia* and *Dobsonia* the missing pair is without doubt  $i^1$  (see *antea* p. 452, footnote). in *Nyctimene*, as just mentioned, probably  $i^2$ , and in *Harpyionycteris* there is no evidence at all to show which pair has been lost. In two genera, *Epomops* and *Notiopteris*, one pair of upper incisors is deciduous; in the former this pair is  $i^2$ , in the latter  $i^1$ .]

anterior extremity of jaw and situated so close together as to be quite or very nearly in contact, rather slender, somewhat curved, in front view broadest at (a little above or below) middle, narrowest at base and tip, cingulum well-developed, front face of crown smooth, no secondary cusp. Premolars and molars in transverse section similar to those of *Cynopterus*, but  $p^1$  a little less reduced in size,  $p^3$ ,  $p_3$ , and  $p_4$  considerably higher, and with posterior basal ledge ("heel") more sharply marked off from outer main cusp of teeth; inner ridge of same teeth tending to become slenderer, more terete and cusp-like, inner cusp in  $p_3$  situated not at anterior extremity but rather toward middle of tooth, outer ridge in  $p_3$ ,  $p_4$ , and  $m_1$ , or in one or two of these, often tending to be more or less distinctly bilobed (see next paragraph); never any trace of surface cusps in any cheek-tooth.

*Secondary cusp of upper canines*; "bilobate" shape of outer ridge of  $p_3$ ,  $p_4$ , and  $m_1$ .—Many specimens of *Nyctimene* lack every trace of a secondary cusp in the upper canines; in others a shallow, obtuse notch is present in the external (hinder) margin of the tooth, below the middle; the next stage is shown by specimens with the notch abrupter and more rectangular; and the final stage by such in which it has become deep and acute, thus sharply separating part of the external edge as a distinct "secondary cusp" from the main cusp of the canine. The variation in this respect is to a considerable extent individual (see *N. papuanus*, *cephalotes*, *geminus*, and *aëlo* in the table p. 687), but a strong development of the secondary cusp is undoubtedly of more frequent occurrence in the large *N. geminus*, *major*, and *scitulus* (but not in *aëlo*) than in the smaller species. [For analogies to this cusp in *Nyctimene* compare *Pteropus tuberculatus*, *Pteralopex*, *Harpyionycteris*; the secondary cusp in the upper canines of *Cynopterus* and *Ptenochirus* is entirely different, being a cingulum cusp on the inner side of the tooth.]

The cutting-edge of the outer ridge of  $p_3$ ,  $p_4$ , and  $m_1$  is in many individuals perfectly simple, in others distinctly notched, but the "notch" varies in development from the merest trace of a flatly concave depression to a relatively sharp emargination, making in the latter case the cutting-edge distinctly, though never deeply, bilobate. The notch is more often developed in  $p_3$  than in  $p_4$  or  $m_1$ , or, if present in all, usually strongest in  $p_3$ . As in the case of the secondary cusp of the upper canines, the variation is largely individual (see *N. papuanus*, *cephalotes*, *geminus*, and *aëlo* in the table p. 687); but as a general rule the notch appears to be most frequently and most distinctly developed in those species (*geminus*, *major*, *scitulus*) which show a tendency to a strong development of a secondary cusp in the upper canines. [For similar modifications of the outer ridge compare  $m_1$  and  $m_2$  of *Pteropus leucopterus*,  $p_4$ ,  $m_1$ , and  $m_2$  of *Pteralopex*,  $p_4$  and  $m_1$  of certain species of *Dobsonia* (*D. viridis* group),  $p_4$ ,  $m_1$ , and  $m_2$  of *Hypsignathus*,  $p_4$ ,  $m_1$ ,  $m_2$ , and  $m_3$  of *Harpyionycteris*.]

	Number of skulls examined.	Secondary cusp of upper canines	Outer ridge of $p_3$ , $p_4$ , and $m_1$
papuanus ...	8	absent (3) obsolescent (2) distinct (3)	simple (7) $p_3$ slightly bilobed (1)
albiventer ...	1	distinct	$m_1$ faintly bilobed
minutus .....	1	distinct	simple
varius .....	1	distinct	simple
cyclotis .....	1	obsolescent	?
cephalotes ...	8	absent (1) obsolescent (6) distinct (1)	simple (6) $p_3$ slightly bilobed (2)
geminus .....	4	absent (1) distinct (1) strong (2)	simple (2) $p_3$ , $p_4$ slightly bilobed (1) $p_3$ , $p_4$ , $m_1$ more distinctly bilobed (1)
major .....	2	strong (both)	$p_3$ , $p_4$ , $m_1$ distinctly bilobed (both)
scitulus .....	3	strong (all)	$p_3$ slightly bilobed (all)
hullulæ ...	1	?	simple
robinsoni ...	2	obsolescent (both)	simple (both)
aëlio .....	4	absent (1) obsolescent (3)	simple (3) $p_3$ faintly notched (1)

*Palate-ridges* (fig. 62) (examined in *N. varius*, *cyclotis*, and *cephalotes*).—About 13–15 ridges, evenly covering the whole of the

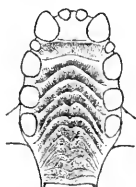


Fig. 62.—Palate-ridges of *Nyctimene cyclotis* (type of species).

interdental and postdental palate, the interspaces between the ridges becoming slowly and gradually narrower in antero-posterior direction; anterior ridge closely behind canines, approximately straight, subsequent ridges gradually more and more convex; five (or four or six or seven) anterior ridges generally undivided, posterior ridges more or less distinctly, though always narrowly, interrupted in middle; postdental ridges very often asymmetric. In total aspect the palate-ridges are strikingly similar to those of *Cynopterus* (fig. 50, p. 591), the only differences worth noticing being these: in *Cynopterus* there is always a ridgeless space in the middle of the postdental palate, in *Nyctimene* the ridges are arranged uninterrupted over the whole of the postdental palate;

the ridges of *Nyctimene* are coarser and more prominent, making the palate rougher, more rasplike in appearance.

*External characters.*—Muzzle short and unusually deep anteriorly: centre of eye in the middle between base of ear and tip of muzzle, depth from top of nasal tubes to inferior point of mandibular symphysis equal to (in *Cynopterus* much less than) length of muzzle from anterior canthus of eye. Inner side of upper and lower lips fringed all round (in *Cynopterus* only from angle of mouth to points opposite  $p^3$  and  $p_3$ ) with several rows of large, densely crowded odontoid papillæ. Circumvallate papillæ of tongue four (in all other Megachiroptera three, in Microchiroptera two, *Desmodus* excepted which has none), the posterior pair considerably smaller than the anterior. Nostrils modified into two cylindrical tubes arising close together from upper extremity of muzzle, and from this point diverging outward and forward under a right angle (fig. 63). Ears in the majority of species rather short and triangularly rounded off at tip, in one (*N. cyclotis*) so broad above as

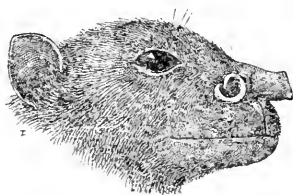


Fig. 63.—*Nyctimene scitululus* (type of species), to show nasal tubes.

to be almost semicircularly rounded off, in one (*N. robinsoni*) somewhat longer than usual and more acutely pointed; antitragal lobe small, triangular. Tail relatively longer than in other Megachiroptera, except *Notopteris*, much longer than hind foot with claws, in most species even equal to or only a little shorter than tibia, but number of caudal vertebræ (seven, in one skeleton of *N. cephalotes*) not greater than in *Rousettus amplexicaudatus*; base of tail connected with interfemoral by its dorsal integument, distal half or two-thirds freely projecting. Interfemoral deep in centre, broad along tibiæ, emargination of posterior margin therefore narrower than usual; calcar well developed, about half the length of hind foot with claws.

Lateral membranes arising low down from sides of back, inserted posteriorly on first phalanx of second toe, on interdigital membrane between second and third toe, or on first phalanx of third toe; the variations in this respect being to some extent individual. Vertical fasciæ of mesopatagium thin and crowded. Basal third of first phalanx of pollex included in membrane. Wings much longer than in *Cynopterus*, both in the total length of the long digits and in the proportions of their metacarpals and phalanges much more

similar to the wings of *Balionycteris*; index of third digit in *Nyctimene* 1902, *Balionycteris* 1847, *Cynopterus* 1637, of fourth digit respectively 1503, 1485, and 1303, of fifth digit 1387, 1403, and 1266; first phalanx of second digit unusually short, about two-thirds of (in *Cynopterus* subequal to) second and third phalanx with claw; claw of second digit stronger than in *Cynopterus*; third metacarpal slightly longer than fifth, fourth the shortest, as generally in Cynopterine bats; distal phalanx of fourth and fifth digits decidedly longer than proximal phalanx of same digits. Compare wing-indices below (upper row, those of *Nyctimene* calculated from sixty adult individuals; second, those of *Balionycteris*; third, those of *Cynopterus*).

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c.u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	427	491	93	147	708	536	658	646	404	453	678	334	375
1000	406	562	118	135	719	512	616	697	404	384	714	347	342
1000	389	428	121	119	640	429	568	599	326	378	625	305	338

*Fur*.—A little longer than in *Cynopterus*, silky or woolly on upperside. Forearm clothed above for basal half or third; tibiae naked or thinly haired above; upperside of interfemoral densely covered in centre, practically naked laterally along the whole or the posterior two-thirds or half of tibia.

*Colour*.—A well-marked dark brown spinal stripe, from the shoulder region (or the occiput) to the interfemoral, renders the large majority of species of this genus easily distinguishable from all other Fruit-bats; the stripe is generally equal in breadth to about one-eighth of the furred area of the back, in one species (*N. aëlio*) about one-third the breadth of the back, sometimes, however, much less conspicuously developed, being very thin (one-fifteenth of back: *N. albiventer*), or traceable only along the posterior half or third of the back (*N. minutus*, *varius*, *cyclotis*), in the latter case sometimes further obscured by the colour of the back being irregularly mottled all over with darker tips to the hairs. The general colour of the fur is paler than usual in Megachiroptera, as a rule fawn-brown, fawn-drab, ashy-drab, wood-brown, buffy, or even cream-coloured above, usually paler beneath, with more or less distinctly darker flanks. In all species the forearm and metacarpals are spotted with yellow, as a rule also the phalanges (most often those of the third, less frequently those of the fourth and fifth digits), membranes, and ears, and often the interfemoral, tibia, metatarsus, and tail; the number, size, and distribution of these yellow spots are subject to considerable individual variation, the markings being even very often conspicuously asymmetric.

*Sexual differentiation*.—Adult individuals of both sexes have been available only of five (of the twelve known) species, viz.: *N. papuanus*, *cephalotes*, *geminus*, *major*, and *scitulus*. Adult males of *N. papuanus* (probably also of *albiventer*, *minutus*, *varius*, and *cyclotis*) differ from females by the much brighter (ochraceous-cinnamon, tawny-cinnamon) colour of the sides of the neck, fore-neck, chest, and flanks; this sexual colour-difference is practically the same as in *Cynopterus*. But in *N. cephalotes*, *geminus*, *major* and *scitulus* (probably also in *lullulæ*, perhaps in *robinsoni*) the differentiation of the sexes, so far as colour is concerned, is carried further than in any other Fruit-bats; adult males are, generally speaking, fawn-brown or fawn-drab or ashy-drab above, adult females cream-buff or cream-white above; beneath, males of these species are conspicuously darker than females, but the bright ochraceous-cinnamon colour of the foreneck and flanks distinguishing the males of *papuanus* is represented only by a more or less pronounced suffusion with tawny-olive or pale raw-umber.

*Range*.—Like *Dobsonia*, the present genus is eminently characteristic of the Austro-Malayan subregion, the geographical boundaries of which are, very nearly, the same as those of the area inhabited by this genus. To the west it nowhere transgresses Wallace's line, Celebes and Timor being the extreme western localities from which it is known (it probably ranges over some of the Lesser Sunda Islands west of Timor); eastward it extends to the Solomon Islands, possibly over the whole of that Archipelago, but so far not recorded from the islands east of Guadalcanar; to the south it has stepped a little beyond the boundaries of the subregion, into the north-east corner of the Australian continent.

	<i>papuanus</i> group.	<i>cyclotis</i> group.	<i>cephalotes</i> group.	<i>aëllo</i> group.
Gilolo group.....	<i>albiventer</i>			
Celebes .....	<i>minutus</i>	.....	<i>cephalotes</i>	
Amboina group.....	<i>varius</i>	.....	<i>cephalotes</i>	
Timor Laut .....	.....	.....	<i>cephalotes</i>	
Timor.....	.....	.....	<i>cephalotes</i>	
Key Is. ....	<i>papuanus</i>			
Mysol.....	.....	.....	.....	<i>aëllo</i>
New Guinea .....	<i>papuanus</i>	<i>cyclotis</i>	<i>geminus</i>	<i>aëllo</i>
Admiralty Is. ....	<i>papuanus</i>			
Trobriand group .....	.....	.....	<i>geminus</i>	
D'Entrecasteaux Arch....	.....	.....	<i>geminus</i>	
Bismarck Arch. ....	<i>papuanus</i>	.....	<i>major</i>	
Woodlark I. ....	.....	.....	<i>lullulæ</i>	
Queensland .....	<i>papuanus</i>	.....	<i>robinsoni</i>	
Shortland I. ....	.....	.....	<i>scitulus</i>	
New Georgia.....	.....	.....	<i>scitulus</i>	
Florida .....	.....	.....	<i>scitulus</i>	
Guadalcanar.....	.....	.....	<i>scitulus</i>	

New Guinea is the only island possessing representatives of all the four groups into which the genus is here provisionally divided (see table of geographical distribution, p. 690); the second and fourth of these groups are as yet monotypic (*N. cyclois* characterized by the reduced  $m^1$  and  $m_1$  and its unusually broadly rounded ears; *N. aello* by its more proclivous premaxille and externally at once recognized by its very broad spinal streak); of the two others, the *papuanus* group is central, western, and southern in distribution, ranging from New Guinea west to Celebes and south to Queensland, while the *cephalotes* group covers practically the whole area of the genus with the possible exception of the Gilolo Archipelago. Both groups are represented in Celebes, Buru, Amboina, and Ceram; of the two species known from N.E. Australia, the one (*papuanus*) is an unmodified immigrant from New Guinea, the other (*robinsoni*) probably a peculiar large-eared form of the *cephalotes* group, perhaps most nearly related to *N. lullulae* (Woodlark Island). The only species inhabiting the Solomon Islands (*scitulus*) is very closely allied to the New Guinea representative of the *cephalotes* group (*N. geminus*).

*Habits*.—The ventricle of a *N. cephalotes* examined by Salomon Müller was found to contain exclusively fragments of Coleoptera and Diptera (*l. s. c.* 1841-44). This appears to be the only published note on the habits of this genus.

*Affinities*.—*Nyctimene* is an offshoot from the Cynopterine branch of Fruit-bats. In several important characters it is quite or nearly on the same level as *Cynopterus* (or allied genera), viz., in the general shape of the skull and mandible, the shortening of the rostrum, the inconspicuous deflection of the basicranial axis, the tendency to disappearance of the postorbital foramina, the number of cheek-teeth ( $m^2$  and  $m_3$  absent), the general outline of the cheek-teeth, the arrangement of the palate-ridges, and the strong development of odontoid papillæ on the inner side of the lips. In one respect it is a little more primitive than the other living genera of the Cynopterine group; in all of these the tail is very short or quite obsolete, whereas *Nyctimene* has the same number of caudal vertebræ as the longest-tailed species of *Rousettus*, and, in so far as the individual vertebræ are rather less reduced in length (*i. e.* less degenerated), may even be said to stand, in this single character, slightly lower than *Rousettus*. *Nyctimene*, therefore has probably originated from a point of the Cynopterine branch at which all the essential Cynopterine characters of the skull, dentition, palate-ridges, and lips were already fully developed (of course no inner cingulum cusp in the upper canines and no surface-cusps in the lower cheek-teeth, both characters secondarily acquired by the living genus *Cynopterus*), but the tail still very nearly on the Rousettine stage. From this point it has in certain respects followed its own line of development. The peculiar characters are, first of all, the long tubular nostrils and the (somewhat *Dobsonia*-like) modifications of the front teeth (incisors and

canines); these, again, have directly or indirectly necessitated a series of other modifications of the skull and dentition. The characters of the present genus may therefore conveniently be discussed under the following three headings, viz., those (certainly or probably) dependent on the development of nasal tubes, those relating to the dentition, and those acquired apparently independently of both.

(1) The nasal tubes.—What purpose the peculiar cylindrical nasal tubes serve in the life-history of these animals is so far entirely unknown; but they represent, in fact, scarcely more than an excessive development of a tendency traceable in most other Fruit-bats; in nearly all genera the nostrils project a little from the surface of the muzzle, in the Cynopterine group, in general, so conspicuously so that they may properly be described as sub-tubular, and in *Megetrops* the character is still a little more emphasized than in its nearest relatives. The nasal tubes in *Nyctimene* have effected some modifications of the bones forming the upper, lower, and lateral margins of the anterior nares:—the median portion of the nasals is produced forward and downward as a triangular projection firmly united with the front edge of the mesethmoid cartilage and evidently acting as a support of the tubes; for the same purpose the upper margin of the alveolar branches of the premaxillæ is expanded upward (as a rule also slightly forward), this strengthening and expansion of the premaxillæ accounting both for the great vertical depth of these bones and for the very early disappearance of the inter-premaxillary suture, perhaps, in some measure, also for the unusually great depth of the rostrum as a whole; at the same time the nasal branches of the premaxillæ (very thin in Cynopterine bats) have been so much shortened as to lose their contact with the nasal bones. Associated with the strong development of the nasal tubes is a considerable widening of the posterior narial passage and mesopterygoid fossa, the latter being enlarged both in breadth and depth.

(2) The dental characters.—In Cynopterine bats the incisors, above and below, are weak (as compared with those of *Pteropus* and *Rousettus*), and throughout the whole group there is a distinct tendency of the lower canines to move closer together at the extremity of the jaw; even in those genera which have the full Megachiropteran number of incisors, the inner lower pair ( $i_1$ ) is conspicuously weaker than the outer, and in several genera it has disappeared; in the latter case the outer pair in the premaxillæ ( $i^2$ ) is always considerably reduced in size. These tendencies have been further developed in *Nyctimene*: the lower canines have moved forward to the extremity of the mandible, thus situated so close together (generally in actual contact) as to leave no room at all for lower incisors, which therefore have entirely disappeared, while at the same time that pair of upper incisors ( $i^2$ ), which in some other Cynopterine genera is on the point of degeneration, has also been



entirely suppressed. The constant action of the lower canines against the single pair of upper incisors has moulded these into their peculiar obliquely triangular shape; on the other hand, the upper incisors acting upon the posterior surface of the extremity of the lower canines have ground the cutting-edge of these as sharp as that of the lower incisors of a Rodent, whereas the outer edge of the lower canines, which moves against the inner edge of the upper canines, is worn smooth and rounded. The secondary cusp of the upper canines, if present, is produced by the action of the lower  $p_1$ ; individuals in which  $p_1$  barely touches or only slightly bites against the external edge of the upper canine show no secondary cusp or have this latter indicated only by a more or less distinct notch in the edge. That the posterior "heel" of  $p_3$  and  $p_4$  is rather more well-marked than in other Cynopterine bats is due to the action of the high external cusps of  $p^3$  and  $p^4$ ; similarly, the high cusps of  $p_3$  and  $p_4$  have produced, respectively, a well-developed cingulum in the upper canines and well-marked posterior heel in  $p^3$ ; in some individuals  $p^1$  and the heel of  $p^3$  may effect a more or less distinct depression in ("bilobed" shape of) the cutting-edge of the outer cusp of, respectively,  $p_3$  and  $p_4$ .

(3) Other modifications.—According to Robin, the cardiac portion of the stomach (distinctly differentiated in other Fruit-bats) is wanting or, perhaps more correctly, represented only by a conical enlargement of the œsophagus not differing from the latter in the structure of its mucous membrane; the fact that this is the type of stomach commonly found in Microchiroptera seems to lend support to the statement that *Nyctimene* is (at least to some extent) insectivorous. The three circumvallate papillæ are in *Cynopterus* and other Fruit-bats arranged in the figure of a triangle, two in front and one larger behind; the latter is in *Nyctimene* replaced by two smaller (fig. 65 A, p. 725); whether this difference has anything to do with the supposed insectivorous habits of the present genus is unknown (the fact that all Microchiroptera, so far as known, possess two papillæ, except the bloodsucking *Desmodus* which has none, would seem to indicate that a difference in diet may have an influence on the development of the circumvallate papillæ; in Insectivora the usual number appears to be three or two). The characters of the wing (yellow spots and proportions of metacarpals and phalanges, as in *Balionycteris*), the colour of the fur, and the sexual colour-difference have been discussed above under the headings "External characters," "Colour," and "Sexual differentiation."

All characters considered, it is impossible to deny that *Nyctimene*, though aberrant in some respects, is phylogenetically very intimately connected with the other genera of the Cynopterine group. To separate this genus as a distinct subfamily, *Harpyiinae* or *Nyctimeninae* (as proposed by Robin, *l. s. c.*, 1881, on the basis of some anatomical peculiarities, the more important of which have been referred to above, and again, probably independently of Robin,

by Miller, *l. s. c.*, 1907, owing to the shape of the postdental palate), would only tend to obscure its natural affinities, without any practical advantage as a compensation.

*Chronology of species and revisions.*—Three species of this genus were described between 1767 and 1877, three again between 1900 and 1904, while six were added during the preparation of this Catalogue (see table below). In 1867, when Peters revised the genus, two species had been described, *cephalotes* and *albiventer*; he recognized only the former, considering *albiventer* the young of *cephalotes*. Gray, in 1870, while admitting the possibility of Peters's view, allowed *albiventer* to stand provisionally, until better known, as a species distinct from *cephalotes*. Dobson, in his Catalogue (1878), again united *albiventer* with *cephalotes*, but added a species (*major*) described by himself one year before; "*cephalotes*," as understood by Dobson, is equivalent to *N. papuanus*, *albiventer*, and *cephalotes* of the present Catalogue, his "*major*" to *N. geminus*, *major*, and *scitulus*. Matschie's revision (1899) differed from Dobson's only in an attempt to separate *major* subgenerically ("*Bdellygma*") from *cephalotes*. The distinctness of *albiventer*, as compared with *cephalotes*, was pointed out by Oldfield Thomas in 1900 (Ann. & Mag. N. H. (7) v. p. 217; cf. (7) xiv. p. 198, 1904); "*albiventer*," as understood by Thomas, corresponds to *N. papuanus* and *albiventer* of this Catalogue.

Year.	Name.	Author.	Type locality.	Identification.
1767 ...	<i>cephalotes</i>	Pallas	Amboina	<i>cephalotes</i>
1792 ...	<i>c. melinus</i>	Kerr	Amboina	<i>cephalotes</i>
1810 ...	<i>pallasi</i>	E. Geoff.	Amboina	<i>cephalotes</i>
1863 ...	<i>albiventer</i>	Gray	Morotai	<i>albiventer</i>
1877 ...	<i>major</i>	Dobson	Duke of York I.	<i>major</i>
1900 ...	<i>aëlo</i>	Thomas	Milne Bay, B. N.G.	<i>aëlo</i>
1904 ...	<i>robinsoni</i>	Thomas	Cooktown	<i>robinsoni</i>
" ...	<i>m. lullulæ</i>	Thomas	Woodlark I.	<i>lullulæ</i>
1910 ...	<i>papuanus</i>	K. And.	Milne Bay, B. N.G.	<i>papuanus</i>
" ...	<i>minutus</i>	K. And.	Tondano, N. Celebes	<i>minutus</i>
" ...	<i>varius</i>	K. And.	Mt. Mada, Buru	<i>varius</i>
" ...	<i>cyclotis</i>	K. And.	Arfak Mts., D. N.G.	<i>cyclotis</i>
" ...	<i>geminus</i>	K. And.	Huon Gulf, B. N.G.	<i>geminus</i>
" ...	<i>scitulus</i>	K. And.	Guadalcanar	<i>scitulus</i>

*Technical names.*—The earliest name of this genus, *Nyctimene* (Borkhausen, 1797; single species, *Vespertilio cephalotes*, Pallas), rested for more than a century in practically complete oblivion, until revived, in 1902, by Oldfield Thomas (who traced it back to Bechstein, 1800). Till this earlier name was discovered, the history of the Tube-nosed Fruit-bats, as a genus distinct from "*Vespertilio*" and "*Pteropus*," was commonly believed to date

from Étienne Geoffroy's classical paper on the Fruit-bats (1810), in which he described a new genus, "*Cephalotes*," including two species, *C. peroni* [= *Dobsonia peroni*] and *C. pallasi* [new name of *Vespertilio cephalotes* = *Nyctimene cephalotes*]. The type of *Cephalotes*, by tautology, is *V. cephalotes*, and that also E. Geoffroy intended this species (not *peroni*) as the type of the new genus is clear not only (as has been pointed out by Palmer, 1898) from several passages in the original description of *Cephalotes*, but even more unquestionably so from the fact that, having satisfied himself of the necessity of a generic separation of the two species, E. Geoffroy, in 1828, kept *V. cephalotes* in the genus *Cephalotes*, and proposed a new generic name, *Hypoderma*, for *C. peroni*. Nearly all subsequent writers took, however, a different view of this nomenclatural question. Probably without knowledge of E. Geoffroy's paper of 1810, Illiger had, in 1811, placed Pallas's *V. cephalotes* in a distinct genus, *Harpyia* (preoccupied in Entomology), and this is the name under which the present genus has been commonly known until quite recently, whereas *Cephalotes* was generally accepted as the generic name of *C. peroni* (see anteà, p. 458).—*Gelasinus* (1837) is a name for which Temminck is technically responsible, although he quoted it only to have an opportunity of saying that it was not required ("cette innovation [viz. *Hypoderma* instead of *Cephalotes*] nous paraît aussi superflue que la dénomination générique *Gelasinus*, sous laquelle nos naturalistes dans l'Inde nous ont adressé l'*Harpyia Pallasii*"). An attempt to revive this name was made by Matschie (1899).—*Uronycteris*, based on the species *Nyctimene albiventer*, was originally described by Gray (1863) as a subgenus of *Cynopterus*, differing from this latter in restricted sense chiefly by its longer tail; when, four years later, it was pointed out by Peters that *albiventer* is in reality not a *Cynopterus* but a "*Harpyia*," Gray of course dropped the name and placed it in the synonymy of the latter genus (1870). It was revived, for a few years (1892-1899), by some authors, to replace the preoccupied "*Harpyia*."—Lastly, in 1899, Matschie proposed to split the present genus into two subgenera, "*Gelasinus*" (one species, *N. cephalotes*) and "*Bilelygma*" (subg. n., one species, *N. major*). Among the supposed differential characters of *Bilelygma* given by Matschie the only one worth mentioning here is the presence of "zwei deutliche Nebenhöcker" in  $p_3$ ; this refers to the more or less distinct depression in the cutting-edge of  $p_3$  (and  $p_4$ ) so frequently seen in various species of *Nyctimene*, a character which (as shown by Oldfield Thomas, 1900, and evident at a glance from the table above, p. 687) is of very little value for a discrimination of the species, and of none at all for a natural subdivision of this perfectly homogeneous genus.

*Synopsis of the Species.\**

- A. Dorsal stripe narrow (not nearly  $\frac{1}{3}$  of breadth of furred area of back), generally well-marked from nape to interfemoral, sometimes (*N. albiventer*, *minutus*, *varius*, *cyclotis*) obsolete anteriorly.
- a. Small: forearm 50-59, c-m<sup>1</sup> (crowns) 8.7-10.3 mm. [Sexual colour difference, so far as known, as in *Cynopterus*, i. e., males similar in colour to females, but with fore-neck and flanks much richer in colour.]
- a'. m<sup>1</sup> subequal in size to p<sup>1</sup>; ears unmodified ..... [N. PAPUANUS GROUP.]
- a<sup>2</sup>. Inner cusp of p<sup>3</sup> not completely fused with outer. General colour of back practically uniform (except for presence of dorsal stripe).
- a<sup>3</sup>. Larger: forearm 54.5-59; dentition heavier: c-m<sup>1</sup> 9.7-10.3 mm.; dorsal stripe broader ( $\frac{1}{3}$  of furred area of back) and well-marked from nape to interfemoral; membranes usually from 2nd toe. (New Guinea and surrounding islands; Queensland) . . . [p. 698.]
1. *N. papuanus*,
- b<sup>3</sup>. Smaller: forearm 50-54.5; dentition weaker: c-m<sup>1</sup> 8.7 mm.; dorsal stripe narrower ( $\frac{1}{4}$  of furred area of back), often ill-defined or indistinct anteriorly; membranes usually from 3rd toe. (Gilolo group) . . . [p. 700.]
2. *N. albiventer*,
- b<sup>2</sup>. Inner cusp of p<sup>3</sup> completely fused with outer. Colour of back conspicuously mottled with darker tips to the hairs; dorsal stripe indistinct in anterior half or third of back. Forearm 51-55 mm.
- c<sup>3</sup>. Teeth smaller: c-m<sup>1</sup> 8.8 mm.; fur not longer than usual. (Celebes) . . . [p. 701.]
3. *N. minutus*,
- d<sup>3</sup>. Teeth heavier: c-m<sup>1</sup> 10 mm.; fur longer. (Amboina group) . . . . . 4. *N. varius*, p. 702.

\* The specific variations in the skull and dentition of this genus are but small; one third of the number of species are based on single specimens; and the geographical distribution of most is as yet but imperfectly known. It is evident, therefore, that the arrangement of the species in four groups as indicated in the above Synopsis must be considered merely provisional, subject to perhaps essential modifications in the future. The *cyclotis* and *aëlio* groups will probably prove to be sufficiently well founded to be allowed to stand. On the other hand, *N. robinsoni* cannot be allocated with certainty, so long as the females are unknown; and the line between the *papuanus* and *cynopterus* groups will remain a little uncertain, so long as the sexual colour difference in *N. albiventer*, *minutus*, and *varius* has not been definitely proved to be essentially the same as in *N. papuanus*.

Anyone desirous of identifying specimens of this genus will find it useful for such purpose first to consult the geographical table on p. 690.

- b'*.  $m^1$  noticeably smaller than  $p^1$ ; ears unusually broad, semicircularly rounded off above; colour of back mottled with darker tips to the hairs ..... [N. CYCLOTIS GROUP.]
- a*. Forearm about 53 mm. (New Guinea) 5. *N. cyclotis*, p. 703.
- b*. Medium-sized or large; forearm 60·5–85·5,  $c-m^1$  (crowns) 10·7–14·2 mm. [Females of all species, with the possible exception of *N. robinsoni*, much paler above and beneath than males.] ..... [N. CEPHALOTES GROUP.]
- c'*. Skull smaller, lambda to gnathion 30–32;  $c-m^1$  10·7–11·2 mm. Forearm 60·5–69. (Celebes; Amboina group; Tenimber Is.; Timor) ..... [p. 703.
- d'*. Skull larger, lambda to gnathion 32·8–37·2;  $c-m^1$  11·5–14·2 mm. Forearm 66–85·5, 6. *N. cephalotes*,
- c''*. Ear conspicuously shorter than hind foot with claws, triangularly rounded off above; fur of back seal-brown at base.
- e''*. Large; forearm 70·5–85·5,  $c-m^1$  12·2–14·2, mandible 26·7–29 mm.
- a'*. Ear longer, 15·5–17 mm. from orifice; free edge of bony palate evenly concave.
- a''*. Forearm 70·5–77,  $c-m^1$  12·2–13·5 mm. Males brownish drab above. (New Guinea; Trobriand and D'Entrecasteaux Is.) ..... [p. 709,
- b''*. Forearm 78–85·5,  $c-m^1$  13·5–14·2 mm. Males ash-grey or greyish-hairbrown above. (Bismarck Arch.) ..... 7. *N. geminus*,
- b'*. Ear shorter, about 14 mm. from orifice; free edge of bony palate more acutely angular at middle. Forearm 71·5–80 mm. (Solomon Is.) ..... 8. *N. major*, p. 710.
- f''*. Medium; forearm 69,  $c-m^1$  11·5, mandible 25 mm. (Woodlark I.) ..... 9. *N. scitulus*, p. 711.
- d''*. Ear equal in length to hind foot with claws and more acutely pointed; fur of back uniform from base to tip. Forearm about 66–67 mm. (Queensland) ..... [p. 714,
10. *N. tullulæ*, p. 713.
- B. Dorsal stripe very broad (about  $\frac{1}{3}$  of furred area of back); premaxillæ more proclivous than in other species (fig. 64, p. 715) ..... [N. AELLO GROUP.]
- $\beta$ . Forearm 81·5–84 mm. (New Guinea; Mysol) ..... 11. *N. robinsoni*,
12. *N. aello*, p. 715.

1. *Nyctimene papuanus*, K. *Anal.*

*Harpyia cephalotes* (pt.), Dobson, *Cat. Chir. B. M.* p. 88.

*Harpyia cephalotes* (nec Pallas), Dobson, *Cat. Chir. B. M.* p. 89, specimen c (1878: Cape York); *id.*, *P. Z. S.* 1878, p. 875 (1879: New Guinea); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 207, n. 328 (pt.) (1879); *id.*, *Cat. Mamm.* i. p. 87, n. 468 (pt.) (1897); Heller, *Abh. Mus. Dresden*, vi. n. 8, p. 4 (pt.) (1897).

*Uronycteris cephalotes*, Ogilby, *Cat. Austr. Mamm.* p. 81 (1892); ? Thomas, *Ann. Mus. Civ. Genova*, (2) xviii. p. 608 (1897: Bara Bara, Milne Bay).

*Cephalotes cephalotes* (pt.), Trouessart, *Cat. Mamm.* ii. p. 1277 (1899).

*Gelasinus cephalotes*, Matschie, *Megachir.* p. 83 (pt.) (1899: Andai; Bismarck Arch.); *id.*, Krieger's *New-Guinea*, p. 77 (1899); Trouessart, *Cat. Mamm., Suppl.* p. 63, n. 551 (pt.) (1904).

*Nyctemene cephalotes*, Jentink, *Notes Leyd. Mus.* xxviii. p. 164 (1903: Skru, S.W. New Guinea).

*Cephalotes albiventer* (pt., nec Gray), Thomas, *Ann. & Mag. N. H.* (7) v. p. 217 (1900: B. New Guinea; Key Is.; Admiralty Is.; Cape York).

*Nyctimene albiventer* (pt.), Thomas, *Ann. & Mag. N. H.* (7) xiv. p. 197 (1904); Jentink, *Notes Leyd. Mus.* xxviii. p. 165 (1906); Miller, *Fam. & Gen. Bats*, p. 76 (1907).

*Nyctimene papuanus*, K. Andersen, *Ann. & Mag. N. H.* (8) vi. p. 621 (1 Dec. 1910: New Guinea; Key Is.; Admiralty Is.; Bismarck Arch.; Cape York).

*Diagnosis*.—Size small: forearm 54.5–59 mm.;  $m^1$  and  $m_1$  subequal in size to respectively  $p^1$  and  $p_1$ ; inner cusp of  $p^3$  not completely fused with outer; ears triangularly rounded off above; membranes usually from second toe; colour of back not distinctly mottled with dark brownish tips to the hairs; dorsal stripe well-defined along the whole of the back, about 3.5–5 mm. broad (about  $\frac{1}{8}$  of furred area of back); sides of neck, breast, and belly much brighter in males than in females, but scarcely any sexual difference in the colour of the upperside. *Hab.* New Guinea generally (localities p. 699, under the heading “Specimens examined”); Key Is.; Admiralty Is.; Bismarck Arch.; Cape York.

In eleven individuals examined (representing all the localities noted above) the wing membrane is inserted on the first phalanx of the second toe, in two (Skru and Bismarck Archipelago) distinctly on the interdigital membrane between that phalanx and the first phalanx of the third toe, and in one (Bismarck Archipelago) on the first phalanx of the third toe. There is no appreciable sexual difference in size (forearm of eight adult males 54.5–59, average 56.3; of five adult females 54.5–58.5, average 56.4 mm.).

Four species of *Nyctimene* are known from New Guinea, *papuanus*, *cyclotis*, *geminus*, and *aëlla*. *N. papuanus* is so much smaller than *N. geminus* (forearm 70.5–77 mm.) and *N. aëlla* (81.5–84) that a confusion with these is hardly possible. From the small *N. cyclotis*

it is readily distinguished by the relative size of  $m^1$  (in *cyclotis* conspicuously smaller than  $p^1$ ), the shape of the ears (in *cyclotis* unusually broad and semicircularly rounded off above), and the colour of the fur (back in *cyclotis* mottled with dark brownish tips to the hairs, spinal stripe rather ill-defined).

*Colour*.—Adult males. Type of species (Milne Bay, March): General colour of back dark wood-brown distinctly tinged with fawn; individual hairs woodbrown-drab for greater extent (those on posterior half of back slate at extreme base), with short fawn-brown tips. Dorsal stripe sharply defined, nearly seal-brown. Nape of neck and dorsal surface of head similar to back but rather darker, owing to greater predominance and rather darker tinge of brownish hair-tips; sides of head ashy drab. Centre of breast and belly yellowish white; foreneck, sides of breast and belly, and flanks ochraceous-cinnamon, contrasting with yellowish-white centre of underparts.—A second male (S. coast of B. New Guinea, February, 1.11.5.2) is similar to the type in the colour of the underparts, but noticeably paler above: back pale fawn-woodbrown (approaching fawn-drab), shading to ashy drab on nape of neck, and to a rather more yellowish ashy drab on head.—A third male (same locality and date, 1.11.5.3) is conspicuously richer in colour than the type both above and below: back russet-woodbrown, shading to a more typical wood-brown on nape of neck, this again to light russet-woodbrown on head; foreneck, sides of breast and belly, and flanks deep tawny cinnamon, shading rather gradually to buffy cinnamon on centre of breast and belly.

Adult females. Differing from males chiefly in the much duller colour of the sides of the breast and belly; upperside essentially as in males, varying individually between richer or paler wood-brown or drab-woodbrown. ♀ ad., Eaga, undated, 97.12.6.3: back and head light wood-brown slightly tinged with very pale russet; nape of neck lighter; breast and belly ashy buff in centre, fawn-woodbrown on sides.—A female skin from Cape York (74.10.9.2) is similar, but rather darker above and with sides of breast and belly of a paler tinge.—A third female skin from Elat, Key Is. (July, 10.3.1.94), is in the colour of the upperside rather closely similar to the male 1.11.5.2 (see above): breast and belly yellowish white in centre, pale fawn on sides.

*Measurements*. On pp. 717, 719, 721.

*Specimens examined*. Fifteen (two in the Leyden, four in the Berlin Museum), from the following localities:—Dutch New Guinea (Andai and Skru), two, forearms 58 and 56.5 mm.; German New Guinea (Stephansort), one, f. 56.5; British New Guinea (Eaga: "S. Coast"; and Milne Bay), four, f. 54.5, 54.5, 2, and 59; Key Is., two, f. 56.5 and 58.5; Admiralty Is., one, f. 56; Bismarck Archipelago, three and one odd skull, f. 54.5, 55, 57; Cape York, one, f. 55.5.

*Type in collection*. Skull, total length —, mandible 21.8, c- $m^1$  (crowns) 10, forearm 59, third metacarpal 41, tibia 21 mm.

a. ♀ ad. sk.; skull.	Eaga, B. New Guinea (Anthony).	Hon. W. Rothschild [P.].	97.12.6.3.
b, c. 2 ♂ ad. sks.; skulls.	S. Coast of B. New Guinea; 9, 16 Feb. 1900.	A. S. Meek [C.].	1.11.5.2.
d. [♂] ad. sk.; skull.	Milne Bay, B. New Guinea; 19 Mar. 1899.	A. S. Meek [C.]. (Type of species.)	99.12.3.2.
e. ♂ subad. al.; skull.	Key Is.	Purchased (Rolle).	99.12.4.1.
f. ♀ ad. sk.; skull.	Elat, Key Is.; 17 July, 1909 (W. Stalker).	New Guinea Expedition [P.].	10.3.1.94.
g. ♂ ad. al.; skull.	Mainland opposite Pigeon I., Admiralty Is. (H.M.S. 'Challenger').	Lords of the Admiralty [P.].	82.7.27.4.
h. ♀ ad. al.; skull.	Blanche Bay, New Britain; July-Sept. 1897.	Dr. A. Willey [P.].	1.10.12.3.
i. [♀] subad. sk.; skull.	Cape York.	Purchased (Gerrard).	74.10.9.2.

## 2. *Nyctimene albiventer*, Gray.

*Harpyia cephalotes* (pt.), Dobson, Cat. Chir. B. M. p. 88.

*Cynopterus* (Uronycteris) *albiventer*, Gray, P. Z. S. 1862, p. 262 (1863: Morotai).

*Harpyia albiventer*, Gray, Cat. Monk. &c. p. 121 (1870: type).

*Cephalotes albiventer* (pt.), Thomas, Ann. & Mag. N. H. (7) v. p. 217 (1900: type).

*Gelasinus albiventeris*, Matschie, Abh. Senck. nat. Ges. xxv. H. 2, p. 271 (1900: ♀, Tobelo, Gilolo: forearm 52.5 mm.). *albiventer*, Willink, Nat. Tijds. Ind. xv. p. 277 (1905).

*Gelasinus cephalotes a. albiventer*, Trouessart, Cat. Mamm., Suppl. p. 64 (1904).

*Nyctimene albiventer* (pt.), Thomas, Ann. & Mag. N. H. (7) xiv. p. 198 (1904: measurements of lower jaw); Jentink, Notes Leyd. Mus. xxviii. p. 165 (1906); Miller, Fam. & Gen. Bats, p. 76 (1907).

*Harpya* [sic] *pallasi* (pt., nec E. Geoff.), Finsch, Neu-Guinea, p. 151 (1865).

*Harpyia cephalotes* (pt., nec Pallas), Peters, MB. Ak. Berlin, 1867, p. 868; Dobson, Cat. Chir. B. M. p. 89, specimen *a* (1878: Morotai, type); Trouessart, Rev. & Mag. Zool. (3) vi. p. 207, n. 328 (1879); Jentink, Cat. Syst. Mamm. p. 155, specimens *c*, *d*, *f* (1888: Ternate); Trouessart, Cat. Mamm. i. p. 87, n. 468 (1897).

*Cephalotes cephalotes* (pt.), Trouessart, Cat. Mamm. ii. p. 1277 (1899).

*Gelasinus cephalotes* (pt.), Matschie, Megachir. p. 83 (1899: Ternate); Trouessart, Cat. Mamm., Suppl. p. 63, n. 551 (1904).

*Diagnosis*.—Similar to *N. papuanus*, but somewhat smaller (forearm 50.5–54.5, against 54.5–59 mm.) and with conspicuously smaller teeth (c-m<sup>1</sup> 8.7, against 9.7–10.3 mm., see also measurements of



individual teeth, p. 721); dorsal stripe much narrower, about 1.5–2 mm. ( $\frac{1}{15}$  of breadth of furred area of back), and sometimes obsolete in anterior third of back; membranes from third toe. *Hab.* Gilolo group, probably generally distributed (so far known from Morotai, Gilolo, and Ternate).

Other characters essentially as in *N. papuanus*: inner cusp of  $p^3$  distinctly separated at tip from outer;  $m^1$  and  $m_1$  not reduced in size; ears triangularly rounded off above. Membranes in all the four specimens examined inserted on first phalanx of third toe (compare individual variation in this respect in *N. papuanus*, p. 698).

This is the only species of the genus known to occur in the Gilolo group.

*Colour* (type, adult skin, probably female).—Back, nape of neck, and dorsal surface of head approximately wood-brown (slightly darker than Ridgway's pattern); individual hairs wood-brown, with basal third seal-brown; some hairs narrowly tipped with dark brown. Dorsal stripe narrow, seal-brown, nearly obsolete at anterior third of back. Foreneck and centre of breast and belly cream-buff; flanks, sides of breast and belly, and anal region dull fawn.

*Measurements.* On pp. 717, 719, 721.

*Specimens examined.* The type, and three specimens from Ternate in the Leyden Museum.

*Type* in collection. Forearm 50.5 mm.; measurements of skull and teeth on pp. 719, 721.

a. Ad. sk.; skull. Morotai; 1861. Dr. A. R. Wallace 62.10.21.5.

[C.].

(Type of species.)

### 3. *Nyctimene minutus*, K. And.

*Nyctimene minutus*, K. Andersen, *Ann. & Mag. N. II.* (8) vi. p. 622 (1 Dec. 1910; Tondano, Minahassa).

*Diagnosis.*—General size as *N. albiventer* (forearm about 51 mm.); inner cusp of  $p^3$  completely fused with outer; length of fur of back 9 (general mass of hair) and 12 mm. (longest hairs); colour of back distinctly mottled with dark brownish tips to the hairs; dorsal stripe very narrow, somewhat ill-defined, and confined to posterior two-thirds of back; membranes from third toe. *Hab.* Celebes (recorded only from Tondano).

$m^1$  and  $m_1$  not reduced in size; ears triangularly rounded off above.

The only other species of *Nyctimene* known from Celebes is the considerably larger *N. cephalotis* (forearm 60.5–69 mm.).

*Colour* (type, ♀ ad. skin).—General colour of back drab-wood-brown mottled with dark brown tips to the hairs; individual hairs dark slate (slate-sealbrown) at base, then wood-brown, with short brownish bistre tips. Dorsal stripe seal-brown, narrow, somewhat irregular and ill-defined, confined to posterior two-thirds of back.

Head and nape of neck similar to back, but washed with raw-umber, this latter tinge shading into tawny-olive on sides of neck. Centre of breast and belly greyish white, contrasting with dull brownish colour of sides of breast and belly, anal region, and flanks.

*Measurements.* On pp. 717, 719, 721.

*Specimen examined.* The type, in collection, appears to be the only specimen on record.

a. ♀ ad. sk.; skull.	Tondano, Minahassa, N. Celebes; 1859 (Dr. A. R. Wallace).	Tomes Coll.	7.1.1.271. (Type of species.)
----------------------	---	-------------	----------------------------------

#### 4. *Nyctimene varius*, K. Andl.

*Nyctimene varius*, K. Andersen, *Ann. & Mag. N. H.* (8) vi. p. 622 (1 Dec. 1910: Mt. Mada, Buru).

*Diagnosis.*—Closely allied to *N. minutus*, as small as, or only very little larger than, that species (forearm 55 mm.), but with considerably heavier teeth (c-m<sup>1</sup> 10, against 8.8 mm.; compare also measurements of individual teeth, p. 721); fur longer, more woolly and spreading (length of general mass of hair of back 10, of longest hairs of back 15 mm.); colour of back coarsely mottled with dark brownish tips to the hairs; dorsal stripe confined to posterior half of back. *Hab.* Known only from the island of Buru; presumably generally distributed over the Amboina group.

Other characters as in *N. minutus*: inner cusp of p<sup>3</sup> completely fused with outer, m<sup>1</sup> and m<sub>1</sub> not reduced, membranes from third toe.

From the only other species of *Nyctimene* known to inhabit the Amboina group, viz. *N. cephalotes* (forearm 60.5–69 mm.), this form is readily distinguished by its smaller size, fused cusps of p<sup>3</sup>, mottled colour of back, and feebly developed dorsal stripe.

*Colour* (type, adult skin, probably female).—General colour of back drab-woodbrown rather thickly varied with dark brown; individual hairs blackish brown for basal half, then light wood-brown, with narrower dark brown (brownish bistre) tips. Seal-brown dorsal stripe narrow, irregular and ill-defined, traceable only along posterior half or third of back. Nape of neck similar to back; crown and sides of head nearly uniform pale wood-brown, with short blackish brown bases to the hairs of the crown. Foreneck and centre of breast and belly greyish white; sides of breast and belly, anal region, and flanks dull broccoli-brown with a faint wash of fawn.

*Measurements.* On pp. 717, 719, 721.

*Specimen examined.* The type (in collection) is the only specimen on record.

a. Ad. sk.; skull.	Mt. Mada, W. Buru; Sept. 1898 (A. Everett).	Hon. W. Rothschild [P.].	10.11.13.1. (Type of species.)
--------------------	---	--------------------------	-----------------------------------

5. *Nyctimene cyclotis*, K. *Andl.*

*Nyctimene cyclotis*, K. *Andersen*, *Ann. & Mag. N. II.* (8) vi. p. 623 (1 Dec. 1910: Arfak Mts.).

*Diagnosis*.—Size small (forearms of type broken, real length probably about 53 mm.). Premolars and molars peculiarly short and broad, subcircular in outline (character particularly pronounced in  $p^1$  and  $m^1$ ,  $p_4$  and  $m_1$ );  $m^1$  reduced to about  $\frac{2}{3}$  or  $\frac{3}{4}$  the size of  $p^1$ ,  $m_1$  slightly smaller than  $p_4$ ; outer and inner cusp of  $p^3$  distinctly separated at tips. Ears unusually broad, nearly as broad as long, and semicircularly rounded off above. Back pale, mottled with brownish tips to the hairs; a narrow dorsal stripe along posterior half of back; membranes from second toe. *Hab.* New Guinea; so far known only from the Arfak Mountains.

The short rounded cheek-teeth, reduced  $m^1$  and  $m_1$ , and very broad and broadly rounded ears at once distinguish this form from any other species of the genus. The fur is long and woolly as in *N. varius* (length on back, general mass of hair 9.5, longest hairs 14 mm.).

Compare the above diagnosis with that of the only other *small* species of *Nyctimene* known from New Guinea, *N. papuanus* (p. 698).

*Colour* (type, ♂ ad. al.).—General colour of back light greyish wood-brown, irregularly mottled with dark brown tips to the hairs, and tainted with cinnamon along antibrachial and brownish raw-umber along lateral membranes; individual hairs blackish brown (seal-brown) for basal half, then very pale (nearly cream) wood-brown, with short dark brown tips. Dorsal stripe narrow, seal-brown, confined to posterior half of back. Neck similar to back, but paler and without any tinge of wood-brown; head similar, but more thickly powdered with dark brown. Sides of neck and foreneck light cinnamon; centre of breast and belly dull cream; sides of breast and belly, anal region, and flanks dark wood-brown with a faint tinge of fawn.

*Measurements*. On pp. 717, 719, 721.

*Specimen examined*. The type (in collection) and only specimen known.

a. ♂ ad. al.: skull. Arfak Mts., N.W. A. E. Pratt [C.] 10.7.16.9.  
New Guinea. (Type of species.)

6. *Nyctimene cephalotes*, Pallas.

*Harpyia cephalotes* (pt.), Dobson, Cat. Chir. B. M. p. 88.

*Vespertilio cephalotes*, Pallas, *Spic. Zool.*, fasc. 10, p. 10, pl. i. (animal; head), pl. ii. (skull; skeleton: anatomy) (1767: Moluccas); *Schreber*, *Säug.* i. p. 172, pl. lxi. (animal, coloured copy from Pallas) (1774); *Erxleben*, *Syst. R. An.* p. 152 (1777); *Zimmermann*, *Spec. Zool. Geogr.* p. 451 (1777); *Gatterer*, *Brev. Zool.* i. p. 43, no. 11 (1780); *Höschel*, *Linn. Nat. Syst.* i. p. 46 (1781); *Zimmermann*, *Geogr. Gesch. Mensch.* &c. iii. p. 168,

- Anhang*, p. 31 (1783); *Boddaert, Elench. An.* i. p. 70 (1785); *Gmelin, Linn. Syst. Nat.* i. p. 50, n. 18 (1788); *Donndorff, Zool. Beytr.* i. p. 81 (1792); *Kerr, An. Kingd.* i. pp. xviii, 98 (1792); *E.-A., Der Zoologe*, II. v-viii. p. 60 (1797); *Tarleton, Linn. Syst. Nat.* i. p. 26 (1802); *Treviranus, Biol. od. Philos. d. Natur*, i. p. 216 (1802); *Oken, Lehrb. Naturg.* iii. Abth. 2, p. 938 (1816); *id., Allg. Naturg.* vii. Abth. 2, p. 991 (1838).
- Nyctimene cephalotes*, *Bechstein, Pennant's Vierfüßs. Th.* ii. p. 736, n. 557 (1800); *Thomas, Ann. & Mag. N. H.* (7) xiv. p. 198 (1904: measurements of lower jaw); *Miller, Fam. & Gen. Bats*, p. 76 (1907).
- Pteropus cephalotes*, *E. Geoffroy, Cat. Mamm. Mus. Nation. d'Hist. Nat.* p. 49 (pt.) (1803: see anteâ, pp. 467, 470); *Desmarest, N. Dict. d'Hist. Nat.* xxiv., *Tabl. Méth.*, *Mamm.* p. 11 (pt.) (1804); *Tiedemann, Zool.* i. p. 535 (1808).
- Harpyia cephalotes*, *Illiger, Abh. Ak. Berlin*, 1804-11, pp. 90\*, 98 (1815); *Wagner, Schreber's Säug., Suppl.* i. p. 370 (1839); *Schinz, Syst. Verz. Säug.* i. p. 136, n. 1 (1844); *Gray, Zool. 'Samarang,' Vert.* p. 12 † (1849); *Wagner, Schreber's Säug., Suppl.* v. p. 612 (1853-55); *Gervais, Hist. Nat. Mamm.* i. p. 192 †, fig. (head) (1854); *Giebel, Säug.* p. 993 (1855); *Peters, M.B. Ak. Berlin*, 1867, p. 868 (pt.) (Celebes; Amboina); *Dobson, P. Z. S.* 1877. p. 117, figs. 3, 3 a (skull; lower teeth) (Timor); *Dobson, Cat. Chir. B.M.* p. 89, specimens b, d (1878: Amboina); *Leche, Lunds Univ. Årsskr.* xiv. pp. 17 & seq., pl. ii. fig. 10 (1878: permanent and milk dentition); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 207, n. 328 (pt.) (1879); *Robin, Ann. Sci. Nat.* (6) *Zool.* xii. Art. 2, pp. 4 & seq. (1881: visceral anatomy); *Jentink, Notes Leyd. Mus.* v. p. 173 (1883: Amurang, N. Celebes; forearm 67 mm.); *id., Cat. Ost. Mamm.* p. 266 (1887: Celebes; Amboina); *id., Cat. Syst. Mamm.* p. 155, specimens a, b, e, g, h (1888: Menado; Amboina); *Hickson, Nat. in N. Celebes*, pp. 84, 359, 360 (1889: Menado); *Trouessart, Cat. Mamm.* i. p. 87, n. 468 (pt.) (1897).
- Cephalotes cephalotes*, *Palmer, Proc. Biol. Soc. Wash.* xii. p. 114 (1898); *Trouessart, Cat. Mamm.* ii. p. 1277 (pt.) (1899).
- Uronycteris cephalotes*, *A. B. Meyer, Abh. Mus. Dresden*, vii. n. 7, p. 8 (1899: Kema, Minahassa, forearms 65, 69 mm.; Macassar, f. 67).
- Gelasinus cephalotes* (pt.), *Matschie, Megachir.* p. 83 (1899: Menado; Amboina); *Trouessart, Cat. Mamm., Suppl.* p. 63, n. 551 (1904); *Willink, Nat. Tijl. Ned. Ind.* lxx. p. 277 (1905); *Toldt, Ann. Nat. Hofmus. Wien*, xxiv. pp. 238, 244, pl. i. fig. 9 (1910: hair).
- Molucca Bat*, *Pennant, Syn. Quadr.* p. 368, n. 285 (1771); *id., Hist. Quadr.* ii. p. 558, n. 405 (1781); *id., op. c.*, 3 ed. ii. p. 315, n. 508 (1793); *Shaw, Gen. Zool.* i. pt. i. p. 134 (1800).
- Cépalote*, *Buffon, Hist. Nat., Suppl.* iii. p. 263 §, pl. lii. (animal, head; somewhat altered copies from Pallas) (1776). *Cépalote de Pallas*, *E. Geoffroy, Cours Hist. Nat. Mamm.*, 13 leçon, p. 31 (1828: description from fresh material).
- Vespertilio cephalotes melinus*, *Kerr, An. Kingd.* i. pp. xviii, 98 (1792).

\* Generic name misspelt *Harpyja*.† Specific name misspelt *cephalotis*.+ Generic name misspelt *Harpyia*.

§ In the text everywhere spelt "Cépalotte." in the plate "Cépalote."

- Cephalotes pallasi*, *E. Geoffroy*, *Ann. Mus. d'Hist. Nat.* xv. p. 107 (1810: renaming of *Vespertilio cephalotes*); *Rafinesque*, *Précis Somiol.* p. 12 (1814); *Desmarest*, *Mamm.* i. p. 113, n. 150, pl. xxxii. figs. 6, 6b (animal, head; copies from Pallas) (1820); *Schinz*, *Thierr.* i. p. 157 (1821); *id.*, *Naturg. & Abb. Säug.* i. p. 70 (1824); *id.*, *Thierr.* iv. p. 291 (1825); *Gray*, *Griffith's An. Kingd.* v. p. 59, n. 167 (1827); *Is. Geoffroy*, *Dict. Class. d'Hist. Nat.* xiv. p. 707 (1828); *J. B. Fischer*, *Syn. Mamm.* p. 89, n. 1, p. 550 (1829); *Macalister*, *Phil. Trans.* 1872, pl. xiv. fig. 11, pl. xv. (myology).
- Harpyia pallasi*, *Lesson*, *Man. Mamm.* p. 114, n. 298 \* (1827); *Burnett*, *Q. J. Sci. Lit. Art*, Apr.-June, 1829, p. 269 † (1829); *Temminck*, *Mon. Mamm.* ii. p. 101, pl. xl. (animal; head; skull; incisors and canines) (1837: Amboina); *Gray*, *Mag. Zool. & Bot.* ii. p. 504 (1838); *S. Müller*, *Temminck's Nat. Gesch. Ned. Or. Bez.*, *Zoogd.* pp. 21, 59 (1841-44: Celebes; Amboina; food); *Macgillivray*, *Cuvier's An. Kingd.* ii. p. 13, pl. viii. B, figs. 9-13 (animal; head; skull; incisors and canines: copies from Temminck) (1840); *Blyth*, *Cuvier's An. Kingd.* p. 69, fig. 9 (animal; head) (1840); *Temminck*, *Mon. Mamm.* ii. p. 358 (1841: food); *Lesson*, *N. Tabl. R. An.*, *Mamm.* p. 15, n. 204 \* (1842); *Gray*, *Voy. 'Sulphur'*, *Zool.* i. p. 29 (1844); *Schlegel*, *Dierk.* i. p. 54, pl. iii. fig. 37 (animal) (1857); *Gerrard*, *Cat. Bones Mamm. B.M.* p. 58, skull a (1862: Amboina); [*Anonymous*], *Mém. Quadr. & Chéir. Arch. Ind.* p. 119 (pt.) (1864: Celebes; Moluccas; food); *Finsch*, *Neu-Guinea*, p. 151 \* (pt.) (1865); *Gray*, *P. Z. S.* 1866, p. 64; *Fitzinger*, *S.B. Ak. Wien*, lx. Abth. i. p. 643 (1870); *Schlegel*, *Dierent.*, *Zoogd.* p. 66 (1872); *Marchi*, *Atti Soc. Ital. Sci. Nat.* xv. p. 519 (1873: hair-structure); *Rosenberg*, *Malay. Arch.* pp. 268 \*, 322 (1878: Celebes; Ceram).

*Diagnosis*.—Larger than *N. papuanus*, but smaller than *N. geminus*; forearm 60.5-69 mm. Colour of back uniform, with dorsal stripe sharply pronounced, about 3.5-5 mm. broad ( $\frac{1}{3}$  of breadth of furred area of back); females much paler than males; membranes from first phalanx of second or third toe or from interdigital membrane between these phalanges. *Hab.* Amboina group (Buru; Amboina; Ceram), west to Celebes (Menado; Kema; Amurang; Macassar), south through Timor Laut to Timor.

The difference in size as between this species and *N. papuanus* is shown in the table p. 706; though in extreme cases the two species may approach rather closely to each other in size, there appears always to remain a perfectly clear line between them, both in the size of the skull and teeth and the external dimensions. Apart from this, there are noteworthy differences in the colour of the fur and in the sexual differentiation. In *N. papuanus* the sexes do not differ conspicuously in the colour of the upperside, but the foreneck and sides of the breast and belly are in males bright cinnamon or tawny cinnamon, in females fawn-woodbrown or fawn-drab. In *N. cephalotes* the sexes are so different in colour both above and below that they might easily be mistaken for different species, the males being (generally speaking) fawn-drab above with the under-

\* Generic name misspelt *Harpya*.

† Specific name misspelt *pallassii*.

parts rather similar in colour to those of females of *papuanus*, whereas the females are (approximately) light buffy- (or even cream-) woodbrown above, cream-buffy beneath. A similar sexual difference in colour is found in *N. geminus*, *major*, and *scitulus*, and so far as this character is concerned *N. cephalotes* therefore stands nearer these species than does *N. papuanus*.

From *N. geminus* the present species is readily distinguished by its smaller size, a difference perhaps even more strongly pronounced in the skulls and teeth than in the external dimensions (see table below).

In the Amboina group (or in any case in Buru) *N. cephalotes* occurs together with *N. varius*; the latter species is at once distinguished by its small size (forearm 55 mm.), mottled colour of the upperside, and the completely fused cusps of  $p^3$ .

	<i>N. papuanus.</i>	<i>N. cephalotes.</i>	<i>N. geminus.</i>	
Skull, lambda to gnathion .....	28.5-29.8	30 -32	36.5	mm.
Mandible .....	21 -22	23 -24.8	26.7-29	"
e-m <sup>1</sup> , crowns .....	9.7-10.3	10.7-11.2	12.2-13.5	"
$p^3$ , length .....	1.9- 2.2	2.2- 2.5	2.9- 3	"
Forearm .....	54.5-59	60.5-69	70.5-77	"
Third metacarpal .....	38.5-41	42 -48.5	50 -55	"

*Colour*.—Adult males. 10.3.4.10, skin, Ceram, October: Back uniform fawn-drab slightly tinged with wood-brown and with the seal-brown dorsal stripe sharply defined along the whole of the back; individual hairs (outside dorsal stripe) dark slate at extreme base, then light wood-brown (this colour partly showing through in the arranged fur), with narrow darker brown tips. Nape of neck similar to back, but slightly more greyish and without median stripe. Crown wood-brown with very short darker brown tips to the hairs; sides of head fawn-drab. Breast and belly light drab-grey tinged with pale yellow (perhaps rather a very pale shade of fawny-olive); flanks and anal region fawn-drab.—A male skin from Buru (August, 10.3.3.27) is similar in colour, but with the drab element of the colour of the back rather more pronounced, the breast and belly light fawn-grey (somewhat approaching ecru-drab) with scarcely any trace of a yellowish tinge, and the flanks and anal region lighter fawn.

Adult females. 82.7.27.5, al., Amboina, October: Back light buffy wood-brown (the colour might equally well be described as buffy tinged with extremely light cinnamon), with a sharply defined vandyck-brown dorsal stripe from nape to interfemoral; individual hairs (outside dorsal stripe) dark brown at extreme base, then buff (this colour partly showing through in the arranged fur), narrowly tipped with light cinnamon. Head and nape of neck nearly cream. Underparts cream-buff, flanks and anal region similar but tinged with pale fawn.—A female from Timor Laut (al., 83.3.24.3) does not differ essentially in colour.

*Measurements*. On pp. 717, 719, 721.

*Specimens examined.* Fifteen (seven in the Leyden, two in the Berlin Museum), from the following localities:—"Celebes," one; Menado, N. Celebes, three; Buru, one; Amboina, seven; Ceram one; Timor Laut, one; Timor, one.

*Cotypes of species and type of Kerr's* *V. c. melinus*.—The species was described by Pallas from two female specimens from the "Moluccas," at least one of which seems to have been in Amsterdam (in the possession of J. A. Schlosser). Whether any of the types are still in existence is unknown. The only point of Pallas's description that needs some comment here is his note on the colours: "supra e gryseo-cinereus, dilutior etiam in capite & versus alas; subtus albo-pallidus, in ventre canus." This description would certainly agree better with the colour of an adult male of the present species, but the fact that Pallas found a foetus in the uterus of the specimen thus described of course settles the question of its sex. It should further be noted that Pallas does not refer with a single word to the dorsal stripe nor to the equally conspicuous yellow spots on the wings, nor is there any trace of either character in his figure. The simplest explanation is perhaps that the specimen, at least so far as the fur and membranes were concerned, may have been in a poor state of preservation, a suggestion apparently supported also by Pallas's statement that the foetus was "semi-corruptus." All the other points of his long and careful description, as well as the external measurements and the size of the skull figure, accord better with the present species than with any other known form of the genus. Amboina may be fixed as the type locality of *N. cephalotes*.

As noted above, Pallas described this species as greyish ash-coloured above. A specimen in Sir Ashton Lever's possession was, Pennant says (*l. c.*, 1781), "fine straw-colour" on the upperside. Owing to this discrepancy in colour, Kerr separated the latter as a variety under the name *V. cephalotes melinus* (*l. c.*, 1792). Curiously enough, also Pennant (and of course Kerr, who only copies his words) omits any reference to the dorsal stripe and the yellow wing-spots. The fate of the type of *melinus* (evidently a female, judging from the colour) is unknown [at the dispersal of the Museum Leverianum, in 1806, part of the collection went to Vienna, part was acquired by Lord Stanley (13th Earl of Derby) and was by him in 1851 bequeathed to the Liverpool Museum, while yet a few specimens turned up a few years ago and came to the British Museum; see 'Ibis,' 1873, pp. 14-54, 105-124, 1874, p. 461, and A. Newton, *Dict. of Birds*, *Introduct.* p. 12 (1896)]. Amboina may be fixed as the type locality of *melinus*.—Temminck (*l. c.*, 1837) was the first to give a description and figure of the present species showing the dorsal stripe and yellow wing-spots.

*Technical names.*—For about forty years, 1767-1810, this species was commonly referred to under its earliest name, *Vespertilio cephalotes*, though a few authors preferred to emphasize its evident affinities by calling it *Pteropus cephalotes*, while fewer still recognized it as a distinct genus, *Nyctimene cephalotes*. A change was effected by the appearance of Étienne Geoffroy's paper on the "Roussettes"

(1810); unaware of the existence of the earlier generic name, *Nyctimene*, he founded for this bat the genus *Cephalotes* (in which he included another species, *peroni*, belonging to a genus now called *Dobsonia*), and, obviously to avoid the tautological combination "*Cephalotes cephalotes*," he renamed the species "*pallasi*." The reign of the name *Cephalotes pallasi* was, however, destined to be relatively short, chiefly confined to the years 1810-1829, and in the later years of this period it had serious competitors. In 1811, a new (third) generic name, *Harpyia*, had been created for this bat by Illiger, and this was slowly becoming generally accepted, while "*Cephalotes*" came into use for the second species originally included in that genus by E. Geoffroy, viz. *C. peroni* (*Dobsonia peroni*). Thus for half a century, 1827-1878, the present bat was commonly styled *Harpyia cephalotes* or *Harpyia pallasi*, both names equally common in the literature of that period. Dobson's acceptance, in his Catalogue (1878), of the combination *Harpyia cephalotes* turned the scale so decidedly in favour of this, the earlier, specific name that, after 1878, "*Harpyia pallasi*" practically disappeared from the literature. Shortly afterwards, however, the modern strict application of the priority principle was brought to bear on the name of this bat, and, as in several other cases, it resulted, to begin with, in a period of instability. First (early nineties of last century), "*Harpyia*" was discarded, as preoccupied in Entomology, and replaced by what was supposed to be the next generic name in chronological order, *Uronycteris* (hence the combination *Uronycteris cephalotes*); second (late in the nineties), it was pointed out by Palmer that the name *Cephalotes* in reality would have to stand for this species, not for "*C. peroni*" (hence the combination *Cephalotes cephalotes*); third (1899) came the combination *Gelasinus cephalotes*, introduced by an author (Matschie) who was unable to accept Palmer's view; and finally, in 1902, the earliest generic name of this bat, *Nyctimene*, was discovered and re-introduced.

a. ♂ ad. sk.; skull.	Kayeli, Buru ("sleeping in banana leaves"); Aug. 1909 (W. Stalker).	New Guinea Ex- pedition [P.].	10.3.3.27.
b. Ad. st.; skull.	Amboina.	Purchased (Ver- reaux).	{ 47.7.8.8. 49.8.16.4.
c. ♀ subad. al.; skull.	Amboina; Oct. 1874 ( <i>H.M.S.</i> <i>'Challenger'</i> ).	Lords of the Admiralty [P.].	82.7.27.5.
d. ♂ ad. sk.; skull.	Wahai, Ceram; 7 Oct. 1909 (W. Stalker).	New Guinea Ex- pedition [P.].	10.3.4.10.
e. ♀ ad. al.; skull.	Larat, Timor Lant ( <i>Dr. H.O. Forbes</i> ).	British Associa- tion [P.].	83.3.24.3.
f. ♂ ad. al.; skull.	Timor.	R. Army Medi- cal College [P.].	9.1.4.8.



7. *Nyctimene geminus*, K. Aud.

*Harpia major* (pt.), Dobson, Cat. Chir. B. M. p. 89.

- Harpia major* (pt., nec Dobson, 1877), Dobson, Cat. Chir. B. M. p. 90, specimen *a* (1878: S. of Huon Gulf); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 207, n. 329 (1879); Thomas, *Nor. Zool.* iii. p. 526 (1896: Kiriwina Is.); Trouessart, *Cat. Mamm.* i. p. 87, n. 469 (1897); Heller, *Abh. Mus. Dresden*, vi. n. 8, p. 4 (1897).  
*Urocyon major*, Thomas, *Nor. Zool.* ii. p. 163 (1895: Fergusson I.; Goodenough I.).  
*Cephalotes major* (pt.), Trouessart, *Cat. Mamm.* ii. p. 1277 (1899).  
*Gelasinus* [*Bdelygma*] *major* (pt.), Matschie, *Megachir.* p. 84 (1899); Trouessart, *Cat. Mamm., Suppl.* p. 64, n. 552 (1904).  
*Bdelygma major*, Matschie, *Krieger's Neu-Guinea*, p. 77 (1899); Jenlink, *Notes Leyd. Mus.* xxviii. p. 165 (1906).  
*Harpia cephalotes* (nec Pallas), ? Ramsay, *Proc. Linn. Soc. N. S. Wales*, iii. p. 243\* (1879: Heath I., S.E. New Guinea); ? Peters & Doria, *Ann. Mus. Civ. Genova*, xvi. p. 690 (1881: Mansinam, forearm 145 mm.); ? Heller, *Abh. Mus. Dresden*, vi. n. 8, p. 4 (pt.) (1897).  
*Nyctimene cephalotes*, Elliot, *Cat. Mamm. Field Col. Mus.* p. 494, n. 871 (1907: Kiriwina Is.).  
*Nyctimene geminus*, K. Andersen, *Ann. & Mag. N. H.* (8) vi. p. 623 (1 Dec. 1910: New Guinea; Kiriwina Is.; D'Entrecasteaux Is.).

**Diagnosis.**—Similar to *N. cephalotes*, but somewhat larger (forearm 70.5–77 mm.) and with relatively considerably heavier skull and teeth. *Hab.* British New Guinea (Huon Gulf) and adjacent islands (Trobriand and D'Entrecasteaux Archipelagos).

For some comparative measurements of this species and *N. cephalotes* see p. 706. The secondary (external) cusp of the upper canines is in *N. geminus* (as well as in the related *N. major* and *scitulus*) generally more sharply marked off than in *N. cephalotes*, but specimens occur (e. g. *N. geminus*, 76.7.5.10) in which it is practically obsolete; a notch in the edge of the outer ridge of  $p_3$ ,  $p_4$ , and  $m_1$  (or in one or two of these teeth), rendering this ridge more or less distinctly bilobed, is rather more often present and more distinctly developed in *N. geminus* and its closest relatives than in *N. cephalotes*; and the front edge of the coronoid process, near its base, is somewhat more expanded (for the insertion of part of the outer layer of the temporal muscle) than in *cephalotes*; but in all these points the difference is scarcely more than one of average. The posterior edge of the bony palate is evenly (semicircularly) concave (compare *N. scitulus*). Sexual colour difference as in *N. cephalotes* (males brownish drab, females buffy); in the colour of the upper-side the single male skin examined is not essentially different from *cephalotes*, but the underside is conspicuously darker. Membranes in all specimens from second toe (middle or distal half of first phalanx).

**Colour.**—♂ ad. skin, S. of Huon Gulf, undated (type of species):

\* Generic name misspelt *Harpia*.

General colour of back pale brownish drab, somewhat warmer in tinge laterally along membranes, and with a well-defined narrow, dark seal-brown spinal stripe; individual hairs seal-brown at base, drab or brownish drab or brownish isabella for terminal half or two-thirds. Nape of neck greyer, head more inclining to pale wood-brown. Chest, breast, and middle of belly pale raw-umber (or dark tawny-olive), this colour gradually shading into pale fawn-brown on flanks and anal region.

♀ ad. skin, Kiriwina, February (96.11.5.1): Scarcely differing in colour from females of *N. cephalotes* (p. 706).

*Measurements.* On pp. 718, 720, 722.

*Specimens examined.* Those catalogued below.

*Type* in collection. Skull, total length — ?, mandible 26.8, c-m<sup>1</sup> (crowns) 12.3, forearm 70.5, third metacarpal 50.5, tibia 26 mm.

a. [♂] ad. sk.; skull.	S. of Huon Gulf, B. New Guinea.	Dr. P. Comrie [C.].	76.7.5.10.
		(Type of species.)	
b. [♀] ad. sk.; skull.	Kiriwina I.; 17 Feb. 1895.	A. S. Meek [C.].	96.11.5.1.
c. Ad. skull.	Goodenough I.	B. Thomson, Esq. [C. & P.].	89.6.3.1.
d. ♂ ad. al.; skull.	Fergusson I.	A. S. Meek [C.].	95.5.8.1.

### 8. *Nyctimene major*, Dobson.

*Harpyia major* (pt.), Dobson, Cat. Chir. B. M. p. 89.

*Harpyia major*, Dobson, P. Z. S. 1877, p. 117, figs. 1, 2, 2a (head; skull; lower teeth) (1 June, 1877: Duke of York I.); *id.*, Cat. Chir. B. M. p. 90, specimens *b*, *c* (1878); Trouessart, Rev. & Mag. Zool. (3) vi. p. 207, n. 329 (pt.) (1879); H. Allen, Proc. Ac. Nat. Sc. Philad. 1889, p. 338 (wing-membranes); Flower & Lydekker, Mamm. p. 653, fig. 303 (head; copy from Dobson) (1891); Trouessart, Cat. Mamm. i. p. 87, n. 469 (pt.) (1897).

*Cephalotes major*, Palmer, Proc. Biol. Soc. Wash. xii. p. 114 (1898); Trouessart, Cat. Mamm. ii. p. 1277 (1899).

*Gelasinus* [Bdelygma] *major* (pt.), Matschie, Megachir. p. 84 (1899: New Britain); Trouessart, Cat. Mamm., Suppl. p. 64, n. 552 (1904).

*Bdelygma major*, Elliot, Cat. Mamm. Field Col. Mus. p. 495, n. 872 (1907: Duke of York I.).

*Nyctimene major*, Thomas, Ann. & Mag. N. H. (7) xiv. p. 197 (1904: measurements of lower jaw); Miller, Fam. & Gen. Bats, p. 76, pl. vii. fig. 2, pl. viii. fig. 2 (teeth) (1907: Duke of York I.).

*Diagnosis.*—Closely allied to *N. geminus*, but larger (see comparative measurements, p. 711); males differing by the more ash-grey or greyish hair-brown colour of the fur (females pale cream-buffy). *Hab.* Bismarck Archipelago.

This species probably represents *N. geminus* in the Bismarck Archipelago. Membranes in all specimens examined inserted on second toe (middle or distal half of first phalanx).

	<i>N. geminus.</i>	<i>N. major.</i>	<i>N. scitulus.</i>	
c-m <sup>1</sup> , crowns .....	12.2-13.5	13.5-14.2	12.7-13.2	mm.
Forearm .....	70.5-77	78 -85.5	71.5-80	"
3rd metacarpal .....	50 -55	54.5-59.5	50 -55.5	"
Ear from orifice .....	16	15.5-17	14	"
Tibia .....	26 -30	28 -30.5	25 -29.5	"

*Colour.*—Males. Four fully adult males (al., Makupa, Dr. Heinroth coll., Berlin Museum) are light greyish hair-brown above (one perhaps with a faint touch of wood-brown), paler beneath; dorsal stripe narrow, well-defined.—An immature male in collection (paratype, skin, 77.7.18.6) is pale ash-grey on back, dorsal stripe as in adults; individual hairs seal-brown at base; nape of neck lighter grey; head similar to back; underparts light greyish, slightly tinged with pale fawn on sides of breast and belly and on anal region.

Females. Type of species (adult skin): Back cream-white with sharply marked dark brown spinal stripe; extreme base of fur seal-brown; nape of neck whiter; head cream-buff; foreneck and chest cream-buff, shading almost to pinkish buff on belly, anal region, and flanks.—Three adult females in the Berlin Museum (al., Makupa, Heinroth; and New Britain, Finsch) are essentially similar in colour; an immature female in the same Museum (al., New Britain, Finsch) is very light wood-brown on back, cream-buff beneath.

*Measurements.* On pp. 718, 720, 722.

*Specimens examined.* Ten (eight in the Berlin Museum), viz. 4 ♂ ad., 1 ♂ imm., 4 ♀ ad., 1 ♀ imm.

*Type* in collection. Skull, total length —?, mandible 28.7, c-m<sup>1</sup> (crowns) 13.5, forearm 79, third metacarpal 54.5, tibia 28 mm.

a. [♂] imm. sk.; skull.	New Ireland.	Rev. G. Brown	77.7.18.6.
		[C].	
b. [♀] ad. sk.; skull.	Duke of York I.	Rev. G. Brown	77.7.18.7.
		[C].	
		(Type of species.)	

## 9. *Nyctimene scitulus*, K. *And.*

*Harpyia major* (pt.), Dobson, *Cat. Chir. B. M.* p. 89.

*Harpyia pallasi* (pt., nec *E. Geoff.*), Gerrard, *Cat. Bones Mamm. B. M.* p. 58, skull *b* (1862: New Georgia, B.M. 60.5.25.1).

*Harpyia cephalotes* (nec *Pallas*), Gray, *Cat. Monk. &c.* p. 121 (1870: same specimen).

*Harpyia major* (pt., nec *Dobson*, 1877), *Dobson, Cat. Chir. B. M.* p. 90, specimen *d* (1878: same specimen); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 207, n. 329 (1879); *Thomas, P. Z. S.* 1887, p. 323 (Alu; New Georgia); *id.*, *P. Z. S.* 1888, p. 476 (1889: Aola); *Trouessart, Cat. Mamm.* i. p. 87, n. 469 (1897).

*Cephalotes major*, *Trouessart, Cat. Mamm.* ii. p. 1277 (1899).

*Gelasinus* [*Bdelygma*] *major* (pt.), *Matschie, Megachir.* p. 84 (1899); *Trouessart, Cat. Mamm., Suppl.* p. 64, n. 552 (1904).

*Nyctimene scitulus*, K. *Andersen, Ann. & Mag. N. H.* (8) vi. p. 623 (1 Dec. 1910: Shortland: New Georgia: Florida: Guadalcanar).

*Diagnosis*.—Similar to *N. geminus*, but free edge of bony palate triangular (in *geminus* evenly concave) and ears conspicuously smaller (14 mm. from orifice, against 16 in *geminus*). General size as *N. geminus*: forearm 71·5–80 mm. *Hab.* Solomon Islands; so far known from Shortland, New Georgia, Florida, and Guadalcanar.

This species no doubt represents *N. geminus* in the Solomon Archipelago. The form of the free edge of the palate, as described above, has been verified in all the skulls examined, except one (that of the New Georgia specimen, of which only the facial portion is preserved); an exact measurement of the ear has been taken only of the single alcoholic specimen (Guadalcanar), but the ears of the dried skins appear to be of the same size. Sexual colour difference as in *N. geminus* (males pale brownish, females cream), and actual colours not essentially different from those of the corresponding sexes of *geminus*. Membranes from first phalanx of second toe. For some comparative measurements of this species and *N. geminus* and *major* see p. 711.

*Colour*.—Males. Adult skin, Shortland, April (87.1.18.6): Back brownish drab with well-pronounced narrow seal-brown spinal stripe; concealed base of fur seal-brown. Nape of neck paler, more pure drab; head similar, but with a slight tinge of wood-brown. Underparts pale brownish (approximately brownish isabella), conspicuously tinged with dark tawny-olive or pale raw-umber on fore-neck and centre of breast and belly.—A second adult male skin (same locality and date, 87.1.18.7) is paler: Back fawn-drab, nape pale drab, head slightly tinged with wood-brown; foreneck and sides of breast between isabella and raw-umber, centre of breast and belly drab-grey, turning into fawn-brown on flanks and anal region.

Females. Adult skin, Florida I., January (1.11.5.1): Back cream-white, shading into buff laterally along membranes; concealed base of fur seal-brown; a narrow seal-brown spinal stripe. Head, sides of neck, and foreneck buffy (colour of head with a slight tinge of wood-brown), shading into wood-brown on centre of breast and belly, this again into fawn-drab on flanks.

*Measurements*. On pp. 718, 720, 722.

*Specimens examined*. Five, as catalogued below.

*Type* in collection. Skull, lambda to gnathion, 36·8, mandible 28, c-m<sup>1</sup> (crowns) 13·2, forearm 80, third metacarpal 55·5, ear from orifice 14, tibia 29·5 mm.

a, b. 2 ♂ ad. sks.; skulls.	Alu, Shortland; April, 1886.	C. M. Wood- ford, Esq. [C.].	87.1.18.6, 7.
c. ♂ ad. st.; skull.	New Georgia.	Purchased (Cunning).	60.5.25.1.
d. [♀] ad. sk.; skull.	Florida; 5 Jan. 1901.	A. S. Meek [C.].	1.11.5.1.
e. ♀ ad. al.; skull.	Aola, Guadalcanar.	C. M. Wood- ford, Esq. [C.].	88.1.5.11. (Type of species.)

10. *Nyctimene lullulæ*, Thos.

*Harpyia major* (pt., *nec Dobson*), *Thomas, Nov. Zool.* iii. p. 526 (1896: Woodlark I.).

*Gelasinus* [*Bdelygma*] *major* (pt.), *Matschie, Megachir.* p. 84 (1899); *Trouessart, Cat. Mamm., Suppl.* p. 64, n. 552 (1904).

*Nyctimene major lullulæ*, *Thomas, Ann. & Mag. N. H.* (7) xiv. p. 197 (1 Sept. 1904: Woodlark I.); *Jentink, Notes Leyd. Mus.* xxviii. p. 165, footnote (1906).

*Nyctimene lullulæ*, *Miller, Fam. & Gen. Bats*, p. 76 (1907).

*Diagnosis*.—Allied to *N. geminus*, but conspicuously smaller (fore-arm about 69 mm.). *Hab.* Woodlark I.

This species probably represents *N. geminus* in the outlying Woodlark Island. In general size it closely approaches the largest individuals of *N. cephalotes*, but is readily distinguished by its heavier skull, broader and more steeply ascending coronoid process (the front margin of which is noticeably expanded near its base, as in *geminus* and its allies), stronger and more outwardly directed angular process (heavier masseter muscle), relatively longer phalanges of digits, and noticeably larger foot (see comparative measurements below). Its rather short ears may perhaps indicate some leanings toward the Solomon Island representative of this group of the genus, *N. scitulus*. Colour of males essentially as in males of *N. geminus* and *scitulus*, females as yet unknown (probably buffy, as in the allied species). Wing-membranes from first phalanx of second toe.

	<i>N. geminus.</i>	<i>N. lullulæ.</i>	<i>N. cephalotes.</i>	
Skull, total length .....	36.5	33.2	30 -32	mm.
Mandible .....	26.7-29	25	23 -24.8	"
c-m <sup>1</sup> , crowns .....	12.2-13.5	11.5	10.7-11.2	"
Forearm .....	70.5-77	69	60.5-69	"
3rd digit, metacarpal .....	50 -55	46.5	42 -48.5	"
„ 1st phalanx .....	38.5-42	36.5	31 -36	"
Ear from orifice .....	16	14	14 -15	"
Tibia .....	26 -30	24	21.5-25	"
Foot, c. u. ....	19.5-20.5	18	14.5-16	"

*Colour* (type, ♂ ad. al.).—Back drab-woodbrown, with well-marked narrow dark brown spinal stripe; concealed base of fur seal-brown. Head and nape of neck similar to back, but slightly paler. Underparts pale drab (pale brownish drab), faintly tinged with raw-umber on foreneck and sides of breast, and shading gradually into fawn-drab on flanks and anal region.

*Measurements*. On pp. 718, 720, 722.

*Specimen examined*. The type (in collection) appears to be the only specimen on record.

α. ♂ ad. al.; skull.

Woodlark I.

A. S. Meek [C.]. 96.11.5.28.  
(Type of species.)

11. *Nyctimene robinsoni*, Thos.

*Nyctimene robinsoni*, Thomas, *Ann. & Mag. N. H.* (7) xiv. p. 196 (1 Sept. 1904: Cooktown); Miller, *Fam. & Gen. Bats*, p. 76 (1907).

*Diagnosis*.—Size as *N. lullulae* (if not a little smaller: forearm about 66 mm.), but ears much longer and fur of back uniform from base to tip. *Hab.* Queensland (Cooktown).

Perhaps the Australian representative of the *N. geminus* type. Size and general shape of skull as in *N. lullulae* (Woodlark I.), but orbit noticeably larger (diameter 9.3–9.5 mm., against 8.5 in *N. lullulae*), body of mandible weaker, coronoid narrower, more slanting backward, and only very slightly expanded at base anteriorly, and angular process less prominent; size and characters of teeth as in *lullulae*; secondary cusp of upper canines obsolescent, outer ridges of lower cheek-teeth simple. Externally at once distinguished by the unusually large and more acutely pointed ears, these being equal in length to (in *lullulae* and the other representatives of the *geminus* type much shorter than) the hind foot with claws, and by the absence of dark (seal-brown) bases to the hairs of the back. Males similar in colour to same sex of *N. geminus* and *scitulus*, but with the flanks of a somewhat deeper tinge; females unknown. Membranes from first phalanx of second toe.

The only other species of *Nyctimene* known from Australia is the much smaller *N. papuanus* (forearm 54.5–59 mm.).

*Colour*.—Type (♂ ad., skinned from alcohol): General colour of back a dark wood-brown tinge of isabella; individual hairs uniform from bases to tips (in all other species of the *geminus* group sharply contrasting seal-brown at base); a well-marked narrow seal-brown spinal stripe along the whole of the back. Head and nape of neck similar to back. Underparts pale isabella tinged with tawny-olive along middle line from throat to belly, dark russet (or dark cinnamon) along flanks and in anal region.—A paratype (al., same sex) is very similar in colour, though rather paler (more pure isabella) on back.

*Measurements*. On pp. 718, 720, 722.

*Specimens examined*. The type and paratype (both in collection) appear to be the only specimens on record.

- |                      |                       |   |
|----------------------|-----------------------|---|
| a. ♂ ad. sk.; skull. | Cooktown, Queensland. | H. C. Robinson, 3.8.3.1.<br>Esq. [P.]<br>(Type of species.) |
| b. ♂ ad. al.; skull. | Cooktown.             | H. C. Robinson, 3.8.3.2.<br>Esq. [P.]                       |

12. *Nyctimene aëllo*, *Thos.*

*Harpyia major* (*nec Dobson*), *Jentink, Cat. Ost. Mamm.* p. 267 (1887: Mysol); *id.*, *Cat. Syst. Mamm.* p. 156 (1888: Mysol).

*Cephalotes aëllo*, *Thomas, Ann. & Mag. N. H.* (7) v. p. 216 (1 Feb. 1900: Milne Bay).

*Gelasinus* [*Bdelygma*] *aëllo*, *Trouessart, Cat. Mamm., Suppl.*, p. 64, n. 553 (1904).

*Nyctimene aëllo*, *Thomas, Ann. & Mag. N. H.* (7) xiv. p. 198 (1904); *Miller, Fam. & Gen. Bats*, p. 76 (1907).

*Bdelygma aëllo*, *Jentink, Notes Leyd. Mus.* xxviii. p. 166 (1906).

*Diagnosis*.—Size large (forearm 81.5–84 mm.), breadth of spinal stripe about one-third that of furred area of back. *Hab.* New Guinea (Milne Bay) and Mysol.

A peculiar species, distinguishable at a glance from all others by its very broad spinal stripe, the seal-brown colour of which stands out in strong contrast to the general light buffy-woodbrown tinge of the back. Premaxillæ more proclivous than in other species (fig. 64), their alveolar branches lower (less expanded vertically); orbits unusually large; zygomata more widely expanded, postorbital processes longer and stouter than in the other large species, frontal sinuses slightly less inflated, coronoid process narrower and more sloping backward, its front margin with hardly any trace of a keel for the insertion of the temporal muscle (compare *N. geminus*, p. 709),



Fig. 64.—A, rostrum of *Nyctimene aëllo* (type skull), to show proclivous premaxillæ and canines, as compared with B, *Nyctimene scitulus* (type skull).

$\frac{2}{3}$  (linear).

masseter arising chiefly from ventral surface of zygomatic process of maxillary (in the species of the *geminus* type extending its origin upward over nearly the whole of the external surface of the bone), angular process of mandible only very slightly bent outward. Dental characters essentially unmodified, but upper and lower canines decidedly longer, and the upper (in conformance with proclivity of extremity of rostrum) slanted slightly more forward than usual; secondary cusp of upper canines obsolescent or completely absent;

outer ridge of  $p_3$ ,  $p_4$ , and  $m$ , usually simple (see table, p. 687). Ears (in dried skins) apparently rather more narrowly rounded off at tips than usual; interfemoral very deep in centre (making tail appear shorter than usual, which probably it is not); membranes from first phalanx of second toe.

*Colour* (type, adult skin, probably male, April).—General colour of back light buffy wood-brown, palest (nearest buff) in lumbar region, dullest (approaching isabella) on shoulders, becoming slightly paler again on nape of neck, and tinged with delicate light cinnamon on head; concealed base of fur fawn-brown; spinal streak seal-brown, greatest breadth about 15 mm.; a narrow dark-brown stripe on either side of back along membranes. Face and chin fawn-drab; centre of breast and belly pale yellowish (a pale yellowish tinge of tawny-olive); flanks warm tawny-cinnamon, shading gradually into pale cinnamon on chest and sides of neck, and into pale fawn in anal region (this tawny-cinnamon colour of the flanks may be characteristic of the males only).

*Measurements.* On pp. 718, 720, 722.

*Specimens examined.* The type of the species (in collection), and five mounted specimens from Mysol in the Leyden Museum.

a. [♂] ad. sk.; skull. Milne Bay, B. New Guinea; A. S. Meek [C.]. 99.12.3.1.  
5 Apr. 1899. (Type of species.)



## Nyctimene: External measurements (I.).

	<i>N. papuanus</i> , 13 ad. New Guinea *; Key Is.; Admiralty Is.; Bismarck Arch.		<i>N. albiventer</i> , 4 ad. Morotai; Ternate.		<i>N. minutus</i> , ♀ ad. Type.		<i>N. varius</i> , Ad. Type.		<i>N. cyclotis</i> , ♂ ad. Type.		<i>N. cephalotes</i> , 13 ad. Celebes; Buru; Amboina; Ceram; Timor Laut; Timor.	
	Min.	Max.	Min.	Max.	mm.	mm.	mm.	mm.	mm.	mm.	Min.	Max.
Forearm .....	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Pollex, total length, c. u. ....	54.5	59	50	54.5	51	55	55	55	(53 †)	60.5	69	69
" metacarpal .....	23	25.5	23	24	22	23.5	23.5	23.5	8.5	24.5	28	28
" 1st phalanx .....	11	9	7.5	8.5	7.5	8	8	8	8.5	8.5	9.5	9.5
2nd digit, metacarpal .....	26.5	30	11.5	12	11.5	12	12	12	10.5	12	14	14
" 1st phalanx .....	4.5	6	2.5	2.8	2.5	2.5	2.5	2.5	2.5	2.8	31	31
" 2nd-3rd phalanx, c. u. ....	7.5	9	4.5	5.5	4.5	5	5	5	5	5	6.5	6.5
3rd digit, metacarpal .....	38.5	41	36	38	8	7.5	7.5	7.5	8	8	10	10
" 1st phalanx .....	28	31	26	30.5	35.5	38.5	38.5	38.5	39	42	48.5	48.5
" 2nd phalanx .....	34	39.5	31.5	38	28	32	32	32	30.5	31	36	36
4th digit, metacarpal .....	35	37	33.5	35.5	...	36.5	36.5	36.5	36.5	39	44	44
" 1st phalanx .....	20	23.5	19.5	22	32	36	36	36	33.5	38	44.5	44.5
" 2nd phalanx .....	22.5	26.5	24.5	25.5	19.5	23	23	23	23	22.5	26.5	26.5
5th digit, metacarpal .....	37.5	40.5	34.5	38	23.5	24	24	24	24	25.5	29	29
" 1st phalanx .....	18	19.5	16.5	18.5	34	38	38	38	36.5	40	46.5	46.5
" 2nd phalanx .....	19	21.5	18.5	22	17.5	19.5	19.5	19.5	20.5	19	22	22
Ear, length from orifice .....	12	14	12.5	10	19	21	21	21	20.5	21.5	25	25
" greatest breadth, flattened .....	9	10.5	10	9	...	11 †	11 †	11 †	14	14	15	15
Tail .....	19.5	24.5	21	19.5	...	9 †	9 †	9 †	12.5	10	11.5	11.5
Tibia .....	20.5	21.5	16.5	19.5	17	...	...	...	22.5	17.5	23.5	23.5
Foot, c. u. ....	14	15	12	14	13	...	...	...	21.5	21.5	25	25
Calcar .....	7.5	9	7	7	13	...	...	...	13.5	14.5	16	16
					...	...	...	...	7.5	7.5	9.5	9.5

\* For localities see p. 700.

† Estimate (relaxed skin).

‡ Estimate (forearms broken).

Nyctimene: *External measurements* (II.).

	<i>N. geminus</i> , 3 ad. Huon Gulf; Kiriwina I.; Fergusson I.		<i>N. major</i> , 8 ad. Bismarck Arch.		<i>N. scitulus</i> , 5 ad. Shortland; New Georgia; Florida; Guadalcanar.		<i>N. tullulæ</i> , ♂ ad. Type.		<i>N. robinsoni</i> , 2 ♂ ad.		<i>N. ællo</i> , 6 ad. Milne Bay; Mysol.	
	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	mm.	Type, mm.	Paratype, mm.	mm.	Min. mm.	Max. mm.
Forearm .....	70.5	77	78	85.5	71.5	80	69	66	66.5	81.5	84	
Pollex, total length, c. u. ....	32	35	33.5	38	...	34	31	27	28.5	35.5		
" metacarpal .....	10.5	12	12	14	11.5	12.5	10.5	10	10	13	13	
" 1st phalanx .....	15.5	17.5	16	18.5	15.5	16.5	15	13	13	16		
2nd digit, metacarpal .....	34.5	38.5	36	42	34.5	38	32.5	32.5	31	39.5	42	
" 1st phalanx .....	6.5	7	7	9	6.5	7.5	6.5	5.5	6	7	8	
" 2nd-3rd phalanx, c. u. ....	11	12	10.5	13.5	10.5	12.5	10.5	10	10	11	12.5	
3rd digit, metacarpal .....	50	55	54.5	59.5	50	55.5	46.5	47	45	54.5	58.5	
" 1st phalanx .....	38.5	42	42	45.5	39.5	43.5	36.5	33.5	32.5	41.5	45	
" 2nd phalanx .....	50	53.5	55	59	52	58.5	49	42	42.5	54	58	
4th digit, metacarpal .....	45.5	49	49	53	46	50	42	42.5	40.5	50	54	
" 1st phalanx .....	29	33	32	36	30.5	33	29	25	25.5	30	32.5	
" 2nd phalanx .....	...	34.5	32.5	37.5	32	35.5	30.5	...	29	33.5	38	
5th digit, metacarpal .....	48	51	50.5	58.5	48	53	45	46.5	45	54.5	57.5	
" 1st phalanx .....	24.5	25.5	26.5	28.5	24	27	23	20.5	21	25.5	28.5	
" 2nd phalanx .....	27.5	30.5	29.5	32.5	27	32	27	23	25	29	32.5	
Ear, length from orifice .....	16		15.5	17	14		14	...	17	(16*)		
" greatest breadth, flattened .....	13		11.5	12.5	11.5		11.5	...	13	...		
Tail .....	24		25.5	29	23.5		24	...	25.5	...		
Tibia .....	26	30	28	30.5	25	29.5	24	...	24	30		
Foot, c. u. ....	19.5	20.5	20	22	19	22	18	...	17	22.5		
Calcaneus .....	.....		11.5	12.5	11.5		10.5	...	10	...		

\* Collector's measurement on type (in flesh).

## Nyctimene: Measurements of skulls and tooth-rows (L.).

	<i>N. papuanus</i> . ♀ ad. B. New Guinea; Key Is.; Admiralty Is.; Bismarek Arch.		<i>N. albiventer</i> . Ad. Type.	<i>N. minutus</i> . ♀ ad. Type.	<i>N. varius</i> . Ad. Type.	<i>N. cyclotis</i> . ♂ ad. Type.	<i>N. cephalotes</i> . ♀ ad. Celebes; Buru; Amboina; Ceram; Timor Laut; Timor.	
	MIN.	MAX.					MIN.	MAX.
Skull, lambda to gnathion .....	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
" condylo-basal length.....	23.5	29.8	...	...	23.8	...	30	32
" palation to incisive foramina.....	26.5	27.8	...	...	...	...	28.5	29.5
" palation to basion.....	9.8	12	...	11	11	...	11.8	12.7
" rostrum, length orbit to nares.....	11.2	12.6	...	...	...	...	12	13
" rostrum, length orbit to nares.....	4.7	5.8	4.8	5.2	5.5	5.2	5.7	6.8
" rostrum, height at alv. of canine.....	5.6	6	5.2	6	5.8	6.2	6	6.9
" width of brain-case at zygomatic.....	12.5	12.8	...	11.8	12.2	...	13.2	13.8
" zygomatic width .....	18.7	19	...	17.5	17.5	...	19	20.5
" across crowns of m <sup>1</sup> -m <sup>1</sup> , externally.....	8.2	9	7.5	7.5	8	7.8	9	10
" lachrymal width .....	7.8	8.5	7	7.7	7.8	...	8.9	10.5
" across crowns of canines, externally.....	5.5	6	5.2	4.8	5.7	5.7	5.8	6.2
" premaxilla, depth at symphysis .....	2	2.7	...	2.8	2.8	3	2	3
" postorbital width .....	4.8	6.5	5.8	5.7	5	...	6	7
" interorbital width.....	4.5	5.7	4.8	5.2	5	4.5	6	6.3
" mesopterygoid fossa, width.....	4.8	5.2	...	4.6	4.7	...	5	5.3
" between p <sup>1</sup> -p <sup>1</sup> .....	4.9	5.5	4.2	4.4	4.2	5.1	5.2	6.3
" between bases of canines .....	1.7	2.2	1.6	1.5	2	2.2	1.7	2.3
" orbital diameter .....	8	8.6	7.6	7.8	7.7	8.2	8	8.8
" Mandible, length from condyle .....	21	22	19.2	19.8	20.8	21.5	23	24.8
" coronoid height.....	11.2	12.8	10	10.7	12	...	13.5	13.8
" Upper teeth, c-m <sup>1</sup> , crowns .....	9.7	10.3	8.7	8.8	10	9.2	10.7	11.2
" Lower teeth, c-m <sub>2</sub> , crowns .....	10.7	11.2	9.8	10.1	11	10.5	11.8	12.3

## Nyctimene: Measurements of skulls and tooth-rows (II.).

	<i>N. geminus</i> . 4 ad.		<i>N. major</i> . 2 ad.		<i>N. scitulus</i> . 5 ad.		<i>N. ballulæ</i> . ♂ ad.		<i>N. robinsoni</i> . 2 ♂ ad.		<i>N. aillo</i> . [♂] ad.	
	Min.	Max.	Type.	♂ ad.	Min.	Max.	mm.	Type.	mm.	Paratype.	mm.	Type.
Skull, lambda to gnathion .....	...	26.5	mm.	37	mm.	37.2	33.2	mm.	32.8	mm.	...	mm.
" condylo-basal length.....	...	34.7	...	35	36.8	...	31.7	...	31	33	...	...
" palation to incisive foramina .....	14	15	14.8	14.7	14	14.6	12.2	12.2	12.7	30.8	15.8	15.8
" palation to basion .....	...	15	...	14.3	15.8	...	14.5	13.2	13	13.2	...	...
" rostrum, length orbit to nares.....	6.2	7.8	7.2	7.2	7	7.5	6.8	6.2	6.2	6	7.2	7.2
" rostrum, height at alv. of canine.....	7.2	7.2	7.5	...	7	7.8	6.8	7.3	7.3	6.7	8	8
" width of brain-case at zygomatica .....	14.8	...	15	16	14.3	14.8	14.5	14.8	14.8	13.8	16.8	16.8
" zygomatic width.....	...	23.2	23.8	23.5	22.8	23	22	22.3	22.3	21.7	26.7	26.7
" across crowns of m <sup>1</sup> -m <sup>3</sup> , externally .....	10.8	11.8	11.2	11.2	10.7	11.2	10.3	10.2	10.2	10.7	12.5	12.5
" lachrymal width .....	9	10	9.8	10	9.5	10	8.8	9.2	9.2	8.8	10.7	10.7
" across crowns of canines, externally .....	6.8	7.8	7.8	7.6	6.6	7.5	7	6.7	6.7	6.7	8	8
" premaxillæ, depth at symphysis .....	2.8	3.2	2.7	...	3.2	3.8	2.8	2.8	2.8	2.5	2.8	2.8
" postorbital width .....	6	6.3	5.8	...	5.8	6.7	5.7	5.8	5.8	5.7	7.8	7.8
" interorbital width .....	5.7	6.8	6	7	6.6	6.8	5.8	6.2	6.2	6	7.2	7.2
" mesopterygoid fossa, width .....	5.5	6.2	5.8	5.8	5.8	6	5.6	5.7	5.7	5	...	...
" between p <sup>1</sup> -p <sup>2</sup> .....	7.2	7.2	6.8	6.3	6.2	6.7	6.8	6.5	6.5	6	7.5	7.5
" between bases of canines .....	2	2.7	2.3	1.8	1.8	2.3	2.7	2.3	2.3	2.2	2.7	2.7
" orbital diameter .....	9.2	9.8	9	8.8	8.7	8.8	8.5	9.5	9.5	9.3	11	11
" Mandible, length from condyle .....	26.7	29	28.7	28.7	27.5	29	25	24.2	24.2	24.6	30.5	30.5
" coronoid height .....	16	18	17.7	17.7	16.5	18.5	15.8	14.7	14.7	14.5	17.8	17.8
" Upper teeth, c-m <sub>2</sub> , crowns .....	12.2	13.5	13.5	14.2	12.7	13.2	11.5	11.7	11.7	12	14.2	14.2
" Lower teeth, c-m <sub>2</sub> , crowns .....	13.8	15.2	15	15.8	14	14.5	13.2	13	13	13.5	16	16

## Nyctimene: Measurements of teeth (1.).

	<i>N. papuanus</i> , 10 skulls. B. New Guinea; Key Is.; Admiralty Is.; Bismarck Arch.; Cape York.		<i>N. albiventris</i> , Type.		<i>N. minutus</i> , Type.		<i>N. varius</i> , Type.		<i>N. cycloctis</i> , Type.		<i>N. cephalotes</i> , 8 skulls. Celebes; Buru; Amboina; Ceram; Timor Laut; Timor.	
	Min.	Max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
p <sup>3</sup> , length .....	1.9	2.2	1.8	1.9	2.1	2.1	2.1	2.1	2	2.2	2.2	2.5
" width .....	1.5	1.7	1.5	1.5	1.7	1.7	1.7	1.7	1.7	1.5	1.5	1.8
p <sup>4</sup> , length .....	1.8	2.1	1.6	1.6	2.1	2.1	2.1	2.1	1.8	2.1	2.1	2.3
" width .....	1.5	1.7	1.5	1.5	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.9
m <sup>1</sup> , length .....	1.8	2.2	1.9	1.8	2.1	2.1	2.1	2.1	1.6	2	2	2.3
" width .....	1.3	1.6	1.3	1.4	1.7	1.7	1.7	1.7	1.3	1.3	1.3	1.8
p <sup>1</sup> , length .....	2	2.3	2	2	2.5	2.5	2.5	2.5	2.3	2.1	2.1	2.5
" width .....	1.5	1.7	1.5	1.5	1.6	1.6	1.6	1.6	1.7	1.4	1.4	1.8
p <sup>2</sup> , length .....	1.5	2.2	2	1.9	2	2	2	2	2.1	2.1	2.1	2.4
" width .....	1.5	1.7	1.5	1.5	1.7	1.7	1.7	1.7	1.7	1.5	1.5	1.8
m <sup>2</sup> , length .....	1.8	2.2	2	2	2.1	2.1	2.1	2.1	1.9	2.2	2.2	2.3
" width .....	1.3	1.7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.8
m <sup>3</sup> , length .....	1.4	1.7	1.3	1.3	1.6	1.6	1.6	1.6	1.2	1.2	1.2	1.6
" width .....	1.1	1.5	1.2	1.2	1.3	1.3	1.3	1.3	1.1	1.3	1.3	1.5

## Nyctimene: Measurements of teeth (II.).

	<i>N. geminus</i> , 4 skulls, Huon Gulf; Kiriwina I.; Fergusson I.		<i>N. major</i> , 3 skulls, Bismarck Arch.		<i>N. scitulus</i> , 5 skulls, Shortland; New Georgia; Florida; Guadalecanar.		<i>N. lullula</i> , Type.		<i>N. robinsoni</i> , Type and Paratype.		<i>N. aëlla</i> , Type.	
	Min.	Max.	Min.	Max.	Min.	Max.	mm.	Type.	mm.	Paratype.	mm.	Type.
p <sup>3</sup> , length .....	2.9	3	2.9	3.1	2.8	2.9	2.6		2.7	2.7	3.2	
" width .....	2	2.2	2	2.2	1.8	2.2	1.8		1.9	2	2.5	
p <sup>4</sup> , length .....	2.8	3	2.8	3	2.7	2.8	2.5		2.5	2.5	3.1	
" width .....	2	2.1	2	2.2	2	2.2	1.8		2	2	2.3	
m <sup>1</sup> , length .....	2.8	3	2.8	3	2.6	2.9	2.2		1.9	2.3	2.3	
" width .....	1.9	2.1	1.9	2.1	1.9	2.1	1.7		1.7	1.9	2.9	
p <sub>3</sub> , length .....	3	3.3	2.9	3.2	2.8	3.1	2.7		2.7	2.7	2.2	
" width .....	1.8	2	2	2.2	1.8	2.1	1.7		1.8	1.9	3.5	
p <sub>6</sub> , length .....	2.9	3	2.8	3.2	2.7	3	2.6		2.7	2.8	3.4	
" width .....	2	2.1	2	2.2	1.9	2.1	1.7		1.8	1.9	2.2	
m <sub>1</sub> , length .....	2.8	3.3	2.9	3.1	2.7	3	2.4		2.5	2.7	3	
" width .....	1.9	2	1.9	2	1.8	2	1.6		1.7	1.8	2.1	
m <sub>2</sub> , length .....	1.7	2.1	1.9	2.1	1.8	2	1.5		1.6	1.8	2.1	
" width .....	1.6	1.8	1.7	1.8	1.6	1.8	1.4		1.5	1.6	1.9	

## Subfamily II. MACROGLOSSINÆ.

*Differential characters.*—Similar to *Pteropodinae*, but tongue highly extensible and with well-developed untringed filiform papillæ at tip.

*Range.*—The Indo-Chinese, Indo-Malayan, and Austro-Malayan subregions, extending a little beyond the latter, south to Queensland, east to New Caledonia and Fiji Islands; one genus in West Africa.

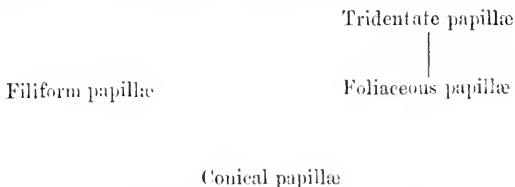
*Characters of tongue of Pteropodinae* (figs. 65 A-H).—The tongue of *Pteropus* is here taken as a paradigm for a description of the shape and surface structure of this organ in the subfamily *Pteropodinae*, not because it is the most primitive in characters, but because it is conveniently large and exhibits the different forms of papillæ perfectly well-differentiated. In *Pt. psephalon* (fig. 65 F) the tongue measures about 46 mm. in length (nine-tenths of the length of the mandible) from the base of the epiglottis; its breadth at base is 16 mm., and from this point it becomes gradually narrower until, about six mm. from the tip, it measures 8 mm. in breadth; for its terminal six mm. it more rapidly tapers to a point. The posterior half is fixed to the floor of the mouth, thick (vertically), and with its dorsal surface conspicuously convex from side to side; the anterior free half much thinner, flat or even distinctly concave above. The whole of the dorsal surface of the tongue as well as the upper lateral borders of its anterior half are covered with closely packed papillæ, the ventral surface perfectly smooth. The papillæ may be described under two headings, *tactual* and *gustatory*:—

(I) *Tactual papillæ.*—In their simplest form the tactual papillæ take the shape of rounded or subconical eminences from the mucous membrane. Papillæ of this form cover, in *Pt. psephalon*, the lateral tracts of the dorsal surface of the anterior half of the tongue, but not its median area nor the extreme tip. On a cursory inspection this coat of so-called *conical*\* *papillæ* (*co.*) looks like a regularly arranged pavement, in reality each papilla is directed obliquely backward; its longitudinal axis is only slightly, or not at all, greater than its transverse diameter, its upper (in the position of the papilla, posterior) and lateral borders finely fringed (the fringes as a rule difficult to detect by the naked eye) (*C*).—Toward the tip of the tongue these papillæ become gradually more elongate (conical), until at the extreme tip of the organ they have developed into long

\* This is the name of these papillæ suggested by Robin in his brief sketch of the surface structure of the tongue of Chiroptera (Ann. Sci. Nat. (6) Zool. xii. Art. 2, p. 17, 1881, no figures). It must be observed, however, that only in the transitional regions between the "conical" and filiform areas of the tongue do these papillæ assume a really conical shape; in their typical form they are rounded or slightly elongate eminences, distinctly flattened antero-posteriorly, not infrequently conspicuously concave on the anterior (dorsal) surface, and with the upper (in the position of the papillæ, posterior) border broadly rounded off.

and slender (longitudinal axis several times longer than transverse diameter), sharply pointed, semi-rigid *filiform papillæ* (*fi.*); the fringes are reduced to a few near the tip of the papilla (*G*). A similar modification has taken place on the lateral area of the base of the tongue, only the filiform papillæ are here considerably longer than at the tip of the tongue, more compressed from side to side, softer, less acutely pointed, and the fringes have entirely disappeared.—On the dorsal surface of the posterior half of the tongue the papillæ exhibit another modification, the *foliaceous* form (*fo.*); the conical papillæ have become gradually more flattened (leaf-like, foliaceous), the fringes along their upper (posterior) and lateral borders longer and coarser and at the same time somewhat fewer in number (*D*).—Passing from the dorsal surface of the posterior half of the tongue to the median area of its anterior half, the foliaceous papillæ become gradually larger and much more rigid, the “fringes” are reduced to three (in the periphery of the area sometimes two) and transformed into horny, posteriorly directed spines (*E*); this median area of *tridentate papillæ* (*t.*), which in *Pt. pselaphon* is about 15 mm. long and 3 mm. broad, forms a powerful rasp, used, probably, partly to penetrate the skin of soft fruits, partly for cleaning the fur and membranes.

It will be noticed from the above that the four types of tactual papillæ are not sharply separated from each other, the relatively simple “conical” papillæ being gradually transformed on the one hand into the filiform, on the other into the foliaceous, and this again into the tridentate—as expressed in the subjoined diagram :



(II) Gustatory papillæ.—Always present in two forms, the *fungiform* and *circumvallate papillæ*. The former (not represented in the figures) are to the naked eye somewhat similar in general appearance to the conical papillæ, but more erect (less retroclivous), more truncated above, and no doubt in the fresh tongue different in colour (in alcoholic specimens paler, more milky in tinge than the conical papillæ). In *Pteropus* they are few in number, thinly scattered among the tactual papillæ on the dorsum and sides of the posterior half of the tongue. The three circumvallate papillæ (*ci.*) are situated at the base of the tongue, arranged in an equilateral triangle, two in front, one behind.

It is beyond the scope of this Catalogue to enter into a detailed description of the variations in the occurrence and arrangement of



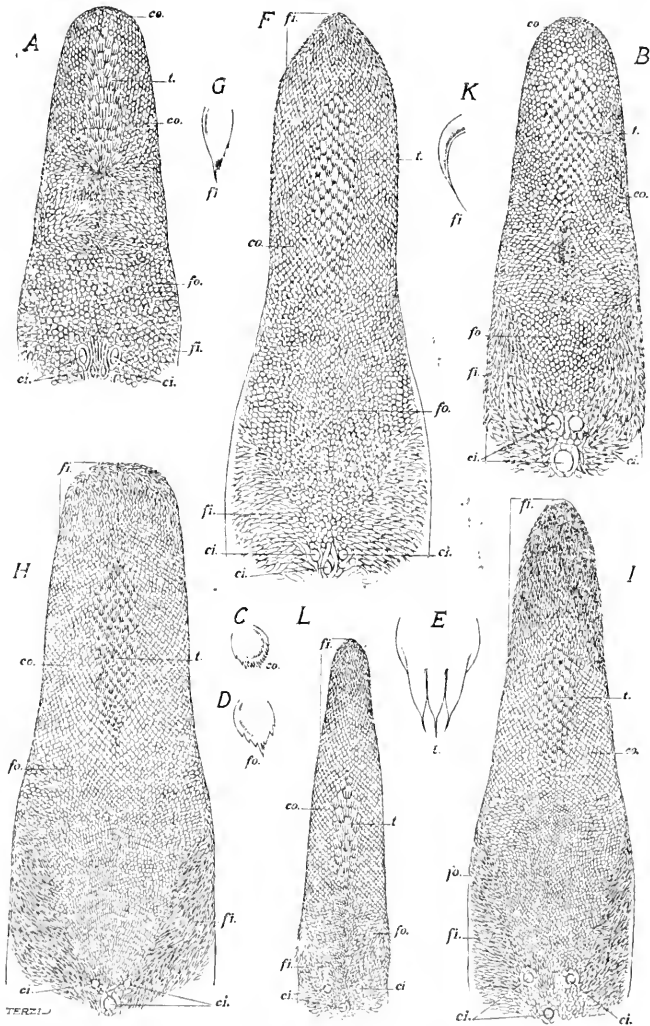


Fig. 65.—Tongues and tongue papillae of Megachiroptera.

A. *Nyctimene gemenis*, 95.5.8.1; B. C. D. E. *Cynopterus sphinx sphinx*, 49.7.27.49; F. G. *Pteropus pseudophyllon*, 84.12.10.2 (G from tip, not base, of tongue); H. *Rousettus (Stenonycteris) lanosus*, 6.7.1.3; I. *Eonycteris spelaea*, 0.8.2.1 (K from tip, not base, of tongue); L. *MacroGLOSSUS lagochilus nanus*, 78.9.14.3.

ci., circumvallate; co., conical; fi., filiform; fo., foliaceous; t., tridentate papillae. Fungiform papillae omitted from figures.

A, B. H. I. L. L. ♀ (linear); F. ♀; C, D. E, G. K further enlarged.

the tongue papillæ in the different genera of *Pteropodine* (if minor differences are taken into consideration, hardly two genera of the subfamily are precisely alike in the surface structure of the tongue, nor even all species of the larger genera, e. g. *Pteropus*), but the following general view of the more important modifications, based on an examination of the tongues of all the principal genera, may not be out of place here:—

The simplest form of the Megachiropteran tongue is seen in *Cynopterus* (*B*) and some allied genera; the anterior extremity is somewhat broadly rounded off, without any trace of filiform papillæ, the conical papillæ extending right to the tip of the tongue; the filiform papillæ laterally at the base of the tongue are well-developed; the tridentate papillæ as in *Pteropus*, though covering a relatively shorter area; the posterior circumvallate papilla about twice as large as the anterior ones. This type of tongue, essentially unchanged or with only minor modifications (e. g. in the length of the filiform papillæ at the base of the tongue, the shape in detail of the foliaceous papillæ, the size of the posterior circumvallate papilla, &c.), reoccurs in *Eidolon*, *Pteralopex*, and *Dobsonia*. The tongue of *Nyctimene* (*A*), though in other respects strikingly similar to that of *Cynopterus*, differs in having four circumvallate papillæ, two in front and two behind. The first faint tendency to a lengthening of the papillæ at the tip of the tongue is seen in *Rousettus*; in *Epomophorus* and *Hypsignathus* they are so far lengthened (but only at the extreme anterior margin of the tongue) as to be subfiliform, and in *Micropteropus* (*Epomophorine* group) they are real filiform papillæ (but, as probably always in *Pteropodine*, with some fringes near the tip) and cover both the anterior margin of the tip of the tongue and a small area of its dorsal surface; finally, in *Lissonycteris* and even more so in *Stenonycteris* (*H*) (both *Ethiopian* subgenera of *Rousettus*) the filiform papillæ are strongly developed and cover a relatively considerable space of the upper surface and lateral margins of the tip of the tongue.

The variations (so far as observed by the writer) may be briefly epitomized as follows:—(1) Within the subfamily *Pteropodine* there is every intergradation from a complete absence to a strong development of filiform papillæ at the tip of the tongue; but, so far as the available material goes, these filiform papillæ, even if conspicuously developed, are never entirely devoid of fringes (compare *G* with *K*, fig. 65, both papillæ from the extremity of the tongue, the former of *Pteropus pselaphon*, the latter of the *Macroglossine Eonycteris spelea*, to show presence of "fringes" in the former, absence in the latter): (2) the filiform papillæ at the base of the tongue are always present and always without fringes, but vary very considerably in length and number (shortest in *Nyctimene*, *Dobsonia*, *Pteralopex*): (3) part of the median area of the anterior half of the tongue is always covered with rigid tridentate papillæ, but the relative size of that area varies greatly (it is smallest in *Epomophorine* bats, and among these smallest again in *Micropteropus*): (4) the number of circumvallate papillæ is three in all

genera, except *Nyctimene* which has four (in Marsupialia \*, a large number of Insectivora †, and some Rodents \* there are three of these papillæ, arranged in an isosceles or equilateral triangle, as in all Megachiroptera except *Nyctimene*; note the variation in the size of the posterior papilla in Megachiroptera, in many genera only equal to, in others (*Cynopterus*, *Stenonycteris*) twice the size of, the anterior ones; it is this posterior papilla which is split into two in *Nyctimene* and, on the other hand, entirely suppressed in some Insectivora and in all Microchiroptera, while in *Desmodus* all circumvallate papillæ have disappeared): (5) the fungiform papillæ are few in number and confined chiefly or entirely to the posterior half of the tongue.

*Characters of tongue of Macroglossinæ* (fig. 65 I-L).—The tongue in this small group of Fruit-bats is relatively longer than in the *Pteropodina*, more extensible, fixed to the floor of the mouth only by its posterior third, narrower and more evenly tapering to a point anteriorly; its terminal fourth or fifth is always covered with well-developed unfringed filiform papillæ; the foliaceous papillæ are smaller and the foliaceous area of the tongue softer, more velvet to the touch; the fungiform papillæ more numerous and not confined to the posterior half of the tongue.

In its most highly differentiated form this type of tongue is found in *Macroglossus* (L), *Megaloglossus*, and *Syconycteris*. In *Eonycteris* (I) the tongue is broader (more Roussettine) in shape, but with a heavy coat of filiform papillæ at the tip. In *Nesonycteris* and *Melonycteris* the filiform papillæ at the tip (while preserving their true filiform character) are much shorter than in *Macroglossus* and its allies. The extreme in the length of the tongue is reached by *Notopterus* (measured from base of epiglottis about 40 mm., i. e. more than  $\frac{3}{2}$  the length of the mandible).

The difference between the Pteropine and Macroglossine tongues is decidedly only one of degree. No new element is introduced in the structure of the Macroglossine tongue, and, as pointed out above, the Pteropine tongue exhibits any intergradation from a complete absence to a relatively strong development of filiform papillæ at the tip; the only essential differential characters of the Macroglossine tongue are its greater extensibility, its more narrowly pointed shape, its heavier coat of filiform papillæ at the tip, and the total absence of fringes in these papillæ (compare *K* with *G*, fig. 65).

In his 'Families and Genera of Bats' (p. 45, cf. p. 68; 1907), Mr. Gorrit S. Miller characterizes the *Macroglossinæ* ("Kiodotina"), in contradistinction to the *Pteropodina*, as follows:—(1) Tongue highly extensible; (2) molars and incisors considerably reduced in size; (3) brain-case strongly deflected; (4) upper surface of mandibular symphysis parallel with alveolar line. It must be

\* Tuckerman, "On the Gustatory Organs of some of the Mammalia," Journ. Morphol. (Boston), iv. p. 192 (1891).

† Dobson, A Monograph of the Insectivora, *passim* (1882-91).

said here that all these differential characters, except the first, break more or less completely down on closer test; they are majority characters leaving out of consideration the exceptions to the general rule in both subfamilies. The molars of *Eonycteris* are neither smaller nor narrower than in *Stenonycteris*, *Pteropus scapulatus*, or *Pt. woodfordi*; the incisors of *Syconycteris* are relatively much larger than in many Epomophorine and Cynopterine genera; the brain-case is in the majority of MacroGLOSSINE genera more strongly deflected than in other Fruit-bats, but in *Eonycteris* and *Megaloglossus* the deflection is by no means greater than in *Stenonycteris* or the two species of *Pteropus* referred to above; the symphysis of the mandible is, as a rule, longer and its upper surface more nearly horizontal than in the *Pteropodine*, but the difference in these respects between *Eonycteris* on the one hand, *Stenonycteris* and certain other *Pteropodine* on the other, is very inconspicuous indeed.

The claim of the *MacroGLOSSINE* to stand as a distinct "subfamily" must rest chiefly, if not entirely, on these two facts, viz., that the tongue, though approached by that of certain forms of *Pteropodine*, is still more highly specialized, and that all the forms included in the *MacroGLOSSINE* are undoubtedly phylogenetically intimately interconnected and therefore form a perfectly natural section. Whether this section is termed a "subfamily" or merely a "group of genera" is a matter of minor consequence; the former alternative is the more convenient from the systematist's point of view, the latter would perhaps lend more emphasis to the fact that the break in the continuity of the forms when passing from the lowest *Pteropodine* (*Rousettus*) to the least specialized *MacroGLOSSINE* (*Eonycteris*) is of the very slightest.

## 28. EONYCTERIS. Dobson.

*Eonycteris*, Dobson, Cat. Chir. B. M. p. 94.

1873. *Eonycteris*, Dobson, Proc. A. S. B. 1873 Type.  
 (meeting 2 July), p. 148 ..... E. spelæa.  
 1889. *Callinycteris*, Jentink, Notes Leyd. Mus. xi.  
 p. 209 (Nov. 1889) ..... E. rosenbergi.

*MacroGLOSSUS* (pt.), Dobson, Proc. A. S. B. 1871 (May), pp. 105-108.  
*Eonycteris*, Dobson, l. s. c. ("2 July," 1873: preliminary note: type designated, no descr. of genus); *id.*, J. A. S. B. xlii. p. 204 (read 5 July, 1873: description); *id.*, Ann. & Mag. N. H. (4) xvi. p. 354 (1875); *id.*, Cat. Chir. B. M. p. 94 (1878); *Leche*, Lunds Univ. Årsskr. xiv. pp. 22 & seq. (1878: dental formula); *Robin*, Ann. Sci. Nat. (6) Zool. xii. Art. 2, pp. 4 & seq. (1881: visceral anatomy); *Thomas*, P. Z. S. 1887, p. 324 (synopsis of MacroGLOSSINE genera); *Flower & Lydekker*, Mamm. p. 654 (1891); *Winge*, E. Mus. Lundii, ii. pt. 1, pp. 24, 27, 28, 56 (1892: affinities; dental formula); *Matschie*, Megachir. p. 89 (1899); *Müller*, Fam. & Gen. Bat., p. 69 (1907); *Bartels*,

*Bull. Dép. Agric. Ind. Néerl.* (Buitenzorg), n. xx. p. 13 (1903: food).

Callinycteris, *Jentink, l. s. c.* (1889); *Flower & Lydekker, Mamm.* p. 655 (1891); *Winge, E. Mus. Lundii*, ii. pt. 1, p. 59 (1892: affinities); *Matschie, Megachir.* p. 90 (1899); *Miller, Fam. & Gen. Bats*, p. 69 (1907); *K. Andersen, Ann. & Mag. N. H.* (8) vi. p. 625 (1910: united with *Eonycteris*).

*Summary of characters.*—Tongue Macroglossine. Brain-case less deflected than usual in the subfamily; premaxillæ subequal in breadth throughout, in simple contact (not ankylosed) or even slightly separated in front. Incisors  $\frac{2}{2}-\frac{2}{2}$ ; cheek-teeth  $\frac{5}{6}$  or (by suppression of minute  $m_3$ )  $\frac{5}{5}$ , and not quite so narrow as usual in *Macroglossine*; palate-ridges eight. Index without claw; fifth metacarpal conspicuously shorter than third; tail subequal in length to foot with claws; a pair of large anal glands. Forearm 61.5–79.5 mm. [Three species. *Hab.* The Indo-Malayan Sub-region, excluding the Philippines, and extending east to Celebes, north-west to Siam and Burma.]

The following two characters, taken together, are sufficient to distinguish this genus from all other Fruit-bats, viz. tongue Macroglossine, tail subequal to foot (with claws); in all other Macroglossine genera, except *Notopteris*, the tail is rudimentary or absent, in *Notopteris* as long as the forearm. Another absolutely diagnostic combination of characters is this: index without claw, two pairs of lower incisors; the three other Megachiropteran genera without claw on the index (*Dobsonia*, *Nesonycteris*, and *Notopteris*) have all one pair only of lower incisors. No other Indo-Malayan Fruit-bat lacks the claw on the index.

*Skull* (fig. 66).—In general aspect as well as in nearly all details very similar to the skull of *Rousettus* (fig. 2, p. 17). Basiscranial axis a little more distinctly deflected than in typical *Rousettus*, but not so much as in the subgenus *Stenonycteris* (fig. 3, p. 49); alveolar line, if projected backward, passing nearly through glenoid fossa, sometimes a little higher or lower. Rostrum as in *Stenonycteris*; palate, both its interdental and postdental portions, and mesopterygoid fossa unmodified Rousettine; nasal branches of premaxillæ subequal in breadth throughout (not or scarcely broadening above), alveolar branches in contact anteriorly or (not infrequently) distinctly separated. Infraorbital canal short, its anterior aperture (infraorbital foramen) vertically below front margin of orbit. Postorbital foramina present. Foramen ovale and rotundum separated. Tympanics as in *Rousettus*. Temporal ridges usually separated, sometimes (in some old males) united to form a low sagittal crest, postorbital processes short and thin, zygomata very slender (though scarcely more so than in *Stenonycteris*), mandible similar to that of *Stenonycteris* (horizontal rami low, coronoid narrow and much sloping backward, angular process projecting downward, condyle below level of alveolar line), but symphysis a little longer comparatively, its upper surface more approximately horizontal (less sloping than in *Rousettus* and *Pteropodine* in general), and its

antero-inferior surface showing a tendency to develop a more or less distinct longitudinal keel along the symphyseal line (character much more developed in *Macroglossus* and some other genera of the subfamily).

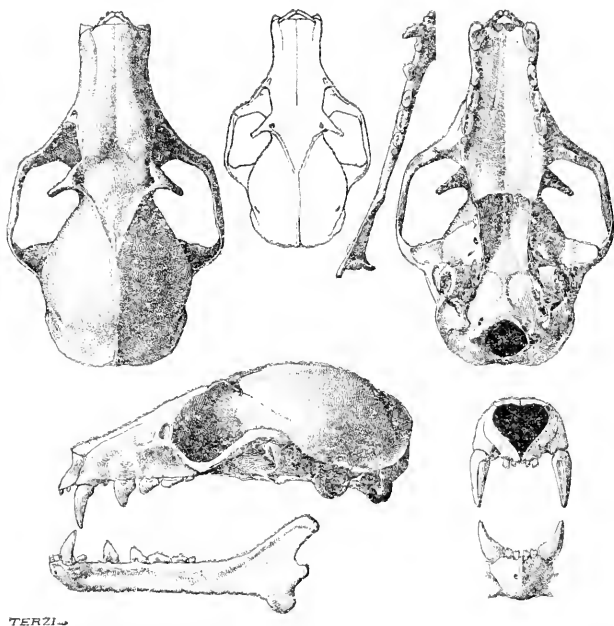


Fig. 66.—*Eonycteris spelæa*, ♂. Lian si Peghe, near Balighe, W. Sumatra. No. 0.8.2.1. (A few details of dentition from skull 8.2.25.4, Batu Caves, Selangor.) ♀ (linear), with front view †, and outline of dorsal aspect of skull ‡.

*Dentition* (fig. 66).— $i^1 i^2 c p^1 p^3 p^4 m^1 m^2$   
 $i_1 i_2 c p_1 p_3 p_4 m_1 m_2 (m_3) \times 2 = 34$  or 32.  
 Dental formula as in *Rousettus*.  $m_3$  generally present (absent on both sides in type of *E. rosenbergi*, and occasionally at least on one side in *E. spelæa*)\*.

\* Dental anomalies observed in 16 skulls of *E. spelæa* :—

A well developed “ $p_4$ ” (nearly half the size of  $p_1$ ) present on right side, and trace of a corresponding alveolus on left side (1.3.9.1, ♂ ad., Selangor);

$m_3$  and its alveolus absent on one side, present on the other (two skulls: 8.2.25.4, ♀ ad., Selangor, and 0.8.2.1, ♂ ad., Balighe, Sumatra; both with quite or nearly unworn teeth);

$p^1$  and its alveoli absent on both sides (0.8.2.1).

Dentition very similar to that of *Stenonycteris*. Upper incisors small, terete, distinctly spaced, crown scarcely differentiated from shaft; lower incisors when perfectly unworn slightly bilobed (the small median notch in the cutting-edge disappears very soon by wear). Upper canines long and thin, with a well-marked longitudinal groove along anterior surface, generally a distinct trace of a cingulum at posterior base of teeth, scarcely any at all at inner base; lower canines slanted conspicuously outward.  $p^1$  subequal to an upper incisor;  $p^3-m^1$  and  $p_3-m_2$  as narrow as, and scarcely differing in any noteworthy character from, those of *Stenonycteris*;  $m^2$  and  $m_3$  individually somewhat variable in size and shape, the former nearly always distinctly larger than  $p^1$ ,  $m_3$  (if present) as a rule smaller than  $p^1$ .

*Palate-ridges* (fig. 67 B).— $4+3+1$ , *i. e.* four anterior undivided, three posterior divided, and one at extreme hinder edge of palate. Number and arrangement as in typical species of *Rousettus* (fig. 67 A), except for some difference in the shape and position of the posterior

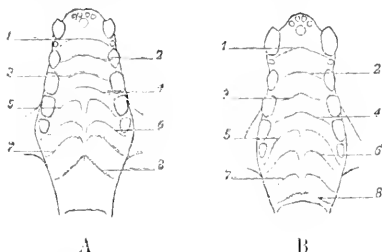


Fig. 67. —Palate-ridges. A, *Rousettus bruchi* (75.S.9.2);  
B, *Eonycteris spelaea* (9.S.2.1).  
A  $\frac{1}{2}$ , B  $\frac{2}{3}$  (linear).

ridges; that the only noteworthy difference is to be found at this region of the palate is significant, inasmuch as it is chiefly the extreme posterior ridges which within the genus *Rousettus* show some tendency to variation in number and arrangement according to species and individuals.

*External characters.*—Muzzle thinner (and, chiefly for that reason, looking longer) than in typical *Rousettus*; odontoid papillæ on lips absent (in *Rousettus* a single short and thin row fringing upper and lower lips at angle of mouth). Ears as in *Rousettus*; antitragal lobe small, rounded-triangular. Length of tail as in *Rousettus* (tail-vertebræ seven, the terminal one very small). Calcar a little shorter than in typical *Rousettus*, between  $\frac{1}{3}$  and  $\frac{1}{4}$  of foot with claws. A large kidney-shaped gland on either side of anal opening, present in both sexes (absent in *Rousettus*). Lateral membranes arising widely separated from sides of back and inserted posteriorly on extremity of first metatarsal, or between first and second, or on second, sometimes extending as far as base of proximal phalanx of

these toes, the variation in this respect being to a large extent individual (in typical *Rousettus* inserted on first toe, in the subgenus *Stenonycteris* on second). Vertical fasciæ of mesopatagium few in number (about 9-12), very thick, and widely spaced, quite as in typical *Rousettus*. Second digit without claw (present in *Rousettus*), the third phalanx wholly included in the membrane; relative lengths of metacarpals and phalanges very nearly as in typical *Rousettus*, but *Eonycteris* perhaps a shade more primitive in so far as the difference in length of the third (longest) and fifth metacarpals has remained a little greater than in typical *Rousettus* (compare table below, showing in upper row the wing-indices of *Eonycteris*, calculated from 17 adult specimens, and in lower row those of typical *Rousettus* for comparison). Distribution and colour of fur as in *Rousettus leachi* and allied species (tibia naked; back some tinge of dark brown, underside paler, often hair-brown).

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph.*	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	324	441	133	105	675	451	596	658	369	351	608	291	262
1000	361	442	105	105	644	438	601	635	344	379	622	315	286

*Sexual differentiation.*—(1) Sides of neck and foreneck in females thinly clothed, the skin usually showing through; same region in adult males covered with a well-marked "ruff" of longer hair, the colour of which is generally a shade deeper (more saturated) than that of back and chest. (2) Males averaging larger than females (see tables of measurements pp. 743, 744).

*Range.*—From Burma and Siam, south through the Malay Peninsula, to Sumatra and Java, east to Borneo and Celebes. Unknown from the Philippines and (thus far) from the islands east of Java. The whole region from Burma and Siam through the Malay Peninsula to Sumatra and Java is occupied by one species, *E. spelæa*; the two other species are as yet (1911) known only from the type specimens, *E. major* from Borneo, *E. rosenbergi* from Celebes.

*Habits.*—In the later months of the year 1907 a group of flowering *Agave* in a garden at Pasir Datar, Java, was visited regularly every night by a considerable number of *E. spelæa*. They were noticed dodging swiftly about among the inflorescences, alighting now and then, but always for a few moments only, on the flowers (which are remarkable for their long projecting stamens), and so persistent was their predilection for this particular group of plants that neither shooting nor artificial light would frighten them away. The stomach of one specimen (examined by Dr. Valetton, Botanic Gardens, Buitenzorg) was

\* In *Rousettus* with claw.



found to contain nothing but pollen. (Bartels, *l. s. c.*, 1908.)—By day *Eonycteris* hides in caves.

*Affinities*.—*Eonycteris* is the least specialized genus of *Macroglossinæ* (hence it is here placed as the first genus of the subfamily), but it is not in every respect the most primitive (*Melonycteris*, *Nesonycteris*, and *Notopterus* have preserved two primitive (unmodified Insectivorous) cranial characters which are quite or nearly lost in other Fruit-bats, viz. a long infraorbital canal and broad upper extremities of the premaxillæ; and *Notopterus* is the only living Fruit-bat in which the tail has remained long). Perhaps the most appropriate diagnosis of *Eonycteris* would be this: similar to *Rousettus* in all important characters, except two, viz. tongue with a heavy coat of unfringed filiform papillæ at tip, and claw of second digit absent. So complete is the resemblance, and so trivial the differences, in the skull, the dentition, the palate-ridges, the tail, the fasciæ of the membranes, the relative length of the metacarpals and phalanges, the distribution of the fur, even in the colour of the fur and the secondary sexual characters (neck-tufts in males), that, if it were not for the two peculiar characters referred to, it would hardly be possible to separate *Eonycteris* generically from *Rousettus*. As noted in the foregoing paragraph, *Eonycteris* (like probably all other genera of the subfamily) has adapted itself to a diet consisting partly, perhaps chiefly, of pollen; hence the modification of the papillæ at the extremity of the tongue, the slightly longer and more horizontal symphysis of the mandible, the weak dentition (not quite so weak as in other *Macroglossine* genera) and weak mandible (not quite so weak as in other genera of the subfamily); for parallels, within the subfamily *Pteropodina*, in weak dentition and mandible, compare *Stenonycteris* (fig. 3, p. 49), *Pteropus scapulatus* (fig. 18, p. 404), and *Pt. woodfordi* (fig. 19, p. 408).

*Callinycteris*.—The species catalogued on p. 737 as *Eonycteris rosenbergi* was originally (by Jentink, *l. s. c.*, 1889) placed in a distinct genus, *Callinycteris*, stated to differ from *Eonycteris* by the absence of  $m_3$  and the insertion of the membranes on the second (instead of the first) toe. The genus has been accepted, as distinct from *Eonycteris*, by the latest revisers of the Megachiroptera, Matschie (1899) and Miller (1907). But whether, or not, the small  $m_3$  is really permanently absent in *E. rosenbergi*, nobody can tell with certainty, so long as this species is known only from a single specimen; in *E. spelæa* this tooth is sometimes missing on one side (see footnote p. 730), and it is quite possible, therefore, that specimens may occur in which it has disappeared on both sides; neither would it be surprising, if specimens of *E. rosenbergi* were found showing the tooth present on one or even on both sides. Supposing, however, that the rudimentary  $m_3$  is constantly absent in *E. rosenbergi*, this would be no valid reason to separate the species generically, when, as is in fact the case, in every other respect (in skull, dentition, palate-ridges, and all external characters) it is a genuine *Eonycteris*, and when the definite loss of this tooth is even foreshadowed by those individuals of *E. spelæa* in

which it is missing on one side. As to the insertion of the membranes, this is not commonly considered (and was perhaps not by Jentink intended to be taken as) a character of generic importance; but it may be as well to mention here that it is not even constant in individuals of the same species; in *E. spelæa* the membranes are often inserted on the first toe, often between the first and second, and sometimes on the second.

### *Synopsis of the Species.*

- a. A small m, normally present (cheek-teeth  $\frac{5}{6}-\frac{5}{6}$ ).  
 a'. Smaller: forearm, females 61·5-70·5, males 67·5-73 mm. (Burma and Siam, to Malay Pen., Sumatra, Java) . . . . . 1. *E. spelæa*, p. 734.  
 b'. Larger: forearm, females about 79·5 mm.; colour of fur different. (Borneo) . . . . . 2. *E. major*, p. 736.  
 b. m, absent (cheek-teeth  $\frac{5}{5}-\frac{5}{5}$ ); size as *E. spelæa*. (Celebes) . . . . . 3. *E. rosenbergi*, p. 737.

### 1. *Eonycteris spelæa*, Dobson.

*Eonycteris spelæa*, Dobson, Cat. Chir. B. M. p. 94.

*Macroglossus spelæus*, Dobson, *Proc. A. S. B.* 1871, pp. 105, 106 (read 3 May, 1871: preliminary descr.); *id.*, *J. A. S. B.* xl. p. 261, pl. x. figs. 3, 4 (lower portion of body; skull) (read 26 June, 1871: full descr.: Farm Caves, Moulmein); *id.*, *Proc. A. S. B.* 1872, p. 154 (Burma); *id.*, *J. A. S. B.* xli. p. 334 (1872: osteology).  
*Eonycteris spelæa*, Dobson, *J. A. S. B.* xlii. p. 204, pl. xiv. fig. 10 (ear) (1873); *id.*, *Cat. Chir. Ind. Mus.* p. 4, nos. 78-82 (1874: Farm Caves); Blyth, *J. A. S. B.* xliii. Extra number, p. 15 (1875: Tenasserim; Siam); Dobson, *Mon. As. Chir.* p. 33, c. fig. (ear), p. 190, nos. 78-82 (1876: Farm Caves); *id.*, *Cat. Chir. B. M.* p. 94 (1878: Moulmein; Burma); *id.*, *P. Z. S.* 1878, p. 877 (1879: Java); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 209, n. 339 (1879); J. Anderson, *Cat. Mamm. Ind. Mus.* i. p. 106, n. 100 (1881: Farm Caves); Robin, *Ann. Sci. Nat.* (6) *Zool.* xii. Art. 2, pp. 4 & seq., pl. iii. figs. 5, 8, pl. viii. fig. 59 (1881: visceral anatomy); Theobald, *Mason's Burma*, i. p. 426 (1882); Sterndale, *Mamm. Ind.* p. 41, n. 35 (1884); Fea, *Boll. Soc. Geogr. Ital.* 1888, p. 636 (Farm Caves); Jentink, *Cat. Syst. Mamm.* p. 158 (1888: Moulmein); *id.*, *Weber's Zool. Erg. Nied. Ost-Ind.* i. p. 126 (1890: Singkarak, Sumatra); Blanford, *Faun. B. Ind.*, *Mamm.* pt. ii. p. 266 (1891: Moulmein); Flower & Lydekker, *Mamm.* p. 654 (1891); Thomas, *Ann. Mus. Civ. Genova*, (2) x. p. 922 (1892: Farm Caves, Moulmein; Yado, Karin Hills); Lydekker, *R. Nat. Hist.* i. p. 261 (1893-94); Trouessart, *Cat. Mamm.* i. p. 89, n. 484 (1897); Matschie, *Megachir.* p. 89 (pt.) (1899: Moulmein; Perak; Java); S. S. Flower, *P. Z. S.* 1900, p. 341; Bonhote, *P. Z. S.* 1901, p. 53 (Nan); Beddard, *Mamm.* p. 526 (1902); Trouessart, *Cat. Mamm.*, *Suppl.* p. 66, n. 565 (pt.) (1904); Miller, *Fam. & Gen. Bats*, p. 69 (1907); Elliot, *Cat. Mamm. Field Col. Mus.* p. 496,

n. 874 (1907: Malay Pen.); *Kloss, J. Fed. Mal. St. Mus.* ii. p. 154 (1908: Malay Pen.); *Bartels, Bull. Dép. Agric. Ind. Néerl.* (Buitenzorg), n. xx. p. 13 (1908: food); *K. Andersen, Ann. & Mag. N. H.* (8) vi. p. 625 (1910: from Burma and Siam, south to Sumatra and Java).

*Diagnosis*.— $m_3$  normally present; forearm, males 67.5–73, females 61.5–70.5 mm. *Hab.* From Burma (Karin Hills), Tenasserim (Moulmein), Siam (Nan), and Cochinchina in the north, through the Malay Peninsula (Perak; Kuala Lumpur; Singapore), to Sumatra (Balighe; Singkorah) and Java.

On the occasional absence of  $m_3$  on one side of the mandible see p. 730, footnote. In 40 per cent. of the specimens examined the membranes are inserted on the first toe (end of metatarsal or base of first phalanx), in 50 between the first and second, and in 10 on the second toe.

*Flur.*—Short, velvet, closely adpressed; tibia naked above. Length of general mass of hair of back and belly 1.5–2.5 mm., longest hairs 2.5–3.5.

*Colour*.—♂ ad. skin, Batu Caves, Selangor, August (1.3.9.1): Back, occiput, and crown brown-black, deepest (practically black) on head; breast, belly, and flanks greyish hair-brown: foreneck, throat, and sides of neck pale brownish, somewhat contrasting with colour of breast and belly (sexual character). This is the darkest specimen examined.

♀ ad. skin, same locality, September (8.2.25.4): Back, occiput, and crown dark brownish bistre; breast, belly, and flanks light greyish hair-brown; foreneck, throat, and sides of neck similar, but very thinly haired, the skin everywhere showing through.—A second adult female from same locality and date (8.2.25.5) and an adult female from Nan, N. Siam, June (0.10.7.2), are closely similar in colour.

Individual colour variation not inconsiderable. In the whole series examined the colour of the back and crown varies from dark brown (a tinge darker than Prout's brown) without any admixture of bistre or blackish to dark brownish bistre or even brown-black: the colour of the breast, belly, and flanks from light greyish hair-brown (approaching silvery grey), through broccoli-brown, to the latter colour strongly tinged with pale bistre; colour of the "ruff" often deep raw-umber. The variations in colour seem to be independent of the localities.

*Measurements*. On pp. 743–745.

*Specimens examined*. Twenty-six, as catalogued below.

*Type*, in the Indian Museum, Calcutta (no. 78 of Dobson's Catalogue, no. 100 a of J. Anderson's), ♀ ad. al., Farm Caves, Moulmein, 1871, collected by Dr. Stoliczka; forearm, according to Dobson, 2.75 in. (70 mm.).

a. [♂] ad. skull.	"Burma" [? Moulmein].	Surg.-Gen. G. E. Dobson [P.]	77.2.20.4.
b. ♂ imm. al.	Farm Caves, Moulmein (Theobald).	Indian Museum (no. 80 of Dobson's Cat.) [E.].	Not reg.

<i>c. c.</i>	♂ ad., ♀ ad., ♀ juv. al.; skulls of nos. 34, 35.	Farm Caves; May, 1887 ( <i>L. Fea</i> ).	Genoa Museum [P.].	88.12.1.31 35.
<i>f.</i>	♂ ad. al.	Farm Caves.	R. Army Medical College [P.].	9.1.4.7.
<i>g. h.</i>	2 ♀ ad. sks.; skulls.	Nan, N. Siam, 200 m.; 10 May, 3 June, 1900.	Th. H. Lyle, Esq. [P.].	0.10 7.1, 2.
<i>i. k.</i>	♂ ad., 2 pull. sks.; skull of the ad.	[Cochinchina.]	Mons. A. Pierre [P.].	78.6.17.45 17.
<i>l. m.</i>	♀ ad., ♀ juv. al.; skull of no. 1.	Perak; 1907 ( <i>G. B. Cerruti</i> ).	Genoa Museum [P.].	8.7.18.1, 2.
<i>n.</i>	♀ ad. al.	Batu Caves, Se- langor.	Selangor Mu- seum [P.].	0.7.3 1.
<i>o.</i>	♂ ad. sk.; skull.	Batu Caves; Aug. 1900.	A. L. Butler, Esq. [C.].	1.3.9.1.
<i>p. q.</i>	2 ♀ ad. sks.; skulls.	Batu Caves; 10 Sept. 1907.	Selangor Mu- seum [P.].	8.2.25.4, 5.
<i>r. s.</i>	2 ♀ imm. al.; skulls.	Singapore I. ( <i>H. N. Ridley</i> ).	Singapore Mu- seum [E.].	94.6.19.6, 7.
<i>t.</i>	♂ ad. al. exhibit.	Sumatra ( <i>Dr. E. Modigliani</i> ).	Genoa Museum [P.].	0.1.12.1.
<i>u-z.</i>	4 ♂ ad., 1 ♀ ad., 1 ♀ imm. al.; skulls of nos. 1, 2, 5.	Lian si Peghe, cave near Ba- lighe, W. Su- matra; Feb. 1891 ( <i>Dr. E. Modigliani</i> ).	Genoa Museum [P.].	0.8.2.1 6.

## 2. *Eonycteris major*, *K. And.*

*Eonycteris spelea* (*nec Dobs.*), *Everett, P. Z. S.* 1893, p. 494 (Borneo); *Hose, Mamm. Borneo*, p. 39 (1893); *Matschie, Megachir.* p. 89 (pt.) (1899: Darvel Bay); *Trouessart, Cat. Mamm., Suppl.* p. 66, n. 565 (pt.) (1904).

*Eonycteris major*, *K. Andersen, Ann. & Mag. N. H.* (8) vi. p. 625 (1 Dec. 1910: Mt. Dulit).

*Diagnosis*.—Similar to *E. spelea*, but noticeably larger (forearm of type, a female, 79.5 mm.), and colour of fur a tinge of brown not matched by any specimen examined of *E. spelea*. *Hab.* Borneo (Mt. Dulit; Darvel Bay).

*m*<sub>3</sub> present. Membranes inserted at distal extremity of metatarsus, between first and second toe (probably some individual variation in this respect, as in *E. spelea*, see p. 735). Distribution, length, and quality of fur as in *E. spelea*.

*Colour* (type, adult female, Sept.).—Head and back glossy deep vandyck-brown (slightly darker on head); underparts, from fore-neck to interfemoral, uniform pale brown (café-au-lait), much paler than back.

*Measurements*. On pp. 743-745.

*Specimen examined*. The type, in collection.

<i>a.</i>	♀ ad. sk.: skull.	Mt. Dulit, Sarawak, 2060, Sept. 1896.	Dr. Ch. Hose [P.]. ( <i>Type of species</i> .)	8.1.27.23.
-----------	-------------------	--	---	------------

3. *Eonycteris rosenbergi*, Jentink.

*Eonycteris spelæa variété insulaire*, Jentink, *Cat. Syst. Mamm.* p. 158 (1888: Gorontalo).

*Callinycteris rosenbergi*, Jentink, *Notes Leyd. Mus.* xi. p. 210, pl. ix. figs. 1-4 (extremity of muzzle, palate-ridges, tongue, anal region) (Nov. 1889: Gorontalo); Trouessart, *Cat. Mamm.* i. p. 90, n. 489 (1897); Matschie, *Megachir.* p. 91 (1899); Trouessart, *Cat. Mamm., Suppl.* p. 66, n. 568 (1904); Willink, *Nat. Tijds. Ned. Ind.* lxx. p. 278 (1905); Miller, *Fam. & Gen. Bats*, p. 70 (1907). *Eonycteris rosenbergi*, K. Andersen, *Ann. & Mag. N. II.* (8) vi. p. 625 (1910).

*Diagnosis*.—As *E. spelæa*, but  $m_3$  absent. *Hab.* Celebes (Gorontalo).

The single specimen known is immature (fronto-parietal suture present), but probably very nearly full-grown. Skull not differing in any respect from that of *E. spelæa*. Dentition exactly as in *spelæa*, except for loss of the small  $m_3$  (on the occasional absence of this tooth on one side in *spelæa* see footnote, p. 730), even the proportionate size of the individual teeth being practically the same:  $p^1$  subequal to (faintly larger than)  $i^2$ ,  $m^1$  a trifle longer antero-posteriorly than  $p^1$  (not shorter, as represented in the published figure, Jentink, *l.c.*). Palate-ridges unmodified. The figure of the tongue (*l.c.*) shows no filiform papillæ; in reality these are present and occupy the same position as in *spelæa*, viz. the tip of the tongue and its lateral margins backward to a point approximately at a level with the front of the median area of tridentate papillæ, reoccurring on the lateral margins of the extreme posterior portion of the tongue; as compared with the tongue structure of *spelæa* the only tangible difference is the slightly smaller size of all papillæ (filiform, as well as tridentate, &c.). External characters (even including size of animal) as in *E. spelæa*; membranes inserted on tibial (preaxial) side of distal half of second metatarsal (for insertion in *spelæa* see p. 735); anal opening in the middle between the anal glands (as is also the case in many specimens of *E. spelæa*, while in others the glands are situated slightly behind the anus). Colour of fur unsuitable for description (somewhat deteriorated in alcohol). On the proposed genus *Callinycteris* for this species see *antea* p. 733.

*Measurements*. On pp. 743-745.

*Specimen examined*. The type (Leyden Museum), ♂ imm. (subad.) al., skull extracted, Gorontalo, N. Celebes, collected by H. von Rosenberg.

29. MEGALOGLOSSUS, *Pagenst.*

Type.

1885. *Megaloglossus*, *Pagenstecher*, *Zool. Anz.* viii. no. 193 ("27 Apr."), p. 245. . . . . *M. woermanni*.  
 1891. *Trygenycteris*, *Lydekker*, in *Flower & Lydekker*, *Mamm.* p. 655 . . . . . *M. woermanni*.

*Megaloglossus*, *Pagenstecher*, *l. s. c.* ("27 Apr." 1885: preliminary descr.); *id.*, *Jahrb. wiss. Anst. Hamb.* ii. p. 126 (1885); *Thomas*, *P. Z. S.* 1887, p. 324 (synopsis of Macroglossine genera); *Winge*, *E. Mus. Lundii*, ii. pt. 1, pp. 24, 27, 28, 56 (1892: affinities; dental formula); *Matschie*, *Megachir.* p. 101 (1899).

*Trygenycteris*, *Lydekker*, *l. s. c.* (1891: intended to replace *Megaloglossus*, the latter said to be preoccupied by *Megaglossa*, Rondani, 1865, a genus of Diptera); *Miller*, *Fam. & Gen. Bats*, p. 73 (1907).

*Summary of characters.*—Tongue Macroglossine. Brain-case less deflected than usual in the subfamily; premaxillæ subequal in breadth throughout (not much broader above than below) and solidly united anteriorly; infraorbital canal short. Incisors  $\frac{2}{2} - \frac{2}{2}$ ; cheek-teeth  $\frac{5}{6}$ , sublinear;  $p^3$  (second upper cheek-tooth) about three times as high and between three and four times as long (antero-posteriorly) as  $p^1$ ; lower incisors distinctly bilobed; palate-ridges seven. Index with claw; fifth metacarpal much shorter than third; external tail reduced to a knob or quite obsolete. Forearm 40–43.5 mm. [One species. *Hab.* W. Africa, from Congo at least as far west as Liberia.]

This is the only Macroglossine genus possessing the following two characters combined, viz. external tail absent or obsolescent, fifth metacarpal considerably shorter than third (the latter character is found only in one other genus of the subfamily, namely *Eonycteris*, in which, however, the tail is well developed). Another diagnostic combination is this: tongue Macroglossine, index clawed, fifth metacarpal conspicuously shorter than third. *Megaloglossus* is the only Ethiopian representative of the subfamily *Macroglossinae*.

The skull of *Megaloglossus* may be distinguished from that of any other Macroglossine genus by these three characters taken together: infraorbital canal short (foramen vertically below, or even a little behind, front of orbit),  $p^3$  much higher than  $p^1$ , premaxillæ fused anteriorly; the first character excludes all other Macroglossine genera except *Eonycteris* and *Syconycteris*, the addition of the second excludes *Syconycteris* (and is at the same time a character by which *Megaloglossus*, without extraction of the skull, may be distinguished at a glance from *Macroglossus*), and that of the third *Eonycteris*.

*Skull* (fig. 68, cf. fig. 71 B, p. 749).—In nearly all important characters similar to that of *Eonycteris*, but much more delicately built, with thinner bones. Basicranial axis not much more deflected than in *Eonycteris*, alveolar line if projected backward passing a little above glenoid fossa. Rostrum relatively slightly

longer and much slenderer; front of orbit above  $m^2$  (in *Eonycteris* above  $m^1$ ). Premaxillæ similar in form to those of *Eonycteris*, but more proclivous and fused anteriorly (as in *Macroglossus*, see fig. 70). Infraorbital canal quite as in *Eonycteris*, short, anterior aperture (infraorbital foramen) vertically below or slightly behind anterior point of orbital margin, outer wall of canal a bridge of bone as narrow as the thinnest portion of zygoma. Postorbital foramina present. Foramen ovale and rotundum relatively widely separated. Tympanics unmodified. Temporal ridges low down on sides of cranium, a sagittal crest therefore never developed; horizontal rami of mandible low, their inferior margin conspicuously

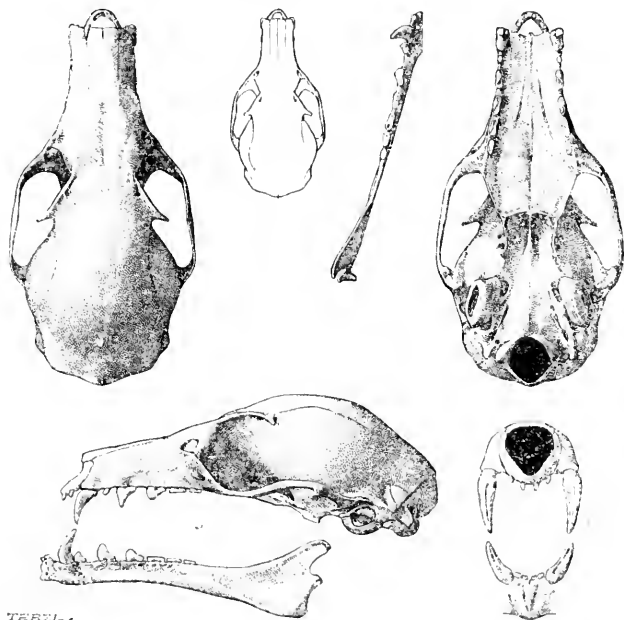


Fig. 68.—*Megaloglossus wocemanni*, ♂. Bitye, R. Ja, Cameroons.  
No. 11.5.5.4. † (linear), front view ‡, outline of dorsal aspect of skull †.

descending in posterior half, coronoid process much sloping backward, low, and narrow, top of process little higher than (in some specimens practically at a level with) tip of canines, angular process rounded off; symphysis not longer than in *Eonycteris* (decidedly shorter than in *Macroglossus*), but extremity of mandible (in front of canines) more drawn out in length, partly to fit to the more proclivous premaxillæ, partly owing to development of a

prominent vertical keel (varying in size individually) on anterior inferior surface of symphysis (compare B with A in fig. 71, p. 749).

*Dentition* (fig. 68).—Dental formula unmodified Rousettine (as in typical *Eonycteris*):

$$\frac{i^1 i^2 c p^1 p^3 p^4 m^1 m^2}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2 m_3} \times 2 = 34.$$

All teeth relatively smaller than in *Eonycteris*, premolars and molars nearly as narrow (linear) as in *MacroGLOSSUS*,  $m^3$  and  $m_2$  somewhat less reduced than in *Eonycteris*; other dental characters as in *Eonycteris*. Upper incisors minute, subterete (faintly pointed), spaced; lower incisors faintly but distinctly bilobed. Upper canines with deep vertical groove along front face, lower canines slanted considerably outward.  $p^1$  about twice the bulk of an upper incisor;  $p^3$  about three times as high as  $p^1$  (tip nearly at level with middle of canine) and three to four times as long (antero-posteriorly);  $p^4$  intermediate in height between  $p^3$  and  $m^1$ ;  $m^1$  and  $m^2$  in profile practically flat (no cusp-like elevation of ridges).  $p_3$  much higher than  $p_1$  (tip nearly at level with middle of canine),  $p_4$  intermediate in height between  $p_3$  and  $m_1$ ,  $m_1$ ,  $m_2$ , and  $m_3$  in profile practically flat.

*Palate-ridges* (fig. 69 B).—4+2+1, i. e. four anterior undivided,

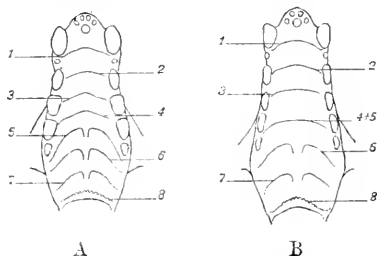


Fig. 69.—Palate-ridges. A, *Eonycteris spelea* (0.8.2.1);  
B, *Megaloglossus woermanni* (11.5.5.4).  
A  $\frac{3}{2}$  (linear), B  $\frac{7}{2}$ .

followed by two divided, and one at extreme posterior border of palate. Position of first, second, and third ridges as in *Eonycteris* (fig. 69 A), fourth more posterior, its median point at a level with middle of  $m^1$  (in *Eonycteris* with back of  $p^4$ ), fifth and sixth postdental. The only noteworthy difference from *Eonycteris* is the reduction of the divided ridges from three to two (a fusion of the fourth and fifth ridges of *Eonycteris* would give a system of palate-ridges similar to that of *Megaloglossus*; see figures).

*External characters*.—Tongue relatively longer than in *Eonycteris*, measured from base of epiglottis noticeably longer than (in *Eonycteris* a little shorter than or equal to) lower jaw, tip narrow and more pointed, and filiform papillæ longer. Tail often undetectable externally, sometimes traceable by touch as a knob below the skin (postischial vertebræ five, the terminal two or three very small).



Membranes inserted at base of first phalanx of second toe, or at corresponding point of third toe, or between second and third toe; vertical fasciæ of mesopatagium, as crossed by the main internal cutaneous line, relatively few (9-13, as in *Eonycteris*) and rather widely spaced. All digits relatively considerably longer than in *Eonycteris*, index of first digit 409 (*Eonycteris* 324), second 756 (679), third 1835 (1722), fourth 1456 (1376), fifth 1319 (1161); greater length of second to fifth digits due chiefly to a lengthening of all the metacarpals and of the proximal phalanx of the third and distal of the fourth and fifth digits; owing to this, the distal phalanx of the fourth and fifth digits become, as a rule, longer (while in *Eonycteris* they are shorter) than the proximal phalanx of the same digits (compare table below, showing in upper line the wing-indices of *Megaloglossus*, calculated from seven adult individuals, in lower those of *Eonycteris*).—Other external characters as in *Eonycteris*, except for the denser hairing of the base of the forearm, tibia, and central interfemoral, and the stronger development and paler (cream or ochre-buff) colour of the neck-tufts in adult males.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph.*	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	100	505	121	130	760	484	591	716	317	393	670	305	344
1000	324	411	133	105	675	451	516	656	369	361	608	297	262

*Sexual differentiation*.—Adult males with well-developed neck-tufts, forming a ruff of pale-coloured hair across foreneck strongly contrasting with fur of throat and breast. Neck-tufts entirely absent in adult females (and immature males).

*Habits*.—Unknown.

*Affinities*.—Phylogenetically *Megaloglossus* occupies a position intermediate between *Eonycteris* and *Macroglossus*. In several characters it has remained on almost exactly the same level as *Eonycteris*, viz. in the relatively slight deflection of the brain-case (strongly deflected in *Macroglossus*), the relatively short symphysis of the mandible (longer in *Macroglossus*), the large size of  $p^3$  and  $p_3$  (reduced in *Macroglossus*), and in having the fifth metacarpal (index 670) considerably shorter than the third (760), the fourth intermediate (716) (in *Macroglossus* all three metacarpals subequal). But it is more specialized than *Eonycteris* in the following respects, viz. the slenderer rostrum and longer tongue, the fusion of the premaxillæ, the very narrow (linear) cheek-teeth, and the reduction of the tail. In all of these latter characters it is quite or very nearly on a level with *Macroglossus*.

\* In *Megaloglossus* with claw.

1. *Megaloglossus woermanni*, Pagenst.

*Megaloglossus woermanni*, Pagenstecher, *Zool. Anz.* viii. no. 193 ("27 Apr." 1885), p. 245 (Sibange Farm, Gaboon); *id.*, *Jahrb. wiss. Aust. Hamb.* ii. p. 126, pl. — fig. 1 (animal; palate-ridges; tongue; insertion of membranes) (1885); Jentink, *Notes Leyd. Mus.* x. p. 53 (1887: Schieffelinville, Junk R., Liberia); Thomas, *P. Z. S.* 1887, p. 324; Jentink, *Cat. Syst. Mamm.* p. 159 (1888); Noack, *Zool. Jahrb., Syst.* iv. p. 209, pl. v. figs. 56–58 (skull) (1889: Netonna, Congo); Büttikofer, *Reisebild. Liberia*, ii. p. 471 (1890: Liberia); Matschie, *Mitth. D. Schutzgeb.* vi. H. 3, p. 7 (1893: Liberia; Gaboon; Congo); Sjöstedt, *Zool. Anz.* xviii. p. 274 (1895: diagnosis of ♂ ad., Ekundu, Cameroons); *id.*, *K. Sv. Vet.-Ak. Handl.* xxvii. n. 1, p. 119 (1895: Ekundu); *id.*, *Bih. K. Sv. Vet.-Ak. Handl.* xxi. Afd. 4, n. 1, p. 3, with plate (♂ ad.; pelvis and caudal vertebrae) (1895: Ekundu); *id.*, *Mitth. D. Schutzgeb.* x. p. 31 (1897: Ekundu); Trouessart, *Cat. Mamm.* i. p. 90, n. 485 (1897); Sjöstedt, *Bih. K. Sv. Vet.-Ak. Handl.* xxiii. Afd. 4, n. 1, p. 16 (1898: Ekundu); Matschie, *Megachir.* p. 101 (1899); Miller, *Proc. Wash. Ac. Sci.* ii. p. 646 (1900: Mt. Coffee, Liberia); Cabrera, *Mem. Soc. Esp. II. N. i.*, mem. 1, p. 6 (1903); Weber, *Säug.* p. 339 (1904); H. H. Johnston, *Liberia*, ii. p. 691 (1906).

*Trygenycteris woermanni*, Trouessart, *Cat. Mamm., Suppl.* p. 66 n. 567 (1904); Miller, *Fam. & Gen. Bats*, p. 73 (1907); Cabrera, *Mem. Soc. Esp. II. N. i.*, mem. 25, p. 442 (1908: Spanish Guinea).

*Fur.*—Length moderate (longer than in *Eonycteris*): back 7 (general mass of hair) and 9 (longest hairs), belly 6 and 8 mm. Forearm and tibia furred above for proximal half or third.

*Colour.*—♂ ad. skin, Bitye, R. Ja, December (11.5.5.4): General colour of back dark brown (considerably darker than Prout's brown); individual hairs almost ecru-drab for greater length, with short dark brown tips. Crown, occiput, and nape of neck pale drab finely powdered with brown (owing to very short brown tips of hairs); hair along middle line of crown and occiput more broadly tipped with brown, producing an ill-defined dark longitudinal stripe; muzzle dark brown, slightly contrasting with pale crown. Throat, breast, belly, and flanks approximately broccoli-brown; sides of neck and foreneck cream-white, forming a ruff strongly contrasting in colour with throat and breast.—Another adult male (Gold Coast, December, 11.1.22.1) differs by the darker (more blackish-brown) tinge of the brown element of the coloration of the upperside, and the deeper (more ochre-buff) colour of the ruff.—In a subadult male (3.2.4.44, January, practically full-grown, but finger joints unconsolidated) the ruff is beginning to appear on either side of the neck.

♀ ad. skin, Efulen, Cameroons, January (3.2.4.45): As the above-described adult male from Bitye, but without any trace of a ruff, the sides of the neck and foreneck being similar in colour to (or only a little paler than) the throat.

*Measurements.* On pp. 743–745.

*Fonycteris and Megaloglossus: External measurements.*

	<i>F. spelaea.</i>		<i>F. major.</i>		<i>F. rosebergi.</i>		<i>M. uernanii.</i>	
	♂ ad.		♀ ad.		♂ subad.		7 ad.	
	Burma; Cochlin China; Malay Pen.; Sumatra.		Burma; Siam; Malay Pen.; Sumatra.		Type.		Cameroons; Gold Coast; Liberia.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Forearm .....	67.5	73	61.5	70.5	67	79.5	67	43.5
Pollex, total length, c. u. ....	21.5	24	20	24	22	25.5	16	18
" metacarpal .....	6.5	7	6	7.5	6.5	7	5.5	6
" 1st phalanx .....	9.5	13	9	11.5	12	12	8	9.5
2nd digit, metacarpal .....	29	33	26	33.5	30.5	34	20.5	22.5
" 1st phalanx .....	8.5	11.5	7.5	10.5	9.5	9.5	4.5	5.5
" 2nd-3rd phalanx * .....	6.5	8.5	6	8.5	7	7	5	6
3rd digit, metacarpal .....	44	48.5	42.5	49.5	45	54	29.5	34.5
" 1st phalanx .....	30.5	33	27	33	29.5	34.5	19	22
" 2nd phalanx .....	39.5	43	36	42.5	40.5	45	23	27
" 4th digit, metacarpal .....	42	47	41	47.5	44.5	54	27	32
" 1st phalanx .....	24.5	27.5	21.5	28	25.5	28.5	14	15.5
" 2nd phalanx .....	22.5	25.5	21.5	26	23.5	26.5	14.5	18
" 5th digit, metacarpal .....	40	43.5	36.5	45.5	40	45	26.5	30.5
" 1st phalanx .....	19	21.5	18	22	19	23.5	12	13.5
" 2nd phalanx .....	17.5	19.5	15	21	24	24	13	16
Ear, length from orifice .....	17	19	16.5	18	...	...	13	15
" greatest breadth, flattened .....	12	13	11	12.5	...	...	10	12
Tail .....	13.5	16.5	13.5	16	...	...	...	...
Tibia .....	29.5	32	25	31	...	...	...	...
Foot, c. u. ....	17.5	20	17	19.5	27	33	17.5	18
Cullear .....	4.5	5.5	4.5	5.5	19.5	21	12	13
					4.5	...	3.5	5

\* In *Megaloglossus* including claw.

## Eonycteris and Megaloglossus: Measurements of skulls and tooth-rows.

	<i>E. spalen.</i>		<i>E. major.</i>		<i>E. rosenbergi.</i>		<i>M. voermanni.</i>	
	6 ♂ ad. Burma; Cochin China; Malay Pen.; Sumatra.	7 ♀ ad. Burma; Siam; Malay Pen.; Sumatra.	♀ ad. Type.	♂ subad. Type.	5 ad. Cameroons; Gold Coast.	Min.	Max.	Min.
Skull, total length .....	35.8	37	32.7	35.5	33	26.6	28	26.6
" condylo-basal length .....	33.5	35.5	30.8	33.2	31	25.5	27	25.5
" palation to incisive foramina .....	15.8	16.8	15	16.5	15	12.5	13.7	12.5
" palation to basion .....	12	14	11.8	14	12	9.7	10	9.7
" rostrum, length orbit to nares .....	10.8	11.7	9.6	11.2	10.7	8.7	9.8	8.7
" brain-case, width at zygomatic .....	14.8	15.2	13.8	15	14.2	10.5	11	10.5
" zygomatic width .....	21.2	22.8	18.8	19.7	18.5	13.2	14.2	13.2
" greatest breadth across molars *, externally .....	8.8	9.2	8.8	9.7	8.5	6	6.8	6
" lacrimal breadth .....	8.7	9.5	8.2	9.2	9	6.5	7.2	6.5
" across crowns of canines, externally .....	7.5	7.8	6.7	7.5	7.1	4.8	5.6	4.8
" postorbital breadth .....	7.2	8.5	7.2	8.5	...	7.2	7.7	7.2
" interorbital breadth .....	6.5	7.8	6.5	6.8	6.5	3.8	4.8	3.8
" mesopterygoid fossa, width .....	4.2	5	4.6	4.8	4.8	3.7	3.9	3.7
" between p <sup>4</sup> -p <sup>1</sup> .....	5.2	5.7	4.6	5.6	4.6	2.8	4.3	2.8
" between bases of canines .....	4.3	4.9	4	4.8	3.5	2.9	3.2	2.9
" orbital diameter .....	8	8.8	7.8	8.5	7.8	6.1	6.5	6.1
" Mandible, length from condyle .....	26.7	28	25	27.5	25	20	21	20
" " symphysis, length .....	5	5.5	4.2	5	5	3.2	3.5	3.2
" " coronoid height .....	9.8	10.7	8.2	10	...	5.5	6.5	5.5
" Upper teeth, c-m <sup>2</sup> , crowns .....	12.5	13	12	13.2	12	9	9.8	9
" Lower teeth, c-m <sub>3</sub> <sup>†</sup> , crowns .....	13.7	14.6	13.2	14.5	12.1	9.7	10.7	9.7

\* In *Eonycteris* across external surfaces of m<sup>1</sup>-m<sup>1</sup>, in *Megaloglossus* across m<sup>2</sup>-m<sup>2</sup>.† In *E. rosenbergi* c-m<sub>2</sub>.

*Eonycteris and Megaloglossus: Measurements of teeth.*

	<i>E. spelaea.</i> 16 skulls. Burma; Siam; Cochin China; Malay Pen.; Sumatra.		<i>E. major.</i> ♀ ad. Type.		<i>E. rosenbergi.</i> ♂ subad. Type.		<i>M. voermanni.</i> 5 skulls. Camerouns; Gold Coast.	
	Min.	Max.	mm.	mm.	mm.	mm.	Min.	Max.
p <sup>1</sup> , length	...	mm.	0.7	0.9	...	mm.	mm.	mm.
" width	...	1	0.7	0.9	...	0.6	0.6	0.7
p <sup>2</sup> , length	...	0.9	1.8	2.2	...	0.4	0.5	0.5
" width	...	2.2	0.9	2.1	...	1.2	1.6	1.6
p <sup>3</sup> , length	...	1	1.8	2	...	0.5	0.6	0.6
" width	...	2.4	1.1	2	...	1.2	1.6	1.6
m <sup>1</sup> , length	...	1.5	2	2.3	...	0.5	0.7	0.7
" width	...	2.6	1	1.2	...	1.3	1.5	1.5
m <sup>2</sup> , length	...	1.4	1	1.6	...	0.5	0.5	0.5
" width	...	1.3	1	1.6	...	0.8	1	1
p <sup>1</sup> , length	...	1	0.6	0.9	...	0.4	0.5	0.5
" width	...	1.4	1	1.1	...	0.8	1	1
p <sup>2</sup> , length	...	1	0.8	0.9	...	0.5	0.5	0.5
" width	...	1.9	1.6	2	...	1.1	1.3	1.3
p <sup>3</sup> , length	...	1	0.8	0.9	...	0.5	0.6	0.6
" width	...	2	1.8	2	...	1.2	1.3	1.3
m <sup>1</sup> , length	...	1	1	0.9	...	0.5	0.6	0.6
" width	...	1.2	2	2.1	...	1.2	1.5	1.5
m <sup>2</sup> , length	...	2.4	1	1.1	...	0.5	0.6	0.6
" width	...	1.3	1.2	1.1	...	1.2	1.5	1.5
m <sup>3</sup> , length	...	1.7	1.2	1.7	...	1	1.2	1.2
" width	...	1.1	0.9	1.1	...	0.5	0.6	0.6
m <sup>3</sup> , length	...	1.2	0.5	1.2	...	0.6	1	1
" width	...	0.9	0.5	1	...	0.3	0.4	0.4

*Specimens examined.* Eight, viz. those catalogued below and one adult female from Schiefelinsville, Liberia (Leyden Museum).

*Range.* The western Ethiopian forest region, from Congo westward at least to Liberia. So far recorded from:—Lower Congo (Netonna), Gaboon (Sibange), Spanish Guinea, Cameroons (Ekundu; Efulen; Assobam; Bitye), Gold Coast (Bibianaha), and Liberia (Junk R.; St. Paul's R.).

*Type*, in the Hamburg Museum, ♀ ad., Sibange farm, Gaboon, collected by H. Soyaux; forearm (according to Pagenstecher) 45 mm.

<i>a, b.</i>	2 ♀ ad. al.; skull of no. 34.	Efulen, Cameroons.	G. L. Bates [C.]	3.2.4.34.25.
<i>c, d.</i>	♂ subad., ♀ ad. sks.; skull of no. 45.	Efulen, Cameroons. 1500-1800'; 7, 1 Jan. 1902.	G. L. Bates [C.]	3.2.4.44.45.
<i>e.</i>	♂ ad. al.	Assobam, R. Bumba, R. Ja, Cameroons.	G. L. Bates [C.]	11.5.5.5.
<i>f.</i>	♂ ad. sk.; skull.	Bitye, R. Ja, 2000'; 15 Dec. 1909.	G. L. Bates [C.]	11.5.5.4.
<i>g.</i>	♂ ad. sk.; skull.	Bibianaha, Gold Coast, 700'; 26 Dec. 1910.	Dr. H. G. F. Spurrell [C. & P.]	11.1.22.1.

### 30. MACROGLOSSUS, *F. Cuvier*.

*Macroglossus* (pt.), Dobson, Cat. Chir. B. M. p. 95.

Type.

1824. *Macroglossus*, *F. Cuvier, Dents Mamm.* p. 248 (nec *Macroglossum*, *Scopoli*, 1777, a genus of Lepidoptera) ..... *M. m. minimus*.
1840. *Kiodotus*, *Blyth, Cuvier's An. Kingd.* p. 69, footnote (to replace the "preoccupied" *Macroglossus*) ..... *M. m. minimus*.
1848. *Rhynchocyon*, *Gistel, Naturg. Thierr.* p. ix (nec *Rhynchocyon*, *Peters*, 1847, a genus of Insectivora) (to replace the "preoccupied" *Macroglossus*) ..... *M. m. minimus*.
1891. *Carponycteris*, *Lydekker, in Flower & Lydekker's Mamm.* p. 654 (to replace the "preoccupied" *Macroglossus*) ..... *M. m. minimus*.
1902. *Odontonycteris*, *Jentink, Notes Leyd. Mus.* xxiii. p. 140 (July) ..... *M. l. lagochilus*.

*Pteropus* (pt.), *E. Geoffroy, Ann. Mus. d'Hist. Nat.* xv. p. 94 (1810: genus *Pteropus*, part of section \*\*, "Roussettes à queue"); *Desmarest, Mamm.* i. p. 110 (1820: as *E. Geoffroy*); *Horsfield, Zool. Res. Java*, fasc. 3, p. — (1821: habits); *Temminck, Mon. Mamm.* i. p. 191 (1825: genus *Pteropus*, second section); *Gray, Griffith's An. Kingd.* v. p. 57 (1827: genus *Vespertilionidæ*, subgenus *Pteropus*, part of second section); *J. B. Fischer, Syn. Mamm.* p. 88 (1829: genus *Pteropus*, section †††); *Blainville, Ost. Mamm., Atl. i. Chêir.* pls. vi., xiii. (1840: skull and dentition of *M. minimus sobrinus*).

*Eidolon* (pt.), *Rafinesque, Anal. Nat.* p. 54 (1815: name proposed for *E. Geoffroy's* second section of *Pteropus*, "Roussettes à queue"

= the modern genera *Eidolon*, *Rousettus*, *Cynopterus*, and *MacroGLOSSUS*).

MacroGLOSSUS, *F. Cuvier, Dents Mamm.* p. 40 (1822); *id.*, *Hist. Nat. Mamm.* iii. livr. 38 c (Dec. 1822).

MacroGLOSSUS, *F. Cuvier, l. c.* (1824); *Schinz, Naturg. & Abb. Säug.* i. p. 71 (1824); *Gray, Ann. Philos.* x. p. 339 \* (1825); *Temminck, Mon. Mamm.* i. p. 194 (1825: not admitted as distinct from *Pteropus*); *Lesson, Man. Mamm.* p. 115 † (1827); *E. Geoffroy, Cours Hist. Nat. Mamm.*, 13 leçon, p. 34 (1828); *J. B. Fischer, Syn. Mamm.* p. 88 (1829: section of *Pteropus*); *Burnett, Q. J. Sci. Lit. Art*, Apr.-June 1829, p. 269; *Temminck, Mon. Mamm.* ii. pp. 50, 96 (1837); *Gray, Mag. Zool. & Bot.* ii. p. 504 † (1838); *Wagner, Schreber's Säug., Suppl.* i. p. 368 (1839); *S. Müller, Temminck's N. G. Ned. Or. Bez., Zoogd.* pp. 21, 22 (1841-44: habits); *Gray, List Mamm. B. M.* pp. xix, 39 (1843); *id.*, *Foy, 'Sulphur,' Zool.* i. p. 28 (1844); *id.*, *Zool. 'Samarang,' Vert.* p. 12 (1849); *Wagner, Schreber's Säug., Suppl.* v. p. 611 (1853-55); *Peters, MB. Ak. Berlin*, 1865, p. 256; *Gray, P. Z. S.* 1866, p. 64; *Peters, MB. Ak. Berlin*, 1867, p. 870 (pt.) (= *MacroGLOSSUS* + *Syconycteris*); *Gray, Cat. Monk. Sc.* p. 114 (1870); *Macalister, Phil. Trans.* 1872, pls. xiii, xiv. (myology); *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 519 (1873: hair); *Dobson, J. A. S. B.* xlii. p. 204 (1873); *id.*, *Ann. & Mag. N. H.* (4) xvi. p. 354 (1875); *id.*, *Cat. Chir. B. M.* p. 95 (pt.) (1878); *Leche, Lunds Univ. Årsskr.* xiv. pp. 19 & seq. (1878: dental formula; milk dentition); *Rosenberg, Mal. Arch.* p. 268 (1878: habits); *Thomas, P. Z. S.* 1887, p. 324 (synopsis of MacroGLOSSINE genera); *id.*, *P. Z. S.* 1888, p. 476 (1889: two species recognized, *minimus* without, "*australis*" (i. e. *lagochilus*) with, vertical groove on upper lip); *Winge, E Mus. Lundii*, ii. pt. i. pp. 24, 27, 28, 56 (1892: affinities; dental formula); *Matschie, Megachir.* p. 93 (genus), p. 95 (subgenus) (1899); *Jentink, Notes Leyd. Mus.* xxiii. p. 131 (1902: revision).

*Koidotus*, *Blyth, l. c.* (1840); *Palmer, Proc. Biol. Soc. Wash.* xii. p. 111 (1898: name revived); *Trouessart, Cat. Mamm.* ii. p. 1278 (1899); *Waterhouse, Ind. Zool.* p. 188 † (1902); *Miller, Fam. & Gen. Bats*, p. 70 (1907).

*Carponycteris*, *Lydekker, l. c.* (1891); *Blanford, Faun. B. Ind., Mamm.* pt. ii. p. 265 (1892); *A. B. Meyer, Abh. Mus. Dresden*, vii. n. 7. p. 10 (1899); *Trouessart, Cat. Mamm., Suppl.* p. 65 (1904); *Jentink, Notes Leyd. Mus.* xxviii. p. 171 (1906).

*Odontonycteris*, *Jentink, l. c.* (1902); *Miller, Proc. Biol. Soc. Wash.* xviii. p. 253 (1905); *id.*, *Fam. & Gen. Bats*, p. 71 (1907).

*Diagnosis*.—Similar to *Megaloglossus*, but brain-case much more strongly deflected, infraorbital canal longer, symphysis of mandible longer,  $p^3$ ,  $p^4$ , and  $p_3$  considerably reduced in size, lower incisors simple (not distinctly bilobed), number of palate-ridges eight, third, fourth, and fifth metacarpals subequal. Size small, forearm 37-48.5 mm. [Two species, six recognizable forms. *Hab.* The Indo-Chinese, Indo-Malayan, and Austro-Malayan subregions.]

The only genera with which *MacroGLOSSUS* is likely to be confused are *Megaloglossus* and *Syconycteris*, to both of which it bears no small resemblance externally, in general appearance as well as in

\* Misspelt *MacroGLOSSUS*. † Misspelt *MacroGLOSSA*. ‡ Misspelt *Koidotus*.

size. Its principal differences from the former are summed up in the diagnosis above (the most convenient differential characters, for practical use, being the much lower  $p^3$  and  $p_3$ , and the subequal length of the third, fourth, and fifth metacarpals; in *Megaloglossus* the fifth is much shorter than the third, the fourth intermediate). From *Syconycteris* it is readily distinguished by:—(1) the wide interspace between  $i^1-i^1$  and  $i_1-i_1$  (narrowly spaced or in contact in

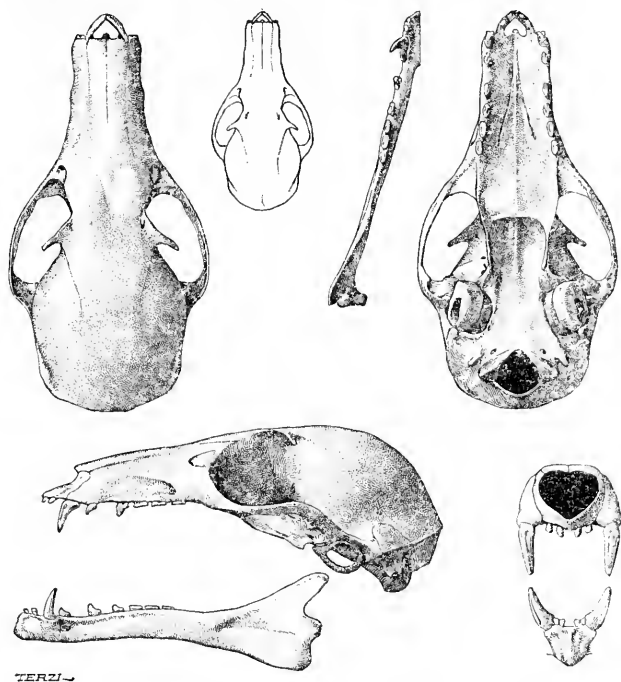


Fig. 70.—*MacroGLOSSUS minimus sobrinus*, ♀, type of subspecies. (Upper incisors from skull 79.11.15.6, Kediri, Java.) ♂ (linear), front view ♀, outline of dorsal aspect of skull ♂.

*Syconycteris*): (2) the very small incisors,  $i^2$  being subequal to (if not smaller than)  $i^1$ ,  $i_2$  to  $i_1$  (in *Syconycteris* upper incisors much larger and proclivous, and  $i_2$  about twice the bulk of  $i_1$ ); (3) the normally developed interfemoral and calcar (interfemoral in *Syconycteris* reduced to a narrow rim along inner side of tibia, and calcar rudimentary). In dried skins the third of these characters is, of course, often more or less obscured.

*Skull* (figs. 70, 71 C).—Basiscranial axis much more deflected than in *Eonycteris* and *Megaloglossus*; alveolar line, if continued backward, passing through brain-case a considerable distance above



lambdoid crest. Rostrum long and slender (as in *Megaloglossus*), its actual length (orbit to nares) varying, according to species and races, from a little less to a little more than one-third of total length of skull; front of orbit above same point of, or even (*M. minimus sobrinus*, often also *M. m. minimus*) distinctly behind,  $m^2$ . Premaxillæ similar in form to those of *Eonycteris* and *Megaloglossus* (ascending branches not broader above than below), but more proclivous than in *Megaloglossus* and much more so than in *Eonycteris* (see fig. 71, below), and (as in *Megaloglossus*) solidly united anteriorly. Infraorbital canal less shortened than in *Eonycteris* and *Megaloglossus*, its anterior aperture (infraorbital foramen) at least a little, and in the longer-muzzled forms (e. g. *M. m. sobrinus*) much, in front of anterior point of orbit, its outer wall conspicuously broader (antero-posteriorly) than height of zygoma at

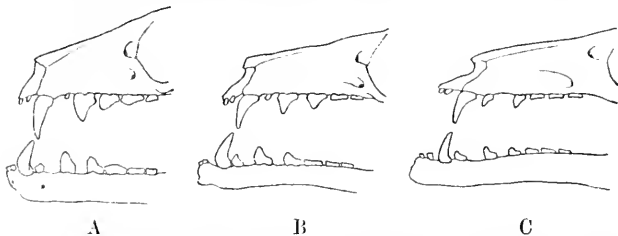


Fig. 71.—A. *Eonycteris spelæa* (0.8.2.1); B. *Megaloglossus woermanni* (11.5.5.4); C. *MacroGLOSSUS minimus sobrinus* (type of subspecies). Note in *Eonycteris* Roussettine aspect of extremity of rostrum and mandible, unreduced  $p^1$ ,  $p^4$ ,  $p_3$ ,  $p_4$ ; in *Megaloglossus* proclivous premaxillæ, lengthened extremity of mandible, almost unreduced  $p^3$ ,  $p^4$ ,  $p_3$ ,  $p_4$ ; in *MacroGLOSSUS* still greater proclivity of premaxillæ and lengthening of extremity of mandible, long infraorbital canal, reduced  $p^3$ ,  $p^4$ ,  $p_3$ ,  $p_4$ , relatively large  $p^1$ .

A  $\frac{3}{2}$  (linear), B and C  $\frac{7}{4}$ .

middle. Postorbital foramina present. Foramen ovale and rotundum close together or (in some individuals, irrespective of species and race) confluent. Tympanics unmodified. Temporal ridges low down on sides of cranium, a sagittal crest therefore never developed; mandible very similar to that of *Megaloglossus*, but symphysis relatively longer, as a rule between one-fifth and one-fourth (in *Megaloglossus* about one-sixth) of length of mandible from condyle; symphysis keel (on anterior inferior surface of symphysis) generally strongly developed (obsolescent or absent in the eastern races of *M. lagorchilus*).

*Dentition* (figs. 70, 71 C).—Dental formula unmodified Ronsettine (as in *Megaloglossus* and typical *Eonycteris*):  $\frac{i^1 i^2 c p^1 p^3 p^4 m^1 m^2}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2 m_3}$   
 $\times 2 = 34^*$ .

Upper and lower incisors small, subequal ( $i^2$  sometimes a little

\* On the frequently occurring anomalies in the dentition of this genus, see p. 754. under the heading "*Odontonycteris*."

weaker than  $i^1$ ), cutting-edge simple; a wide space between  $i^1-i^1$  and  $i_1-i_1$ . Upper canines with a deep vertical groove on anterior surface; lower canines slanted outward. Premolars and molars narrow, linear (narrowest in the eastern races of *M. lagochilus*);  $p^1$  relatively less reduced than in *Eonycteris* and *Megaloglossus*;  $p^3$ ,  $p^4$ , and  $p_3$  much lower than in those genera;  $p^4-m^1$  and  $p_4-m_2$  with slightly concave crushing surface and (except in  $p_4$ ) with scarcely any trace of cusp-like elevation anteriorly;  $m^2$  and  $m_3$  similar in length to, or very little shorter than, respectively  $m^1$  and  $m_2$ .

*Palate-ridges* (fig. 72 B).—Eight undivided, the five anterior interdental, sixth and seventh postdental, eighth at palation border.

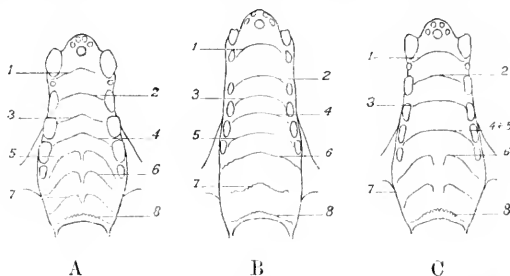


Fig. 72.—Palate-ridges. A. *Eonycteris spelea* (0.8.2.1); B. *Macroglossus minimus sobrinus* (7.9.11.15.6); C. *Megaloglossus woermanni* (11.5.5.4). A  $\frac{3}{2}$  (linear), B and C  $\frac{1}{2}$ .

Number and arrangement nearly unmodified Eonycterine (compare B with A in fig. 72). The species and subspecies do not differ in the arrangement of the palate-ridges (but trivial individual variations in the form of the ridges and length of the interspaces occur in both species and any race).

*External characters.*—General appearance and most characters of importance as in *Megaloglossus*. Rhinarium in *M. lagochilus* unmodified Megaloglossine, nares directed half outward and half forward, and internarial groove continued downward to margin of upper lip; in *M. minimus* nares directed much more outward than forward, internarial groove shallower and not, or only indistinctly, continued downward along middle of upper lip. External tail rudimentary or absent, as in *Megaloglossus*, but caudal vertebrae reduced to three or two (five in *Megaloglossus*). Membranes inserted as a rule on base of first phalanx of fourth (in *Megaloglossus* second or third) toe, sometimes on interdigital membrane between third and fourth, rarely on third toe (the two latter variations of more frequent occurrence in the eastern races of *M. lagochilus* than in the western race of the same species and in *M. minimus*). Vertical fasciae of mesopatagium as in *Megaloglossus* (8–14). Metacarpals and phalanges differing as follows:—(1) in *Megaloglossus* the indices of the third, fourth, and fifth metacarpals are,

respectively, 760, 716, and 670, *i.e.* the third is the longest, the fifth the shortest, the fourth intermediate; in *MacroGLOSSUS* the indices are 726, 733, and 740, *i.e.* the metacarpals are practically equal in length, though with a slight tendency of the fifth to become the longest, the third the shortest, and this change, it should be noted, is effected by a shortening of the third, a slight lengthening of the fourth, and a considerable lengthening of the fifth: (2) at the same time, in *MacroGLOSSUS*, both phalanges of the third, fourth, and fifth digits are distinctly lengthened: (3) owing to all these changes the total length of the third, fourth, and fifth digits is in *MacroGLOSSUS* greater than in *Megaloglossus*, the indices being in the former, respectively 1893, 1535, and 1444, in *Megaloglossus* 1835, 1456, and 1319, *i.e.* the fifth digit is in *MacroGLOSSUS* lengthened by about 10 per cent., the fourth by 5, the third by only 3 (compare table below, showing in upper row wing-indices of *MacroGLOSSUS*, calculated from about 90 individuals representing all forms known, in lower row those of *Megaloglossus*). General size of animals as *Megaloglossus*; upper half of forearm and nearly the whole of tibia densely clothed above (distal half of tibia naked in *Megaloglossus*); colour of fur much lighter than in *Megaloglossus*, varying on upperside from russet Prout's brown as darkest extreme to wood-brown as lightest, with paler underparts, but like *Megaloglossus* with a more or less conspicuous median longitudinal stripe of darker brown from crown to nape of neck; no neck tufts (well-developed in adult males of *Eonycteris* and even more so in same sex of *Megaloglossus*).

Forearm.	Pollex. c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	387	520	103	129	726	530	637	733	387	415	740	331	370
1000	409	505	121	130	760	484	591	716	347	393	670	305	344

*Sexual differentiation.*—Zygomatic breadth of skull averaging larger in males (as usual in Megachiroptera). No sexual difference in colour nor in the fur of the foreneck (compare strong development of neck-tufts in males of *Megaloglossus*).

*Range.*—For distribution of species and subspecies see table, p. 752. *M. minimus*, it will be observed, occupies the north-western, western, and south-western portions of the area inhabited by the genus, *M. lagochilus* the northern, central, and eastern; they appear nowhere to occur together.

	<i>M. minimus.</i>	<i>M. lagochilus.</i>
Darjeeling .....	(m. sobrinus *)	
Siam .....	(m. sobrinus *)	
Burma .....	(m. sobrinus *)	
Tenasserim .....	(m. sobrinus *)	
Malay Pen.....	m. sobrinus	
Sumatra .....	m. sobrinus	
Nias .....	m. sobrinus	
Java .....	{ m. sobrinus	
	{ m. minimus	
Kangean Is. ....	m. minimus	
Timor.....	(m. minimus *)	
Borneo .....		l. lagochilus
Cagayan Sulu .....		l. lagochilus
Philippines .....		l. lagochilus
Sanghir Is.....		(l. lagochilus *)
Celebes .....		l. lagochilus
Gilolo group .....		No record
Amboina group.....		l. lagochilus
Mysol .....		l. nanus
W. New Guinea .....		l. nanus
Bismarck Arch. ....		l. nanus
Key Is. ....		(l. nanus *)
Aru Is. ....		l. nanus
Murray Is. ....		l. pygmaeus
Solomon Is. ....		l. microtus

\* No specimens examined.

*Habits.*—"Like other species of *Pteropus*, it feeds on fruit of every description, but particularly infests the various species of *Eugenia* or Jambu, which are cultivated in gardens; during the day it remains suspended under branches of trees, or it retires under roofs of old houses and sheds" (Horsfield, *l. c.*, 1821). "Gedurende den dag verbergt het zich tusschen de reuzenbladeren der bananen, der kokos- en pinangpalmen, of het zoekt de meest dooreengevlochtene en donkerste plaatsen in de boomachtige rietbossen der verschillende bamboessoorten tot rustplaats op; de *Macroglossi* leven deels van vruchten, deels van insekten, zijn bovendien ook groote liefhebbers van de bladen en knoppen der boomen, inzonderheid van die des kapokbooms (*Eriodendrum anfractuosum*)" (S. Müller, *l. c.*, 1841-44). "Fliegt einzeln oder paarweise herum und verkriecht sich bei Tag gerne zwischen den jungen noch zusammengerollten Schösslingen der Pisangpflanze" (v. Rosenberg, *l. c.*, 1878). The above seems to be all that is known of the life-history of these bats. Two females collected by W. Stalker in Burn, August 1909 (10.3.3. 24, 25), had embryos about to be born.

*Affinities.*—In two characters *Macroglossus* is a little more primitive than both *Eonycteris* and *Megaloglossus*: the infraorbital canal is less shortened, and  $p^1$  is somewhat less reduced in size. Its palate-ridges have remained almost precisely on the same stage

as in *Eonycteris* (reduced from 8 to 7 in *Megaloglossus*). But in all other characters of any importance it has developed along the same lines as *Megaloglossus*, and in many respects it has carried the development considerably farther than *Megaloglossus*. The characters in which *Megaloglossus* is more highly specialized than *Eonycteris* are (as pointed out p. 741) chiefly these: the slenderer rostrum, the more proclivous and solidly united premaxillæ, the elongated extremity of the mandible, the narrow (linear) cheek-teeth, and the reduced tail. All of these Megaloglossine specializations reoccur in *MacroGLOSSUS*; but in addition to these, the brain-case is much more strongly deflected, the premaxillæ still more proclivous, the extremity of the mandible even more drawn out, the symphysis of the mandible longer,  $p^1$ ,  $p^4$ , and  $p_3$  reduced (on the point of degenerating to the same degree as the posterior cheek-teeth), the number of caudal vertebrae reduced from five to three or two, the third metacarpal shortened and the fifth lengthened (so as to make the third, fourth, and fifth metacarpals subequal in length), and the insertion of the wing-membranes shifted more toward the post-axial (fibular) side of the foot. It appears safe to presume, therefore, that *Megaloglossus* and *MacroGLOSSUS* are offshoots from one branch, but while the Ethiopian genus (*Megaloglossus*) has preserved many Eonycterine characters (viz. slight deflection of brain-case, short symphysis of mandible, short infraorbital canal, unreduced  $p^3$ ,  $p^4$ , and  $p_3$  (though the posterior cheek-teeth are degenerated to the same degree as in *MacroGLOSSUS*), long third, short fifth, and intermediate fourth metacarpal), its eastern representative has got rid of all of these Eonycterine (or præ-Eonycterine) reminiscences.

*Chronology of species and revisions.*—For nearly eighty years (1810–1889) this genus was believed to be monotypic (Horsfield's *Pteropus rostratus*, 1821, was soon seen to be the same as E. Geoffroy's *Pt. minimus*). The first author to point out the existence of two species, the one (*minimus*) without, or with only a slight indication of, a median vertical groove on the upper lip, the other with the internarial groove continued downward to the margin of the upper lip, was Oldfield Thomas (*l. c.*, 1889); but the latter species was wrongly identified with Peters's "*M. australis*" (known to Thomas only from the published description and figures), which in reality is a *Syconycteris*. The error was corrected by Matschie (*l. c.*, 1899), who proposed the name *lagochilus* for the species referred by Thomas to *australis*, and added a third species, *nanus*: the latter will have to stand as a local race of *lagochilus*. The material preserved in the Leyden and Dresden Museums was revised, and the results published, by Jentink, in 1902 (*l. c.*). Finally, three new forms were added during the preparation of this Catalogue. Subjoined a chronological table of the names proposed for forms of this genus.

Year.	Name.	Author.	Type locality.	Identification.
1810	minimus	E. Geoff.	Java	1. minimus minimus
1821	rostratus	Horsf.	Java	minimus minimus
1827	kiodotes	Lesson	Java	minimus minimus
"	horsfieldi	Lesson	Java	minimus minimus
1829	cuvieri	Burnett	Nomen nudum	minimus minimus
1899	lagochilus	Matschie	Buru	2. lagochilus lagochilus
"	nanus	Matschie	Bismarek Arch.	3. lagochilus nanus
"	novæ-guinææ	Matschie	Nomen nudum	lagochilus nanus
1902	meyeri	Jentink	Great Sanghir	lagochilus lagochilus
1911	m. sobrinus	K. And.	Malay Pen.	4. minimus sobrinus
"	l. pygmaeus	K. And.	Murray Is.	5. lagochilus pygmaeus
"	l. microtus	K. And.	Guadalupe	6. lagochilus microtus

*Odontonycteris*.—A bat obtained by Dr. A. B. Meyer in the Sanghir Islands and similar to *Macroglossus* in all respects but for the presence of an "m<sup>3</sup>" on either side of the jaw, was described by Jentink, in 1902 (*l. c.*), as a new genus and species, *Odontonycteris meyeri*; the genus was accepted by Miller (1905 and 1907, *l. c.*), who had seen a second specimen (from Cagayan Sulu). If the character were normal and constant, *Odontonycteris* would be the only known Fruit-bat with three upper molars. But there cannot, in the opinion of the writer, be the slightest doubt that *Odontonycteris* was based on an individual with abnormal dentition. In no other genus of Megachiroptera are dental anomalies of so frequent occurrence as in *Macroglossus*, and on no point of the jaws are these anomalies in *Macroglossus* so often met with as on that occupied by the molar series. About seventy skulls have been examined (representing all the forms recognized in this Catalogue), and of these no less than eight exhibit anomalies in the number of molars\*, as follows (added, two instances from literature):—

$\frac{4-4}{6-5}$  cheek-teeth (instead of the normal formula,  $\frac{5-5}{6-6}$ ):—*M. m. minimus*, ♂ ad.,

Kangean Is., 10.4.6.15; m<sup>2</sup> on both sides and m<sub>3</sub> on right side absent.

$\frac{5-5}{7-5}$ —Specimen mentioned and figured by Temminck, Mon. Mamm. i. p. 192, pl. xv. fig. 27; upper molars normal, in right mandible one molar absent, in left mandible a supernumerary molar ("m<sub>4</sub>") present.

$\frac{5-5}{7-6}$ —*M. l. nanus*, ad., Aru Is., 10.3.3.3; an additional molar ("m<sub>4</sub>") in left mandible.

$\frac{5-5}{7-7}$ —(1) *M. m. minimus*, ♀ subad., Madura, 10.4.7.4; an additional molar ("m<sub>4</sub>") in both halves of the mandible (it looks as if m<sub>3</sub> had been divided into two separate teeth).

(2) *M. l. nanus*, ad., Aru Is., 10.3.2.2; same anomaly.

(3) *M. sp.*, Temminck, Mon. Mamm. i. p. 192, pl. xv. fig. 26; same anomaly.

\* Other dental anomalies observed (apart from those of the molars):—

i<sup>1</sup> redoubled on both sides (3-3 upper incisors): *M. m. sobrinus*, ♀ ad., Patani, 3.2.6.17.

Right i<sup>1</sup> and left i<sup>2</sup> abnormally broad and sharply bilobate at tips (beginning splitting of teeth; compare foregoing): *M. m. sobrinus*, ♀ ad., Perak 98.11.29.1.

- $\frac{5-6}{6-6}$ :—*M. l. lagochilus*, ♀ ad., Buru, 10.3.3.24; an additional upper molar ("m<sup>3</sup>") on right side (accidentally lost during cleaning of skull).
- $\frac{6-5}{6-7}$ :—*M. l. lagochilus*, ♂ ad., Buru, 10.3.3.23; an "m<sup>3</sup>" on left side (with what appears to be a newly closed corresponding alveolus on right side) and an "m<sub>4</sub>" on right.
- $\frac{6-6}{6-6}$ :—*M. m. minimus*, ♀ ad., Madura, 10.4.7.2; an additional upper molar on both sides. [This is the form of anomaly exhibited by the type of *Odontonycteris meyeri*, according to Jentink's description.]
- $\frac{6-6}{7-6}$ :—*M. l. lagochilus*, ♂ ad., Cagayan Sulu, U.S. Nat. Mus. 125316; an "m<sup>2</sup>" on both sides and an "m<sub>4</sub>" on left (the skull, not the mandible, has been examined by the writer; the presence of a left "m<sub>4</sub>" is mentioned by Miller, Fam. & Gen. Bats, p. 72). This specimen was by Miller referred to *Odontonycteris*.\*

### Synopsis of the Species.

- a. Nares directed more outward than forward; median vertical groove on upper lip obsolescent or absent. Forearm 40–48.5 mm. (Indo-Chinese and Indo-Malayan subregions, excluding Borneo and Philippines) . . . . . 1. *M. minimus*, p. 755.
- b. Nares directed half outward, half forward; median vertical groove on upper lip sharply defined. Forearm 37–44.5 mm. (Austro-Malayan subregion, including Borneo and Philippines) . . . . . 2. *M. lagochilus*, p. 762.

### 1. *Macroglossus minimus*, E. Geoff.

*Macroglossus minimus* (pt.), Dobson, Cat. Chir. B. M. p. 96.

(Synonyms under the subspecies.)

*Diagnosis*.—Median vertical groove on upper lip feeble or entirely absent; forearm 40–48.5 mm. *Hab.* Java, east to Timor, west and north-west to Sumatra, Malay Peninsula, Burma, Siam, and Darjeeling.

Nares directed much more outward than forward; internarial groove (perhaps for that reason) shallower than in *M. lagochilus*, its continuation downward (the median groove) sometimes distinctly traceable as a faint groove right to margin of lip, but more often quite obsolete; lateral grooves on upper lip, as a rule, ill-defined or even practically absent. Membranes, in all specimens examined, from fourth toe (base of first phalanx).

*Colour*.—Adults. *M. m. minimus*, twelve skins (seven males, five females: no appreciable sexual colour-difference), Tjilatjap, Java, dates from 30 Oct. to 10 Dec.:—General colour of back

\* Note the comparative frequency of dental anomalies in *Pteropus scapulatus* (antea, p. 405, footnote), a species which is almost Macroglossine (or perhaps rather Megaloglossine) in the degeneration of the cheek-teeth. [Compare with *Macroglossus* the Marsupial genus *Myrmecobius*: degeneration (small size, simplified form) of cheek-teeth associated with a pronounced tendency to development of supernumerary teeth.]

varying from warm russet Prout's brown, or perhaps rather a tinge between cinnamon and Prout's brown (darkest extreme of series), to almost pure wood-brown (palest extreme); individual hairs some tinge of wood-brown (in some individuals almost whitish wood-brown or whitish ecru-drab) at base, with longer or shorter brownish tips; the variation in the general aspect of the colour of the back produced by the deeper or paler colour of the tips of the hairs, or by variation in the length of the brownish tips (the shorter the darker tips, the more exposed the wood-brown ground-colour and, consequently, the lighter the general aspect of the upperside); in the palest specimens the brownish tips are almost entirely wanting on the back, though traceable on the shoulders, humerus, and forearm. Head similar to back or a little deeper in tinge; nearly always a perfectly distinct (though often somewhat ill-defined) darker brown median longitudinal stripe from crown to nape of neck. Underparts deeper or paler fawn-woodbrown, occasionally inclining to whitish wood-brown, as a rule palest (often approaching cream) on foreneck, deepest (sometimes with a distinct touch of russet) on flanks.

Immature individuals (*M. m. minimus*, five skins, Tjilatjap, 30 Oct.-29 Nov.) differ from adult only in the somewhat duller tinges of the colours.

The colour of *M. m. sobrinus* is similar to (and varies within the same limits as) that of *M. m. minimus*.

*Subspecies*.—The reasons which have compelled the writer to subdivide *M. minimus* into two races are these:—(1) The extent of individual variation in size in Chiroptera is usually about ten to twelve per cent., very rarely as much as fifteen or seventeen; i. e., if in a large series of individuals, all belonging to one form, the forearm of the smallest fully adult individual measures 40 mm., that of the largest will be about 44-45, if the minimum is 150, the maximum is about 165. If *M. minimus* were one homogeneous form, the forearm would vary from 40-48.5 mm. (22 p. et.), the third metacarpal from 28.5-35 (23 p. et.), the skull from 24.8-29.5 (19 p. et.), the rostrum from 7.8-10.5 (34 p. et.),—an individual variation unparalleled among other Megachiroptera: (2) All the available adult skulls of *M. minimus* may be arranged in a series according to the length of the rostrum, showing a perfectly gradual increase (by tenths or fifths of a millimetre) in the rostrum from 7.8 to 8.8 mm., and again (similarly by tenths and fifths) from 9.5 to 10.5 mm., but of 32 skulls none has a rostrum between 8.8 and 9.5 mm. It will be noticed that the variations 7.8-8.8 and 9.5-10.5 represent the usual size variation in Bats, about ten to twelve per cent.: (3) All skulls (six adult) from the Malay Peninsula have the longer type of rostrum, while of the Javan skulls (24 adult) two-thirds have the shorter and only one-third the longer type: (4) The following four Javan localities are represented in the collection (excluding specimens ticketed "Java," without more definite locality), viz., Tjilatjap (13 adult), Tasikmalaja (2), Kediri (3), and Madura Island (2); all specimens from



Tjilatjap and Madura belong to the shorter-nosed, all from Tasikmalaja and Kediri to the longer-nosed type, *i. e.*, in no case, thus far, were the two types found together in the same locality.

These facts would seem to warrant the following conclusions:—The name *minimus*, as hitherto understood, covers two distinct races: in the one (*minimus*) the rostrum is, both absolutely and relatively, shorter, measuring (orbit to nares) about 7·8–8·8 mm., or slightly less than one-third of the total length of the skull, and all measurements (skull, tooth-rows, external dimensions) average conspicuously smaller; in the other (*sobrinus*) the rostrum is longer, about 9·5–10·5 mm., or slightly more than one-third of the skull, and all measurements average larger. The former (*minimus*) is, so far, known with certainty only from Java (including Madura) and Kangean Islands, and is probably the truly indigenous Javan race of the species, whereas the latter (*sobrinus*) may be presumed originally to have been confined to S.E. Asia, whence (as soon as altered physical conditions favoured an extension of its area southeastward) it has spread to Sumatra and Java; even now the predominant form in Java seems to be *minimus*; and there is so far no evidence that the two forms actually live together in the same district. Since *sobrinus* (if this theory is correct) has spread southeastward to Java, it is by no means unlikely that *minimus* has extended its range westward to Sumatra and, perhaps, to the Malay Peninsula; only the proof that such is the case is as yet wanting\*.

The table below shows the difference in size as between the two subspecies.

	<i>m. minimus.</i>			<i>m. sobrinus.</i>		
	18 skulls,			14 skulls,		
	31 specimens.			19 specimens.		
	Min.	Med.	Max.	Min.	Med.	Max.
Skull, lambda to gnathion ...	24·8	26·3	27·5	28·5	29	29·5 mm.
Rostrum, orbit to nares .....	7·8	8·4	8·8	9·5	10	10·5 „
Mandible, from condyle .....	18	19·8	20·8	21·2	22·1	22·7 „
c-m <sup>2</sup> , crowns .....	8·2	8·5	9	9·2	9·6	10 „
Forearm .....	40	42·4	44·5	42	45·5	48·5 „
Third metacarpal .....	28·5	30·5	32	30	33·2	35 „
Tibia .....	15·5	16·5	17·5	16	17·4	18·5 „

### 1 a. *Macroglossus minimus minimus*, E. Geoff.

*Pteropus minimus*, E. Geoffroy, *Ann. Mus. d'Hist. Nat.* xv. p. 97 (1810: Java); Oken, *Lehrb. Naturg.* iii. Abth. 2, p. 934 (1816); Desmarest, *N. Dict. d'Hist. Nat.*, new ed. xxix. p. 514 (1819);

\* It is worth noticing that Temminck was well aware of the existence of longer- and shorter-muzzled individuals of "*M. minimus*," and had arrived at the result that the difference was local (racial) rather than individual:—"Les sujets de Sumatra [*sobrinus* in this Catalogue] ont le museau excessivement long; ceux de Java [*minimus*] l'ont un peu plus court et peu différent de ceux de Timor; mais ceux d'Amboine [*lagochilus*] l'ont remarquablement plus court comparativement aux *Kiodotes* de Sumatra" (*Mon. Mamm.* ii. p. 97, 1837).

- id.*, *Mamm.* i. p. 111, n. 147 (1820); *Schinz, Thierr.* i. p. 156 (1821); *Temminck, Mon. Mamm.* i. p. 191, pl. xv. figs. 25-30 (skulls), pl. xvi. figs. 1, 2 (skeleton) (1825: Java; Timor); *Gray, Griffith's An. Kingd.* v. p. 58, n. 164 (1827); *Desmarest, Dict. Sci. Nat.* xlv. p. 372 (1827); *Is. Geoffroy, Dict. Class. d'Hist. Nat.* xiv. p. 706 (1828); *J. B. Fischer, Syn. Mamm.* p. 88, n. 24, p. 550 (1829); *Wagler, Syst. Amph.* p. 9 (1830); *Kaup, Thierr.* i. p. 216 (1835); *G. Cuvier, R. An.*, 3 ed. i. p. 138, footnote (1836); *Oken, Allg. Naturg.* vii. Abth. 2, p. 991 (1838); *Rüppell, Mus. Senck.* Abh. iii. H. 2, p. 154, n. ii. A. 12. a, b (1842: Java); *Gervais, Hist. Nat. Mamm.* i. p. 189, figs. (teeth; animal) (1854); *Schlegel, Dierk.* i. p. 53 (1857); *id.*, *Dierent., Zoogd.* p. 66 (1872).
- MacroGLOSSUS minimus*, *Lesson, Hist. Nat. Mamm. (Compl. Buffon)*, v. p. 66, pl. vii. fig. 2 (animal) (1836); *Temminck, Mon. Mamm.* ii. p. 98 (pt.) (1837), p. 358 (pt.) (1841) (Java; Timor); *Gray, Mag. Zool. & Bot.* ii. p. 504\* (1838); *Wagner, Schreber's Säug., Suppl.* i. p. 369 (pt.) (1839); *Macgillivray, Cuvier's An. Kingd.* ii. p. 13 (pt.), pl. vii. n. figs. 7, 8 (animal; skeleton: copies from Temminck) (1840); *S. Müller, Temminck's N. G. Ned. Ov. Bez., Zoogd.* pp. 21, 22, 58, 59 (pt.) (1841-44: Java; Timor; habits); *F. Cuvier, Hist. Nat. Mamm.* vii., *Tabl. gén. et méth.* p. 2 (1842); *Gray, List Mamm. B. M.* p. 39, nos. b, c (1843: Java); *Schinz, Syst. Verz. Säug.* i. p. 135, n. 1 (pt.) (1844); *Gray, Zool. 'Samorang,' Vert.* p. 12 (pt.) (1849); *Horsfield, Cat. Mamm. Mus. E. Ind. Co.* p. 29 (pt.) (1851: Java); *Wagner, Schreber's Säug., Suppl.* v. p. 611 (pt.) (1853-55); *Giebel, Säug.* p. 993 (pt.) (1855); *Fitzinger, SB. Ak. Wien*, xlii. p. 390 (1861: Java, 'Novara' Exp.); *Gervais, Cat. Bones Mamm. B. M.* p. 59 (1862); [Anonymous], *Mém. Quadr. & Chéir. Arch. Ind.* p. 115 (pt.) (1864); *Kreffl, Cat. Mamm. Austr. Mus.* p. 5 (1864: Java); *Gray, P. Z. S.* 1866, p. 64 (pt.); *Peters, MB. Ak. Berlin*, 1867, p. 871 (pt.); *Zeelbor, Reise 'Novara,' Säug.* p. 13 (1869: Java); *Gray, Cat. Monk. &c.* p. 115 (1870: Java); *Fitzinger, SB. Ak. Wien*, lx. Abth. 1, p. 615 (pt.) (1870); *Macalister, Phil. Trans.* 1872, pl. xiii. figs. 3, 7, 13, pl. xiv. figs. 1, 3, 7-10, 13, 15, 19 (myology); *Marchi, Atti Soc. Ital. Sci. Nat.* xv. p. 519 (1873: structure of hairs); *Dobson, J. A. S. B.* xlii. p. 205 (pt.) (1873: Malay Arch.); *id.*, *Cat. Chir. B. M.* p. 96 (pt.) (1878: Java); *Leche, Lunds Univ. Årsskr.* xiv. pp. 17 & seq., pl. ii. fig. 11 (1878: milk dentition); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 209, n. 340 (pt.) (1879); *Jentink, Cat. Ost. Mamm.* p. 268 (pt.) (1887: Java); *id.*, *Cat. Syst. Mamm.* p. 158 (pt.) (1888: Java); *Trouessart, Cat. Mamm.* i. p. 90, n. 486 (pt.) (1897); *Jentink, Notes Leyd. Mus.* xxiii. p. 133 (pt.) (1902: Java); *Thomas & Wroughton, P. Z. S.* 1909, p. 376 (Tjilatjap, Java).
- Carponycteris minima*, *Flower & Lydekker, Mamm.* p. 654 (pt.) (1891); *Lydekker, R. Nat. Hist.* i. p. 260 (1893-94); *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 557 (pt.) (1904).
- Kiodotus minimus*, *Miller, Fam. & Gen. Bats*, p. 71 (pt.) (1907).
- MacroGLOSSUS* (*Carponycteris*) *minimus*, *Willink, Nat. Tijds. Ned. Ind.* lxxv. p. 278 (pt.) (1905).
- MacroGLOSSUS minimus minimus*, *K. Andersen, Ann. & Mag. N. H.* (8) vii. p. 641 (1911).

*Pteropus rostratus*, *Horsfield, Zool. Res. Java*, fasc. 3, p. —, pl. — (animal; head) (1821: Java; habits); *Desmarest, Mamm.* ii. p. 535, n. 822 (1822); *Schinz, Thierr.* iv. p. 289 (1825); *Gray, Griffith's An. Kingd.* v. p. 56, n. 159 (1827); [*Anonymous*], *Syn. Cont. B. M.*, 26 ed. p. 34 (1832: Java).

*Macroglossus rostratus*, *Schinz, Naturg. & Abb. Säug.* i. p. 71, pl. li. fig. 2 (animal: copy from F. Cuvier) (1824); *id., op. c.* 2 ed. p. 82, pl. xix. fig. 2 (animal: ut supra) (1827).

*Macroglossus kiodontes*, *Lesson, Man. Mamm.* p. 115, n. 300\* (1827: new name of *Pteropus minimus*, E. Geoff., 1810); *id., N. Tabl. R. An., Mamm.* p. 15, n. 203 (1842).

*Macroglossus horsfieldi*, *Lesson, Man. Mamm.* p. 115, n. 301\* (1827: new name of *Pteropus rostratus*, Horsf., 1821).

*Macroglossus cuvieri*, *Burnett, Q. J. Sci. Lit. Art*, Apr.–June, 1829, p. 269 (nom. nud.).

*Diagnosis*.—Smaller, with shorter rostrum. For details see pp. 756–757.

*Measurements*. On pp. 768–770.

*Specimens examined*. Forty (eight in the Leyden Museum); localities as enumerated in the list of specimens in collection, p. 760.

*Range*. Java (incl. Madura) and Kangean Islands. May be found to extend westward to Sumatra and the Malay Peninsula, into the area of *M. m. sobrinus*, though of this there is no evidence in the material examined. A "*M. minimus*," possibly this form, has been recorded from Timor (Temminck, l. c.).

*Cotypes*.—The species was based on two specimens obtained in Java by Leschenault de la Tour, both of which appear to have perished. The subspecies cannot be determined from Geoffroy's description ("grandeur 9 centimètres, envergure 27"), and no figures of the types have been published (F. Cuvier's coloured figure is stated to have been drawn from a specimen from Bengal [*sic*], and is grossly inaccurate in various points of importance, *e. g.* in the proportions of the metacarpals and phalanges as compared with the length of the forearm; the skull figured by Blainville is that of a well-pronounced *M. m. sobrinus*, from Sumatra). In the circumstances it is expedient to fix the name *minimus* on the smaller form of the species, which also is the predominant race in Java.—"*Pt. minimus*" was renamed *Macroglossus kiodontes* by Lesson, 1827. Burnett's *M. cuvieri* (1829), though technically a nomen nudum, was evidently intended as a new name of the same species.

*Pteropus rostratus*, Horsfield.—Described from three adult specimens, two males and one female, obtained in Java by Horsfield, and once in the India Museum, London (probably specimens A, B, C in Horsfield's Catalogue of 1851, p. 29). One of the cotypes is now in the British Museum (skull, total length —, rostrum 8.8, mandible from condyle 20.5, e-m<sup>2</sup>, crowns 8.8, forearm about 43, third metacarpal 30.5 mm.), the fate of the two other cotypes is

\* Generic name misspelt *Macroglossa*.

unknown. Horsfield, in 1821, was evidently unaware that the species had been named and described eleven years earlier by E. Geoffroy; in 1851 (*l. c.*) he recognized his inadvertence by placing *rostratus* in the synonymy of *minimus*.—"Pt. *rostratus*" was renamed *MacroGLOSSUS horsfieldi* by Lesson, 1827.

a. ♀ ad. skeleton.		Purchased (Frank).	1060 a.
b. ♂ imm. sk.; Java. no skull.		Gen. Th. Hardwicke	41 b. [P.].
c. Ad. st.	Java.	Leyden Museum [E.].	37.4.28.36.
d. Ad. sk.; skull.	Java ( <i>Horsfield</i> ).	India Museum [P.].	60.5.4.25. ( <i>Cotype of Pteropus rostratus</i> , Horsf., and <i>MacroGLOSSUS horsfieldi</i> , Lesson.)
e. Imm. sk.; skull.	Java.	Tomes Coll. (Verreaux).	7.1.1.274.
f-k. 3 ♂ ad., 3 ♀ ad. al.	W. Java ( <i>Guy C. Shortridge</i> ).	W. E. Balston, Esq.	9.1.5.897-902. [P.].
l-b <sup>2</sup> . 7 ♂ ad., 3 ♂ imm., 5 ♀ ad., 2 ♀ imm. sks.; skulls.	Tjilatjap, W. Java, sea-level: 30 Oct., 2, 10, 11, 26, 27, 29, 30 Nov., 4, 8, 10 Dec. 1907 ( <i>G. C. S.</i> ).	W. E. Balston, Esq.	9.1.5.122-138. [P.].
c <sup>2</sup> -c <sup>2</sup> . 2 ♀ ad., 1 ♀ imm. sks.; skulls.	Matengan, nr. Sumenep, E. Madura, 2'; 2, 5 Nov. 1909 ( <i>G. C. S.</i> ).	Oldfield Thomas, Esq. [P.].	10.4.7.2-4.
f <sup>2</sup> . ♂ ad. sk.; skull.	Kangean Is., 4'; 18 Nov. 1909 ( <i>G. C. S.</i> ).	Oldfield Thomas, Esq. [P.].	10.4.6.15.

### 1 b. *MacroGLOSSUS minimus sobrinus*, K. And.

♀ Kiodote, *F. Cuvier, Hist. Nat. Mamm.* iii. livr. 38, p. —, pl. 99 (col. fig. of animal from "Bengal"; see remark *antea*, p. 759, under heading "cotypes") (1822).

*MacroGLOSSUS minimus*, *Temminck, Mon. Mamm.* ii. p. 98 (pt.) (1837: Sumatra); *Wagner, Schreber's Säug., Suppl.* i. p. 369 (pt.) (1839); *S. Müller, Temminck's N. G. Ned. Ov. Bez., Zoogd.* pp. 21, 22, 58, 59 (pt.) (1841-44: Java: Timor; habits); *Gray, List Mamm. B. M.* p. 39, no. a (1843: Java); *Horsfield, Cat. Mamm. Mus. E. Ind. Co.* p. 29 (pt.) (1851: Siam); *Wagner, Schreber's Säug., Suppl.* v. p. 611 (pt.) (1853-55); *Blyth, Cat. Mamm. Mus. As. Soc.* p. 21 (1863: Sitang R., Tenasserim); *Peters, ME. Ak. Berlin*, 1867, p. 871 (pt.); *Fitzinger, SB. Ak. Wien*, lx. Abth. i. p. 615 (pt.) (1870); *Dobson, J. A. S. B.* xlii. p. 205 (pt.), pl. xiv. fig. 11 (ear) (1873: Darjeeling; Burma); *id.*, *Cat. Chir. Ind. Mus.* p. 4 (1874: Darjeeling); *Blyth, Cat. J. A. S. B.* xliii. Extra number, p. 15 (1875: Sitang R.); *Dobson, Mon. As. Chir.* p. 34, c. fig. (ear), p. 190 (1876: Darjeeling); *id.*, *Cat. Chir. B. M.* p. 96 (pt.) (1878: Java); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 209, n. 340 (pt.) (1879); *J. Anderson, Cat. Mamm. Ind. Mus.* i. p. 107 (1881: Darjeeling; Siam); *Theobald, Mason's Burma*, i. p. 426 (1882); *Jentink, Cat. Ost. Mamm.* p. 268 (pt.) (1887: Sumatra; Java); *id.*, *Notes Leyd. Mus.* xi. p. 29 (1888: Deli, Sumatra); *id.*, *Cat. Syst. Mamm.* p. 158 (pt.) (1888: Sumatra; Java); *Thomas*,

- P. Z. S.* 1888, p. 476 (1889: Java; characters of *M. minimus*, as compared with *M. "australis,"* i. e. *lagochilus*); *Modigliani, Ann. Mus. Civ. Genova*, (2) vii. p. 242 (1889: Nias); *Jentink, Weber's Zool. Erg. Nied. Ost-Ind.* i. p. 127 (1890: Sumanik, nr. Singkarak, Sumatra); *Trouessart, Cat. Mamm.* i. p. 90, n. 486 (pt.) (1897); *Hanitsch, Ann. Rep. Raffles Lib. & Mus.* 1897, p. 11 (1898: Nias); *Matschie, Megachir.* p. 96 (1899: Java); *Jentink, Notes Leyd. Mus.* xxiii. p. 133 (pt.) (1902: Java); *Bonhote, Fasc. Mal., Zool.* i. p. 15 (1903: Patani); *Thomas & Wroughton, P. Z. S.* 1909, p. 376 (Tasikmalaja, Java).
- Pteropus minimus*, *Blainville, Ost. Mamm.* i. *Chéir.* pp. 100, 103, *Atl. i. Chéir.* pl. vi. fig. 6 (skull), pl. xiii. fig. 7 (dentition) (1840: Sumatra).
- Macroglossus (Pteropus) minimus*, *Sterndale, Mamm. Ind.* p. 41, n. 34 (pt.) (1884).
- Carponycteris minima*, *Blanford, Faun. B. Ind., Mamm.* pt. ii. p. 265, fig. 78 (ear) (1891: warm valleys of Sikhim; Burma); *Thomas, Ann. Mus. Civ. Genova*, (2) x. p. 922 (1892: Taho; Biapo); *S. S. Flower, P. Z. S.* 1900, p. 341; *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 557 (pt.) (1904).
- Kiodotus minimus*, *Bonhote, P. Z. S.* 1900, p. 875 (1901: Ulu Selama, Perak); *Miller, Fam. & Gen. Bats*, p. 71 (pt.) (1907); *Kloss, J. Fed. Mal. St. Mus.* ii. p. 154 (1908: Patani; N. Perak).
- Macroglossus lagochilus* (pt., *nec Matschie*), *Jentink, Notes Leyd. Mus.* xxiii. p. 134 (1902: Sumatra).
- Carponycteris lagochilus*, *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 559 (pt.) (1904); *Schneider, Zool. Jahrb., Syst.* xxiii. p. 76 (1905: Sukaranda; Serdang).
- Carponycteris* sp., *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 558 (1904: Darjeeling; Burma; Siam; Patani).
- Macroglossus minimus sobrinus*, *K. Andersen, Ann. & Mag. N. H.* (8) vii. p. 642 (1 June, 1911: Malay Pen.; Sumatra; Nias; Java).

*Diagnosis.*—Averaging conspicuously larger than *M. m. minimus*, and with relatively longer rostrum. For details see pp. 756–757.

*Measurements.* On pp. 768–770.

*Specimens examined.* Twenty-six (seven in the Leyden, five in the Berlin Museums), from:—Malay Peninsula, six (viz. Patani, one; Perak, four; Selangor, one); Sumatra, five ("Sumatra," three; Deli, two); Nias, one (immature); Java, eleven ("Java," four; W. Java, one; Tasikmalaja, two; Kediri, four); uncertain localities, three.

*Range.* Malay Peninsula, extending south to Sumatra (with Nias) and Java. It is probably this form which has been recorded in literature from Tenasserim (Sitang R.), Burma (Taho; Biapo), Siam, and Darjeeling.

*Type in collection.* Skull, total length 29.5, rostrum, orbit to nares 10, mandible, from condyle 22.7, c-m<sup>2</sup>, crowns 9.5, forearm 47, third metacarpal 34 mm.

- |               |               |                    |                       |
|---------------|---------------|--------------------|-----------------------|
| a. ♀ ad. sk.; | Patani, Malay | Messrs. H. C. Rob- | 3.2.6.17.             |
| skull.        | Pen.; 22 Apr. | inson & N. An-     |                       |
|               | 1901.         | nandale [P.].      |                       |
| b. ♀ ad. sk.; | Gunong Igari, | A. L. Butler, Esq. | 98.11.29.1.           |
| skull.        | Perak, 2000'; | [P.].              | (Type of subspecies.) |
|               | March, 1898.  |                    |                       |

c. ♂ ad. sk.; skull.	Semangko Pass, Selangor, 2800'; Nov. 1900.	A. L. Butler, Esq. [P.]	1.3.9.2.
d. ♂ imm. al.; skull.	Nias.	Dr. Bleeker [C.]	80.1.17.1.
e, f. ♂ imm., ♀ ad. al.		Lidth de Jeude Coll.	67.4.12.336, 380.
g. Ad. sk.; skull.	Java.	Hon. E. India Co. [P.]	41 a.
h-k. ♂ ad., 2 ♀ ad., ♂ pull. al.; skulls of nos. 6-8.	Mringen, Willis Mts., Kediri, Java, 2-3000'; March-May, 1878.	Baron A. v. Hügel [P.]	79.11.15.6-9.
l. ♀ ad. al.	W. Java ( <i>Guy C. Shortridge</i> ).	W. E. Balston, Esq. [P.]	9.1.5.896.
m, n. 2 ♀ ad. sks.; skulls.	Tasikmalaja, Preanger, Java, 1145'; 25, 26 Dec. 1907 ( <i>G.C.S.</i> ).	W. E. Balston, Esq. [P.]	9.1.5.139, 110.

## 2. *Macroglossus lagochilus*, Matschie.

*Macroglossus minimus* (pt.), Dobson, Cat. Chir. B. M. p. 96.

(Synonyms under the subspecies.)

*Diagnosis*.—Median vertical groove on upper lip sharply defined; forearm 37-44.5 mm. *Hab.* The whole of Austro-Malaya (thus far no record from the Gilolo group of islands), extending west to Philippines and Borneo.

Nares directed half outward and half forward; internarial groove deep and always continued downward as a sharply defined groove right to margin of upper lip; lateral groove on upper lip (one on either side of median groove, at a distance of about one millimetre) always well-pronounced, sometimes converted into a notch in margin of lip. Membranes usually inserted on fourth toe (base of first phalanx), in some individuals rather between third and fourth, or distinctly on third.

Colour of fur as in *M. minimus*, though with a tendency of the underparts and the base of the fur of the upperside to average lighter.

*Subspecies*.—A line drawn north-south between the Moluccas and New Guinea divides the area inhabited by this species into a western and eastern half. The islands of the western half, viz. Borneo, the Philippines, Sanghir Islands, Celebes, and Moluccas, are occupied by one race (*M. l. lagochilus*) in which the premolars and molars are not more reduced in breadth than in *M. minimus*; those of the eastern half, viz. Mysol, New Guinea, the Bismarek Archipelago, Key, Aru, Torres Straits, and Solomon Islands, by three races (*nanus*, *pygmaeus*, and *microtus*), which, all taken together, are characterized, as against *M. l. lagochilus*, by still narrower cheek-teeth, and distinguishable from each other by average differences in the length of the rostrum or size of the ears.

*Synopsis of the Subspecies of M. lagochilus.*

- a.* Premolars and molars not narrower than in *M. minimus*. Forearm 38–44.5 mm. (Borneo; Philippines; Sanghir; Celebes; Amboina group) . . . . . 2 *a.* *M. l. lagochilus*, p. 763.
- b.* Premolars and molars averaging narrower (see measurements, p. 770). Forearm 37–39 mm. (New Guinea and adjacencies; Solomon Is.).
- a'*. Ear, length from orifice 12.5–13.5, greatest breadth (flattened) 9–9.5 mm.
- a''*. Rostrum (orbit to nares) 7.5–8.5 mm. (Mysol; W. New Guinea; Bismarck Arch.; Key Is.; Aru Is.) . . . . . 2 *b.* *M. l. nanus*, p. 765.
- b'*. Rostrum slightly shorter, about 6.8 mm. (Murray Is.) . . . . . 2 *c.* *M. l. pygmaeus*, p. 767.
- b''*. Ear slightly smaller, length 11–12.5, greatest breadth 8–8.5 mm. (Solomon Is.) . . . . . 2 *d.* *M. l. microtus*, p. 767.

2 *a.* **Macroglossus lagochilus lagochilus**, *Matschie*.

*Macroglossus minimus* (*nec E. Geoff.*), *Temminck*, *Mon. Mamm.* ii. p. 98 (pt.) (1837: Celebes; Amboina; Banda); *Wagner*, *Schreber's Säug., Suppl.* i. p. 369 (pt.) (1839); *S. Müller*, *Temminck's N. G. Ned. Or. Bez., Zoogd.* pp. 21, 22, 58, 59 (pt.) (1841–44: Borneo); *Waterhouse*, *P. Z. S.* 1843, p. 67 (Philippines, Cuming Coll.); *Schinz*, *Syst. Verz. Säug.* i. p. 135, n. 1 (pt.) (1844); *Gray*, *Zool. 'Samarang,' Vert.* p. 12 (pt.) (1849); *Wagner*, *Schreber's Säug., Suppl.* v. p. 611 (pt.) (1853–55); [*Anonymous*], *Mém. Quadr. & Chér. Arch. Ind.* p. 115 (pt.) (1864: Borneo; Celebes; Moluccas; Banda); *Finsch*, *Neu-Guinea*, p. 151 (pt.) (1865); *Peters*, *MB. Ak. Berlin*, 1867, p. 871 (pt.); *id.*, *op. c.* 1868, p. 626 (1869: Sarawak); *Dobson*, *Cat. Chir. B. M.* p. 96 (pt.) (1878: Philippines); *Rosenberg*, *Mal. Arch.* pp. 268, 322 (1878: Celebes; Ceram; habits); *Trouessart*, *Rev. & Mag. Zool.* (3) vi. p. 209, n. 340 (pt.) (1879); *Jentink*, *Notes Leyd. Mus.* v. p. 174 (1883: Amurang); *id.*, *Cat. Syst. Mamm.* p. 158 (pt.) (1888: Celebes); *Elera*, *Cat. Sist. F. Filip.* i. p. 7 (1895: Panay; Samar; Cuyo); *Sanchez*, *An. Soc. Esp. II. N.* xxix. pp. 276, 288 (1900: Philippines).

*Macroglossus minimus var.* (pt.), *Gray*, *Cat. Monk. &c.* p. 115 (1870: Philippines).

*Carponycteris minima*, *Everett*, *P. Z. S.* 1893, p. 494 (Borneo); *Hose*, *Mamm. Borneo*, p. 39 (1893).

*Macroglossus australis* (*nec Pet.*), *Thomas*, *P. Z. S.* 1888, p. 476 (pt.) (1889: Philippines, Cuming & Everett Coll.); *Trouessart*, *Cat. Mamm.* i. p. 90, n. 487 (pt.) (1897); *Jentink*, *Notes Leyd. Mus.* xix. p. 51 (1897: Ruma Manual, Mt. Kenepai, Kapuas R., W. Borneo); *Thomas*, *Trans. Z. S.* xiv. pt. vi. p. 385 (1898: Canloan Volcano, Negros); *Matschie*, *SB. Ges. nat. Fr.* 1898, p. 39 (Tablas, Philippines).

*Carponycteris australis*, *A. B. Meyer*, *Abh. Mus. Dresden*, vii. n. 7, p. 10 (1899: Kema, N. Celebes).

- Macroglossus lagochilus*, *Matschie, Megachir.* p. 96 (1899: Menado; Buru; Amboina); *Jentink, Notes Leyd. Mus.* xxiii. p. 135 (1902: Menado).
- Carponycteris lagochilus*, *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 559 (pt.) (1904).
- Macroglossus* (*Carponycteris*) *lagochilus*, *Willink, Nat. Tijd. Ned. Ind.* lxx. p. 278 (1905).
- Kiodotus lagochilus*, *Miller, Fam. & Gen. Bats*, p. 71, fig. 10 (skull: Philippines) (1907).
- Macroglossus nanus* (pt., *nec Matschie*), *Jentink, Notes Leyd. Mus.* xxiii. p. 135 (1902: Celebes).
- Carponycteris nana* (pt.), *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 560 (1904).
- Odontonycteris meyeri*, *Jentink, Notes Leyd. Mus.* xxiii. p. 140 (July, 1902: Tabukan, Great Sanghir); *Trouessart, Cat. Mamm., Suppl.* p. 64, n. 556 (1904); *Miller, Proc. Biol. Soc. Wash.* xviii. p. 253 (1905: Cagayan Sulu); *Willink, Nat. Tijd. Ned. Ind.* lxx. p. 278 (1905); *Miller, Fam. & Gen. Bats*, p. 72 (1907).

*Diagnosis.*—See Synopsis, p. 763.

The less outwardly-directed nares and strongly-defined vertical groove on the upper lip appear to be the only characters by which this form can be safely distinguished from the smaller race of *M. minimus*. The relative length of the rostrum, the breadth of the teeth, and the general size of the animal seem to be exactly alike in the two forms. Any difference in the palate-ridges between the present form and *M. minimus* does not exist (*Matschie's* statement to the contrary, *Megachir.* p. 97, must have been based on insufficient material).

Specimens from Borneo, the Philippines, Celebes, and the Amboina group have been compared with each other and found indistinguishable. Subjoined some comparative measurements:—

	Borneo. 2 skulls, 3 specim.	Philippines. 4 skulls*, 3 specim.	Celebes. 2 specim.	Buru & Ceram. 6 skulls, 9 specim.
Skull, total length .....	24.8-27.2	26.2-27	.....	24.8-27 mm.
Rostrum, orbit to nares .	8 - 9.2	8.3- 8.7	.....	7.8- 8.7 „
Mandible, from condyle .	18.6-20.7	19.8-20.5	.....	18.2-20.2 „
c-m <sup>2</sup> , crowns .....	8.2- 8.9	9 - 9.2	.....	8 - 9.2 „
m <sup>1</sup> , breadth .....	0.6- 0.7	0.6- 0.7	.....	0.6- 0.6 „
Forcarnia.....	40 -43.5	41.5-43.5	39-44.5	38 -44.5 „
Third metacarpal .....	29.5-32	29.5-33	.....	27 -33 „
Ear, from orifice .....	13	13 -14	.....	13 -14 „
Tibia .....	16	16 -17	.....	15.5-17 „

*Measurements.* On pp. 768-770.

*Specimens examined.* Twenty-one, viz., in addition to those catalogued below, three in the Leyden Museum (one, Borneo, Büttikofer; one, Celebes, van Delden; one, Menado, F. von Faber; all with skulls *in situ*), one in the Berlin Museum (type of *M. lagochilus*, with skull), and one from the U.S. National Museum (skull without mandible, Cagayan Sulu, Dr. E. A. Mearns, 125316, "*Odontonycteris meyeri*," cf. Miller, *ll. s. c.*).

\* Including one skull from Cagayan Sulu.



*Range.* Borneo (Labuan; Sarawak; Kapuas R.); Cagayan Sulu; Philippines (Tablas; Samar; Panay; Cuyo; Negros); Sanghir Is.; Celebes (Menado; Kema; Amurang); Amboina group (Buru; Amboina; Ceram; Banda Is.). [If a *MacroGLOSSUS* occurs in the Gilolo group, it is likely to be either the present form or *M. l. nanus*.]

*Type*, in the Berlin Museum, ♂ ad. al., skull extracted, Buru, collected by Dr. Bleeker, Reg. no. 3248. Skull, total length 27, rostrum, orbit to nares 8.6, mandible, from condyle 20.2, e-m<sup>2</sup>, crowns 8.6, forearm 44.5, third metacarpal 33, ear, length from orifice 14, greatest breadth (flattened) 11, tibia 17 mm.

*Odontonycteris meyeri*, Jentink.—*Type*, in the Dresden Museum, ♂ ad. skin, with skull, Tabukan, Great Sanghir, Dr. A. B. Meyer coll., 1871; forearm (according to Jentink) 39 mm. The genus *Odontonycteris* was founded on a *M. lagochilus* with a supernumerary posterior upper molar on each side, an anomaly not infrequently observed in both species of *MacroGLOSSUS* (see *antea*, p. 754). The question only remains as to which subspecies of *lagochilus* "*O. meyeri*" is to be referred. Although no specimens from the Sanghir Islands have been available for examination, there can be little doubt that they belong to *M. l. lagochilus*, which occurs both north (the Philippines), west (Borneo), south (Celebes), and south-east (Amboina group) of the Sanghir Islands.

a.	Ad. sk.; skull.	Borneo.	Tomes Coll.	7.1.1.273.
b.	♀ ad. al.; skull.	Labuan; May, 1895.	A. Everett [C.].	95.11.6.1.
c, d.	♂ ad., ♀ subad. al.; skulls.	Philippines ( <i>H. Cuning</i> ).	Zoological Society.	Not reg.
e.	♀ ad. al.; skull.	Philippines.	A. Everett [C.].	77.10.6.12.
f.	♀ ad. al.; skull.	Negros, Philippines.	J. Whitehead [C. & P.].	97.8.4.2.
g.	♀ imm. al.; skull.	Kema, N. Celebes.	Drs. Surasin [C. & E.].	99.10.1.14.
h-n.	3 ♂ ad., 1 ♂ imm., 3 ♀ ad. sks.; skulls.	Kayeli, Buru; Aug. 1909 ( <i>W. Stalker</i> ).	New Guinea Expedition [P.].	10.3.3.20-26.
o.	♀ ad. sk.; skull.	Wahai, Ceram; Nov. 1909 ( <i>W. Stalker</i> ).	New Guinea Expedition [P.].	10.3.4.9.
p.	♂ ad. al.	Ceram ( <i>W. Stalker</i> ).	New Guinea Expedition [P.].	10.3.4.64.

## 2 b. *MacroGLOSSUS lagochilus nanus*, Matschie.

*MacroGLOSSUS minimus* var. (pt., nec *E. Geoff.*), Gray, *Cat. Monks*, &c. p. 115 (Mysol).

*MacroGLOSSUS minimus*, Dobson, *P. Z. S.* 1877, p. 118 (Bismarck Arch.); *id.*, *Cat. Chir. B. M.* p. 96 (pt.) (1878: Mysol; Bismarck Arch.); ? Ramsay, *Proc. Linn. Soc. N. S. Wales*, ii. p. 10 (1878: Katow; an *Syconycteris papuana*?); Trouessart, *Rev. & Mag. Zool.* (3) vi. p. 209, n. 340 (pt.) (1879); Peters & Doria, *Ann. Mus. Civ. Genova*, xvi. p. 691 (pt.) (1881: Andai; Aru Is.; ? Key Is.); Pagenstecher, *Jahrb. wiss. Anst. Hamb.* ii. pl. —, fig. 3 (palate-ridges; tongue; insertion of membranes) (1885); Jentink, *Cat. Syst. Mamm.* p. 158 (pt.) (1888: Aru Is.; New Britain).

- Carponycteris minima* (pt.), *Heller, Abh. Mus. Dresden*, vi. n. 8 p. 4 (1897).  
*Macroglossus australis* (pt., *nec Pet.*), *Thomas, P. Z. S.* 1888, p. 476 (1889: Mysol; Bismarek Arch.); *Trouessart, Cat. Mamm.* i. p. 90, n. 487 (1897).  
*Macroglossus nanus*, *Matschie, Megachir.* p. 97 (1899: Aru Is.; Andai; Bismarek Arch.); *Jentink, Notes Leyd. Mus.* xxiii. pp. 137, 138, 140 (1902: Aru Is.; New Guinea; New Britain).  
*Carponycteris nana*, *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 560 (pt.) (1904); *Jentink, Notes Leyd. Mus.* xxviii. p. 171 (1906); *id.*, in '*Nova Guinea*,' v. p. 363 (1907: Merauke); *id.*, *op. c.* ix. p. 5, pl. i. fig. 3 (palate-ridges) (1908: Noord R.).  
*Macroglossus* (*Carponycteris*) *nanus* (pt.), *Willink, Nat. Tijds. Ned. Ind.* lxx. p. 278 (1905).  
*Macroglossus lagochilus nanus*, *K. Andersen, Ann. & Mag. N. H.* (8) vii. p. 642 (1911).  
*Macroglossus novæ-guinææ*, *Matschie, Krieger's 'Neu-Guinea,'* p. 78 (1899: New Guinea; *nomen nudum*, presumably a slip for *M. nanus*).

*Diagnosis*.—Similar to *M. l. lagochilus*, but premolars and molars averaging slightly narrower (see measurements, p. 770).

General size of animal averaging a trifle smaller; skull usually a little more delicately built, but rostrum scarcely shorter, relatively, than in *M. l. lagochilus*; symphysis keel of lower jaw obsolescent or absent; palate-ridges unmodified; length, distribution, and colour of fur as in *l. lagochilus*.

Comparative measurements of adult specimens from different localities:—

	Mysol. 1 skull, 1 specim.	Andai. 1 skull, 1 specim.	Bismarek Arch. 4 skulls, 11 specim.	Aru Is. 4 skulls, 5 specim.
Skull, total length .....	25	...	25.5-26	24-25.8 mm.
Rostrum, orbit to nares .	7.9	...	8.4-8.5	7.5-8 "
Mandible, from condyle .	18.2	17.8	18.7-19	18-18.8 "
c-m <sup>2</sup> , crowns .....	8	8.5	8.3-8.9	7.8-8.6 "
m <sup>1</sup> , breadth .....	0.5	0.5	0.5-0.5	0.5-0.5 "
Forearm .....	...	38	37-39	37.5-39 "
Third metacarpal .....	28.5	27.5	27.5-30.5	28-28.5 "
Ear, from orifice .....	...	12.5	12.5-13.5*	12.5 "
Tibia .....	15.5	15	15-16*	15 "

*Measurements*. On pp. 768-770.

*Specimens examined*. Nineteen, from:—Mysol, one; Andai, N.W. Guinea, one (Berlin Museum, 4699, D'Albertis coll.); Bismarek Archipelago, twelve (one, Leyden; nine, Berlin, including type of subspecies; Finsch and Dahl coll.); Aru Islands, five (one, Leyden; one Berlin; von Rosenberg coll.).

*Range*. Mysol; W. New Guinea (Andai; recorded by Jentink, *l. c.*, from Noord and Merauke Rivers); Bismarek Archipelago; ? Key Islands (no specimens examined); Aru Islands.

*Type*, in the Berlin Museum, ♂ ad. al., skull *in situ*, Lamellana, New Britain, Dahl coll., Reg. no. 9308. Forearm 39, third metacarpal 29, ear, length from orifice 12.5, greatest breadth (flattened) 9.5, tibia 16 mm.

\* Measured in four specimens.

- a.* Ad. sk.; skull. Mysol; 1860. Dr. A. R. Wallace 61.12.11.7.  
[C.]  
*b, c.* 1 ad., 1 subad. New Ireland. Rev. G. Brown 77.7.18.8, 9.  
sks.; skulls. [C.]  
*d-f.* 3 ad. sks.; Dobo, Aru Is.; May, New Guinea Expe- 10.3.2.1-3.  
skulls. 1909 (*W. Stalker*). dition [P].

### 2 c. *Macroglossus lagochilus pygmæus*, *K. And.*

*Macroglossus australis* (pt., *nec Pet.*), *Ogilby, Cat. Austr. Mamm.* p. 81 (1892).

*Macroglossus nanus* (pt., *nec Matschie*), *Jentink, Notes Leyd. Mus.* xxiii. p. 139 (1902: Murray Is.).

*Carponycteris nana* (pt.), *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 560 (1904).

*Macroglossus lagochilus pygmæus*, *K. Andersen, Ann. & Mag. N. II.* (8) vii. p. 642 (1 June, 1911: Murray Is.).

*Diagnosis.*—As *M. l. nanus*, but rostrum relatively a little shorter, 6.8 mm. (in type) against 7.5–8.5 in *nanus*.

General size of animal as *M. l. nanus*, if not perhaps averaging a trifle smaller; premolars and molars as narrow as in *nanus*; colour of fur not differing.

*Measurements.* On pp. 768–770.

*Specimens examined.* Those catalogued below.

*Range.* Thus far only known from the type locality, Murray Islands, Torres Straits.

*Type* in collection.

- a.* ♀ imm. al.; skull. Murray Is. Rev. S. MacFarlane [C.] 78.9.14.3.  
*b.* ♂ ad. al.; skull. Mer, Murray Is. Prof. A. C. Haddon [P.] 99.9.10.1.  
(*Type of subspecies.*)

### 2 d. *Macroglossus lagochilus microtus*, *K. And.*

*Macroglossus australis* (pt., *nec Pet.*), *Thomas, P. Z. S.* 1888, p. 476 (1889: Aola).

*Carponycteris nana* (pt., *nec Matschie*), *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 560 (1904).

*Macroglossus lagochilus microtus*, *K. Andersen, Ann. & Mag. N. II.* (8) vii. p. 642 (1 June, 1911: Florida; Guadalcantar).

*Diagnosis.*—Similar to *M. l. pygmæus*, but ears relatively smaller.

General size of animal as *M. l. pygmæus*; premolars and molars as narrow as in *nanus* and *pygmæus*; length of ears from orifice in two adult specimens (type and paratype) 11 and 12.5 (12.5–13.5 in *nanus* and *pygmæus*), breadth of flattened ear 8 and 8.5 mm. (9–9.5); colour of fur not differing.

*Measurements.* On pp. 768–770.

*Specimens examined.* Those catalogued below.

*Range.* Solomon Islands; so far recorded from Florida and Guadalcantar.

*Type* in collection.

- a.* Juv. sk.; skull. Florida I.; 29 Dec. A. S. Meek [C.] 1.11.5.5.  
1900.  
*b, c.* ♂ ad., ♀ ad. al.; Aola, Guadalcantar. C. M. Woodford, 88.1.5.13, 14.  
skulls. Esq. [C.]  
(♀ ad., 88.1.5.14, *Type of species.*)

## MacroGLOSSUS : External measurements.

	<i>M. m. minimus.</i> 31 ad. Java; Madura; Kangean.		<i>M. m. sobrinus.</i> 19 ad. Malay Pen.; Sumatra; Java.		<i>M. l. laochilus.</i> 17 ad. Borneo; Philippines; Celebes (Menado); Baru; Ceram.		<i>M. l. nanus.</i> 18 ad. Mysol; Andai; Bismarck Arch.; Aru Is.		<i>M. l. pygmaeus.</i> ♂ ad. Type.		<i>M. l. microtus.</i> 2 ad. Guadalecanar.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	♀ ad. Type.	♂ ad. Paratype.
Forearm .....	mm.	mm.									mm.	mm.
Pollex, total length, c. u. ....	40	44.5	42	48.5	38	44.5	37	39	37.5		37.5	38.5
" " metacarpal .....	15	16.5	16	18	15	18	14	17	15		16	16
" " 1st phalanx .....	4.5	5	4.5	5.5	4	5	3.5	5	4		4.5	5
2nd digit, metacarpal .....	7	8.5	7	9	7.5	9.5	7.5	9	8		9	8
" " 1st phalanx .....	21	24.5	21	25	19.5	23.5	18.5	21.5	19		19	18.5
" " 2nd-3rd phalanx, c. u. ....	4	4.5	4	5	4	5	3.5	4.5	4		4.5	4
3rd digit, metacarpal .....	5	6	4.5	6	4.5	6	4.5	6	4.5		4.5	5
" " 1st phalanx .....	28.5	32	30	35	27	33	27.5	30.5	27		28	28
" " 2nd phalanx .....	20.5	23.5	22.5	25.5	19.5	23.5	20	22.5	20		20.5	21
4th digit, metacarpal .....	26	29.5	27.5	31.5	24	28	22	26	25.5		24	25
" " 1st phalanx .....	29.5	32.5	31	36	27	33	27.5	30.5	27		28	28
" " 2nd phalanx .....	15	17.5	16	19.5	14	17.5	14	16.5	15		14.5	14.5
5th digit, metacarpal .....	16.5	19	18	20	15.5	19	14.5	16.5	15.5		16.5	16.5
" " 1st phalanx .....	30	32.5	31	35.5	27	33.5	26.5	30.5	27		28	28
" " 2nd phalanx .....	13.5	16	13.5	17	11.5	15	12	13.5	13		12.5	12.5
Ear, length from orifice .....	14.5	17	16	17.5	13.5	17.5	12.5	14.5	14.5		15	15
" " greatest breadth, flattened ...	13.5	15	13.5	15	13	14	12.5	13.5	13.5		11	12.5
Tail .....	10	11	9.5	11	9.5	11	9	9.5	9.5		8	8.5
" " greatest breadth, flattened ...	0	2.5	0	2	0	1	0	2.5	2.5		1.5	0
Tibia .....	15.5	17.5	16	18.5	15.5	17	15	16	14.5		14	15
Foot, c. u. ....	11.5	13	12.5	13.5	11.5	13	11	12	10		11	12
Calcaneus .....	2.5	3	2.5	3	2.5	3	2	3	2		3	3

## Macroglossus: Measurements of skulls and tooth-rows.

	<i>M. m. minimus.</i> 18 ad. Java; Madura; Kangean.		<i>M. m. sobrinus.</i> 14 ad. Malay Pen.; Java.		<i>M. l. lagochilus.</i> 14 ad. Borneo; Cagayan Sulu; Philippines; Buru; Ceram.		<i>M. l. natus.</i> 10 ad. Mysol; Andai; Bismark Arch.; Aru Is.		<i>M. l. pygmaeus.</i> ♂ ad. Type.		<i>M. l. microtus.</i> 2 ad. Guadalcanar.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.			♀ ad. Type.	♂ ad. Paratype.
Skull, total length .....	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
" condylo-basal length .....	24.8	27.5	28.5	29.5	24.8	27.2	24	26	...	23.8	24.6	24.6
" palation to incisive foramina .....	23.2	25.9	25.8	28	23.2	26	22.5	24.5	...	22	23	23
" palation to basion .....	10.8	12.5	12.5	13.8	10.8	12.5	10.8	11.9	...	10.6	10.9	10.9
" rostrum, length orbit to nares .....	9	10	10	11.5	8.8	10.8	8.5	9.2	...	8.8	9.4	9.4
" brain-case, width at zygomatica .....	7.8	8.8	9.5	10.5	7.8	9.2	7.5	8.5	6.8	7	7.5	7.5
" zygomatic width .....	10.5	11.2	10.8	11.5	9.8	11	10.1	10.6	...	10.5	10.7	10.7
" across crowns of m <sup>2</sup> , externally .....	13.6	15.8	14.8	15.8	12.8	15.8	12.8	15	...	13.2	15.8	15.8
" lachrymal breadth .....	6	6.6	6.2	7	5.5	6.5	5.8	6	...	5.8	6.1	6.1
" across crowns of canines, externally .....	6.5	7.3	7.2	7.8	6.5	7.3	6.5	6.8	6.5	6.2	6.5	6.5
" postorbital breadth .....	5	5.5	5	5.8	4.5	5.3	4.6	5.2	5	4.7	5.2	5.2
" interorbital breadth .....	6.8	7.8	7	8	6.8	7.7	6.7	7.5	7.5	7	7.5	7.5
" mesopterygoid fossa, width .....	4.5	5.2	4.6	5.7	4.6	5.1	4.3	5.2	5.2	4.3	4.8	4.8
" between p <sup>1</sup> -p <sup>4</sup> .....	3.3	4	3.8	4.2	3.1	4	3	4.2	...	3.5	3.2	3.2
" between bases of canines .....	4	4.6	4.5	5	4	4.6	4	4.5	4.5	4	4.2	4.2
" orbital diameter .....	3	3.5	3.2	3.8	2.8	3.2	2.8	3.3	3.1	3	3.1	3.1
" .....	5.8	6.6	6.1	6.7	5.6	6.2	5.8	6	6.1	6	6.2	6.2
Mandible, length from condyle .....	18	20.8	21.2	22.7	18.2	20.7	17.8	19	17.4	17	17.8	17.8
" symphysis, length .....	3.8	4.5	4.2	5	3.5	4.2	3.2	4.2	3.8	3.6	3.8	3.8
" coronoid height .....	6	7.5	6.8	7.4	5.2	6.8	5.2	6.5	6.2	5.5	6.7	6.7
Upper teeth, c-m <sup>2</sup> , crowns .....	8.2	9	9.2	10	8	9.2	7.8	8.9	7.8	8	8.5	8.5
Lower teeth, c-m <sup>3</sup> , crowns .....	9	10.2	10	11.2	8.8	10.5	9	9.7	8.4	8.6	9.5	9.5

## MacroGLOSSUS: Measurements of teeth.

	<i>M. m. minimus</i> , 25 ad. & juv. Java; Madura; Kangean.		<i>M. m. sobrius</i> , 14 ad. Malay Pen- Java.		<i>M. l. lagochilus</i> , 16 ad. & juv. Borneo; Cagayan Sulu; Philippines; Minahassa; Buru; Ceram.		<i>M. l. nanus</i> , 8 ad. Mysol; Andai; Bismarek Arch.; Aru Is.		<i>M. l. pygmaeus</i> , Type and Paratype, Murray Is.		<i>M. l. microtus</i> , 3 ad. & juv. Guadaleanar; Florida.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
p <sup>1</sup> , length	0.7	1	0.8	1	0.7	1	0.8	1	0.7	0.8	0.9	0.9
" width	0.5	0.6	0.5	0.6	0.5	0.6	0.3	0.5	0.4	0.4	0.4	0.5
p <sup>2</sup> , length	1	1.2	1	1.3	0.9	1.2	0.9	1	0.9	1	1	1.1
" width	0.5	0.6	0.5	0.6	0.5	0.6	0.3	0.4	0.3	0.4	0.4	0.5
p <sup>1</sup> , length	1	1.3	1.1	1.4	0.9	1.2	0.9	1	0.9	1	1	1.1
" width	0.5	0.7	0.6	0.7	0.5	0.7	0.4	0.4	0.4	0.5	0.5	0.5
m <sup>1</sup> , length	1	1.3	1.1	1.5	1	1.3	1	1.2	1	1.1	1.2	1.2
" width	0.6	0.7	0.6	0.7	0.6	0.7	0.5	0.5	0.5	0.5	0.6	0.6
m <sup>2</sup> , length	0.7	1.2	1	1.5	0.8	1.3	0.9	1.2	0.7	1	1	1
" width	0.5	0.6	0.5	0.6	0.5	0.6	0.4	0.5	0.4	0.5	0.5	0.5
p <sup>1</sup> , length	0.9	1	0.8	1.1	0.8	1.1	0.8	1	0.8	0.9	1	1
" width	0.5	0.6	0.5	0.6	0.5	0.6	0.4	0.5	0.4	0.4	0.4	0.5
p <sup>2</sup> , length	1.2	1.2	1	1.3	0.9	1.2	0.8	1	0.9	1	1	1.2
" width	0.5	0.6	0.5	0.6	0.5	0.6	0.4	0.5	0.4	0.5	0.4	0.5
p <sup>1</sup> , length	1.2	1.2	1	1.4	0.9	1.2	0.8	1.1	1	1	1	1.1
" width	0.5	0.6	0.5	0.6	0.5	0.6	0.4	0.5	0.4	0.5	0.4	0.5
m <sup>1</sup> , length	1	1.2	1.1	1.3	1	1.3	1	1.2	1	1.2	1.1	1.2
" width	0.5	0.7	0.6	0.7	0.5	0.7	0.5	0.6	0.5	0.5	0.5	0.6
m <sup>2</sup> , length	0.9	1.2	1	1.2	1	1.2	0.8	1.2	1	1	1	1.2
" width	0.5	0.6	0.6	0.7	0.5	0.7	0.5	0.6	0.5	0.5	0.5	0.6
m <sup>3</sup> , length	1.2	1.2	1	1.4	0.7	1.2	0.5	1	0.8	0.9	0.6	1.1
" width	0.5	0.6	0.5	0.6	0.5	0.6	0.4	0.6	0.4	...	0.5	0.5

31. SYCONYCTERIS, *Matschie*.*Macroglossus* (pt.), Dobson, Cat. Chir. B. M. p. 95.

Type.

1899. Syconycteris (subgenus of *Macroglossus*), *Matschie*,  
*Megachir*. pp. 94, 98..... S. australis.*Macroglossus* (pt.), *Peters*, *MB. Ak. Berlin*, 1867, p. 13, footnote  
(*Syconycteris australis*); *id.*, t. c. p. 870 (= *Macroglossus* + *Syconycteris*); *Dobson*, Cat. Chir. B. M. p. 95 (1878: as *Peters*);  
*Trouessart*, Cat. Mamm. i. p. 90 (1897: as *Dobson*).*Carponycteris* (pt.), *Thomas*, Nov. Zool. ii. p. 163 (1895: *Syconycteris crassa*).*Kiodotus* (pt.), *Trouessart*, Cat. Mamm. ii. p. 1278 (1899: *Macroglossus* + *Syconycteris*).*Syconycteris*, *Matschie*, l. c. (1899); *Jentink*, Notes Leyd. Mus. xxiii. p. 131 (1902: generically distinct from *Macroglossus*; revision); *Trouessart*, Cat. Mamm., Suppl. p. 65 (1904: subgenus of *Carponycteris*); *Miller*, Fam. & Gen. Bats, p. 72 (1907: genus; characters); *K. Andersen*, Ann. & Mag. N. H. (8) vii. p. 642 (1911: revision of genus).

*Diagnosis*.—Similar to *Macroglossus*, but upper incisors much larger, outer lower incisor once and a half to twice the size of inner,  $m^2$  and  $m_3$  small (two species) or absent (one species); interfemoral reduced to a narrow rim along tibia, calcar rudimentary. Forearm 39–49 mm. [Three species, seven recognizable forms. *Hab.* Austro-Malaya, south to Queensland.]

The remarkable contrast in size between  $i_2$  and  $i_1$  is by itself sufficient to distinguish *Syconycteris* from all other Macroglossine genera. From *Macroglossus*, to which it bears great resemblance externally and with which it occurs together over the whole of its distributional area except Queensland, it is easily discriminated by any of the characters given in the diagnosis (in dried skins the characters of the interfemoral and calcar are often obscured by shrinkage) as well as by having the lower incisors placed in a continuous row (in *Macroglossus* a wide diastema between  $i_1$ — $i_1$ ). *Syconycteris* is the only Macroglossine genus known to extend to Australia.

*Skull* (fig. 73).—Essentially as in the eastern races of *Macroglossus lagochilus*, but with rather heavier rostrum and shorter infraorbital canal. Deflection of basiscranial axis as in *Macroglossus* or slightly less, alveolar line if projected backward passing through brain-case near upper extremity of interparietal. Rostrum from orbit to nares somewhat less than one-third of total length of skull, slightly broader and deeper than in *M. lagochilus* (much more so than in *M. minimus sobrinus*, fig. 70, p. 748); front of orbit above  $m^2$ . Premaxillæ proclivous to the same degree as in *Macroglossus* and, as in that genus, solidly united anteriorly. Infraorbital canal short (as in *Eonycteris* and *Megaloglossus*), infraorbital foramen vertically below front of orbit. Postorbital foramina present. Foramen ovale and rotundum confluent or separated by only a very thin bridge. Tympanics unmodified. Temporal ridges as a

rule separated, but sometimes (at least in some males of the larger forms; see fig. 73) united into a low sagittal crest; mandible as in *Macroglossus*, but symphysis (though of the same relative length) a little less horizontal, more obliquely ascending, and with scarcely any trace of a longitudinal keel along its anterior inferior surface.

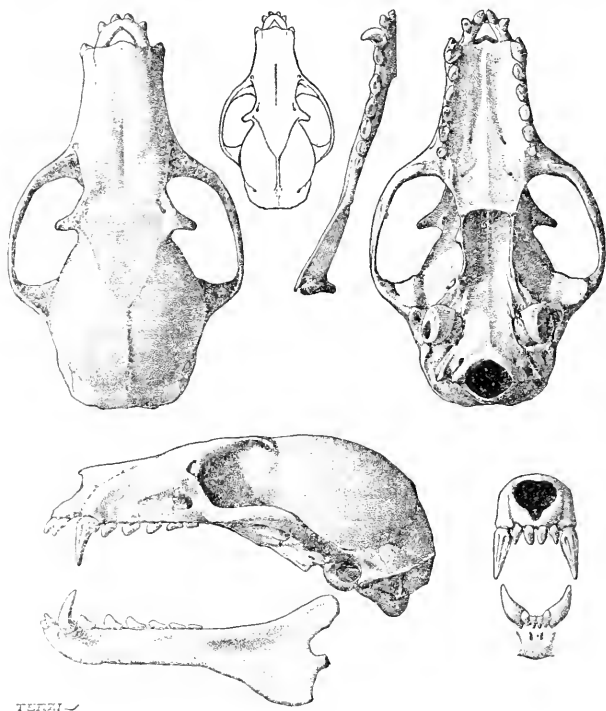


Fig. 73.—*Syconycteris crassa major*, ♂, type of subspecies.  
 $\frac{2}{3}$  (linear), outline of dorsal aspect of skull  $\frac{1}{4}$ .

*Dentition* (fig. 73).—Dental formula in two species (*S. crassa* and *australis*) as in *Macroglossus*, in the third (*S. naias*) differing only by the suppression of the small posterior molar above and below:

$$\frac{i^1 i^2 c p^1 p^3 p^4 m^1 (m^2)}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2 (m_3)} \times 2 = 34 \text{ or } 30.$$

Upper incisors proclivous, remarkably large (for the subfamily), narrowly spaced, almost equidistant, subequal in size, crown well differentiated, narrowly chisel-shaped;  $i^1$ - $i^1$  parallel or (in many individuals) more or less conspicuously converging inferiorly.



Lower incisors proclivous, quite or very nearly in contact;  $i_1$  small (though relatively considerably larger than in *Macroglossus*), cutting-edge faintly but distinctly bifid;  $i_2$  from once and a half to twice as high and broad as  $i_1$ , crown obliquely triangular, its antero-posterior subequal to its transverse diameter. Upper canines with a deep and strongly defined vertical groove along anterior surface of crown, outer surface as a rule marked with two shallow vertical grooves separated by a low keel (the anterior of these grooves generally, perhaps always, distinct, the posterior not infrequently obsolescent; similar grooves as a rule traceable in *Macroglossus*). Lower canines slanted outward and, to a less degree, backward. Cheek-teeth not quite but nearly so low as in *Macroglossus*, and in the majority of forms (all races of *S. crassa*) elongate in transverse section, *i. e.* more than half as broad as long (thus conspicuously different in general aspect from the linear teeth of *Macroglossus*), in the extreme eastern and south-eastern forms (*S. australis*, *naias*), however, sublinear, *i. e.* only half as broad as long (very closely approaching those of *Macroglossus* in outline of transverse section). Upper cheek-teeth gradually decreasing in height from  $p^1$  to  $m^2$ ;  $p^1$  unusually large, only slightly smaller in bulk than  $p^3$ ;  $p^3$ ,  $p^4$ , and  $m^1$  subequal in transverse area;  $m^2$  in *S. crassa* and *australis* small, varying from two-thirds to one-half the bulk of  $m^1$ , in *S. naias* absent.  $p_1$  large, nearly as high as, and not much smaller in bulk than,  $p_3$ ; height of teeth gradually decreasing from  $p_3$  to  $m_3$ ;  $p_3$ ,  $p_4$ , and  $m_1$  subequal in transverse section,  $m_2$  smaller than  $m_1$ ,  $m_3$  in *S. crassa* and *australis* varying from three-fourths to one-half of  $m_2$ , in *S. naias* absent.

*Palate-ridges* (fig. 74 B).—As in *Macroglossus* (fig. 74 A).

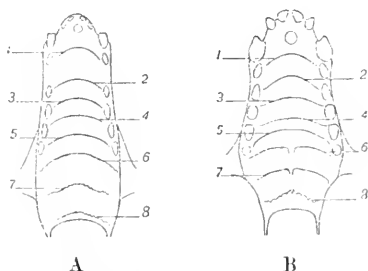


Fig. 74.—Palate-ridges. A. *Macroglossus minimus sobrinus* (79.11.15.6); B. *Syconycteris crassa major* (type of subspecies). ♂ (linear).

*External characters*.—Interfemoral reduced to a sublinear rim along tibia (much narrower than, in *Macroglossus* at least as broad as, tibia); calcar rudimentary (0.5–1.5 mm.). Other external characters, as well as general appearance of animals, quite or very nearly as in *Macroglossus*:—Internarial groove always continued downward to margin of upper lip; external tail obsolete or detectable

by touch as a small knob; membranes inserted on fourth or fifth toe (end of metatarsal or base of first phalanx), or between fourth and fifth toe, rarely between third and fourth (these variations are individual, *cf.* p. 776); vertical fasciæ of mesopatagium varying individually between 7 and 11; wing-indices (upper row in table below, based on thirty adult individuals representing all forms known; in lower row those of *Macroglossus* for comparison) almost unmodified, third, fourth, and fifth metacarpals subequal, but with a faint tendency of the fourth to be the shortest; upper half of forearm and nearly the whole of tibia densely clothed above; colour of fur as in *Macroglossus*; no external secondary sexual characters (males without neck-tufts, as in *Macroglossus*).

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c.u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	409	526	89	129	755	554	643	741	411	407	755	332	371
1000	387	520	103	129	726	530	637	733	387	415	740	334	370

*Range*.—Amboina group, New Guinea and neighbouring islands, south to Queensland, *i. e.* the Austro-Malayan subregion with (so far as known at present) the exception of the extreme west (Celebes), north-west (Gilolo group), and east (Solomon Islands), and extending across its southern boundary into the north-east corner of Australia. The known range of the species and sub-species is shown in the table below.

	Cheek-teeth elongate, $m^2$ and $m_3$ present.	Cheek-teeth linear, $m^2$ and $m_3$	
		present.	absent.
Amboina group .....	<i>c. major</i>		
New Guinea .....	<i>c. papuana</i>		
Aru Islands .....	<i>c. papuana</i>		
Key Islands .....	<i>c. keyensis</i>		
Bismarck Archipelago.....	<i>c. finschi</i>		
Trobriand Islands .....	<i>c. crassa</i>		
D'Entrecasteaux Islands...	<i>c. crassa</i>		
Queensland .....	.....	<i>australis</i>	
Woodlark Island.....	.....	.....	<i>naias</i>

*Habits*.—Unknown.

*Affinities*.—The almost complete resemblance of *Syconycteris* to *Macroglossus* in the skull, palate-ridges, and all external characters except the narrow interfemoral and (consequently) rudimentary calcar, is evidence of the close relationship between the two genera. The claim of *Syconycteris* to stand as a distinct genus rests entirely

on the peculiar differentiation of the incisors. As described above, the majority of the forms of the present genus have the cheek-teeth rather less reduced in breadth, more typically elongate in shape, than *Macroglossus*, while in others they are nearly or quite as narrow (linear) as in the related genus.

*History of genus and chronology of species.*—The two earliest known members of this genus, viz. *australis* (Peters, 1867), from Queensland, and *crassa* (Thomas, 1895), from Fergusson Island (D'Entrecasteaux group), were originally described as forms of *Macroglossus* (or *Carponycteris*), the former as a perhaps doubtfully distinguishable variety of *M. minimus*, without any reference to the peculiar incisors, the latter as a distinct species, with the characters of the incisors correctly described. By Matschie (1899) these two forms were placed in a distinct subgenus of *Macroglossus*, "*Syconycteris*," characterized, as compared with true *Macroglossus*, by its larger incisors, the absence of a diastema between the inner incisors above and below, and its narrower interfemoral; and two new forms, *papua* (type locality, Andai, N.W. New Guinea) and *finschi* (Bismarck Archipelago), were added. Jentink (1902) proposed to consider *Syconycteris* a distinct genus (a view accepted by Miller, 1907), and gave a revision of the material preserved in the Leyden and Dresden Museums. Three new forms, *major* (Amboina), *keyensis* (Key Islands), and *naias* (Woodlark Island), were described during the preparation of this Catalogue. All these forms, now seven in number, are here considered referable to three closely interrelated species, *S. crassa* (with five local races), *australis*, and *naias*.

### *Synopsis of the Species.*

- |  |                                  |
|--|----------------------------------|
| a. Cheek-teeth elongate in transverse section ( $p^1$ , $m^1$ , $p_1$ , and $m_1$ decidedly more than half as broad as long); $m^2$ and $m_3$ present (cheek-teeth $\frac{5}{8}$ ). Forearm 39–49 mm. (Amboina group; New Guinea group, except Woodlark Is.) | 1. <i>S. crassa</i> , p. 775.    |
| b. Cheek-teeth linear ( $p^1$ , $m^1$ , $p_1$ , and $m_1$ only half as broad as long).   |                                  |
| a'. $m^2$ and $m_3$ present (cheek-teeth $\frac{5}{8}$ ). Forearm about 39–40.5 mm. (Queensland) ..  | 2. <i>S. australis</i> , p. 781. |
| b'. $m^2$ and $m_3$ absent (cheek-teeth $\frac{1}{2}$ ). Size as foregoing. (Woodlark Is.)   | 3. <i>S. naias</i> , p. 785.     |

### 1. *Syconycteris crassa*, Thos.

(Synonyms under the subspecies.)

*Diagnosis.*—The broader, more elongate form of the premolars and molars (breadth of  $p^1$ ,  $m^1$ ,  $p_1$ , and  $m_1$  at least somewhat more than half, as a rule about two-thirds, their length) is the only character that distinguishes all races of this species from *S. australis*; in extreme cases the two species approach rather closely to each other (see *S. c. finschi*, p. 779), but any "overlapping" has so far

not been observed. A small  $m^2$  and  $m_3$  is always present. *Hab.* The whole area inhabited by the genus, except Queensland and Woodlark Is.

In twenty-four specimens examined (fifteen *papuana*, two *keyensis*, one *finshi*, four *crassa*, two *major*; including the types of all) the membranes are inserted on the hind limbs as tabulated below (added, *S. australis* and *naias* for comparison; an asterisk indicates that the specimen is a type, or the type included in the number); that the variation in this respect is individual rather than racial or specific is, it may be concluded from the table, scarcely open to doubt:—

	Membranes inserted:—			
	between 3rd and 4th toe (near end of metatarsals).	on 4th toe (end of metatarsal or base of first phalanx).	between 4th and 5th toe (near end of metatarsals).	on 5th toe (end of metatarsal or base of first phalanx).
<i>papuana</i> ...	2	7*	1	5
<i>keyensis</i> .....	...	...	2*	...
<i>finshi</i> .....	...	1*	...	...
<i>crassa</i> .....	...	1	3*	...
<i>major</i> .....	...	...	1*	1
<i>australis</i> ...	...	1*	...	...
<i>naias</i> .....	...	1*	...	...

*Colour*.—*S. c. major* ( $\sigma$  ad. skin, Ceram, 7.1.1.272): General colour of back cinnamon wood-brown, shading into a darker tinge of brown on shoulders, laterally along membranes, and on occiput and crown: individual hairs light wood-brown at base with short cinnamon or darker brown tips. Underparts wood-brown, rather thickly mixed with light greyish hairs on centre of throat, breast, and belly.

Neither the subspecies nor the sexes differ appreciably from each other in colour. In the whole series of *S. crassa* (irrespective of subspecies and sex) the general aspect of the colour as well as the extent of individual variation is very nearly the same as in *Macroglossus minimus* (pp. 755–756): Back varying from russet Prout's brown with a slight tinge of fawn (darkest extreme), through various paler tinges of brown, to dull wood-brown (lightest extreme); underparts always more or less conspicuously mixed with greyish on centre of breast and belly, as a rule also on centre of throat. The darker brown median longitudinal stripe from crown to nape of neck nearly always traceable in *Macroglossus* is in *Syconycteris* absent or represented only by an ill-defined darker tinge on occiput.

Skins of young specimens not seen.

*Subspecies*.—The five subspecies of *S. crassa* recognized in this Catalogue differ from each other only in general size or in the length of the tooth-rows. Specimens from the central region of the area covered by the species, viz. New Guinea with the Aru Islands (*papuana*), are of medium size; those from the Key Islands

(*keyensis*) are characterized by the rather smaller average length of the tooth-rows, those from the Bismarek Archipelago (*finschi*) by their slightly smaller average size; finally, east (Trobriand and D'Entrecasteaux Islands: *crassa*) and even more so west (Amboina group: *major*) of New Guinea the general size of the animals is noticeably increased, though not more so but that there is still no absolutely hard-and-fast line between *papua* and *crassa*, nor between *crassa* and *major*.

*Synopsis of the Subspecies of S. crassa.*

- a. Average size medium or small: Skull, total length 25-27.3, forearm 39-44 mm.
  - a'. Medium: Skull, total length 25.8-27.3, forearm 40-44 mm.
    - a<sup>2</sup>. Tooth-rows averaging slightly longer: c-m<sup>2</sup> (crowns) 7.6-8.8 mm. (New Guinea; Aru Is.) ..... 1 a. *S. c. papuana*, p. 777.
    - b<sup>2</sup>. Tooth-rows averaging slightly shorter: c-m<sup>2</sup> (crowns) about 7 mm. (Key Is.) ..... 1 b. *S. c. keyensis*, p. 779.
    - b'. Small: Skull, total length about 25, forearm 39 mm. (Bismarek Arch.) ..... 1 c. *S. c. finschi*, p. 779.
- b. Averaging larger: Skull, total length 27.6-29.8, forearm 43.5-47 mm.
  - c'. Rather smaller: Skull 27.6-28.8, forearm 43.5-47 mm. (Trobriand Is.; D'Entrecasteaux Is.) ..... 1 d. *S. c. crassa*, p. 780.
  - d'. Rather larger: Skull 28.8-29.8, forearm 46-49 mm. (Amboina group) ..... 1 e. *S. c. major*, p. 780.

1 a. **Syconycteris crassa papuana**, Matschie.

Macroglossus minimus (pt., nec E. Geoff.), Peters & Doria, *Ann. Mus. Civ. Genova*, xvi. p. 691 (1881: Andai; Sorong; Aru Is.); Jentink, *Cat. Syst. Mamm.* p. 158 (1888: Aru Is.).

Carponycteris minima (pt.), Heller, *Abh. Mus. Dresden*, vi. n. 8, p. 4 (1897).

Carponycteris crassa (pt.), Thomas, *Ann. Mus. Civ. Genova*, (2) xviii. p. 608 (1897: Ighibirei: no specimens examined).

Macroglossus [Syconycteris] papuanus, Matschie, *Megachir.* p. 99 (1899: Andai; Sorong; Aru Is.).

Syconycteris papuana, Matschie, Krieger's 'Neu-Guinea,' p. 78 (1899); Jentink, *Notes Leyd. Mus.* xxiii. pp. 137, 138 (pt.) (1902: Aru Is.; Andai); Willink, *Nat. Tijds. Ned. Ind.* lxx. p. 278 (pt.) (1905); Jentink, *Notes Leyd. Mus.* xxviii. p. 172 (1907).

Carponycteris [Syconycteris] papuana, Trouessart, *Cat. Mamm., Suppl.* p. 65, n. 562 (pt.) (1904).

Syconycteris crassa papuana, K. Andersen, *Ann. & Mag. N. H.* (8) vii. p. 643 (1911: revision).

*Diagnosis.*—See Synopsis, above.

The table p. 778 illustrates the differences in size of the local forms of *S. crassa* (for more detailed measurements see pp. 782-784).

	<i>papua.</i> 12 skulls, 16 specim.	<i>keyensis.</i> Type.	<i>finshi.</i> Type.	<i>crassa.</i> 3 skulls, 3 specim.	<i>major.</i> 3 skulls, 4 specim.
Skull, total length .....	25.7-27.3	25.8	25	27.6-28.8	28.8-29.8 mm.
Mandible, from condyle.	18.2-20	18.7	17.7	20 -21.5	21 -22.2 "
c-m <sup>2</sup> , crowns .....	7.6- 8.8	7.1	7.2	8.7- 8.8	8.8- 9.7 "
Forearm .....	40 -44	42.5	39	43.5-47	46 -49 "
Third metacarpal.....	30 -35	32	30.5	32.5-33.5	33 -38 "

*Specimens examined.* Seventeen, viz., in addition to those catalogued below, four in the Berlin Museum (type of subspecies; two from Sorong, N.W. New Guinea, D'Albertis coll.; one from Aru Is., v. Rosenberg coll.) and two in the Leyden Museum (Aru Is., v. Rosenberg).

*Range.* Dutch New Guinea (Sorong; Andai; Moari Mt.); British New Guinea (for localities see list of specimens in collection, below); Aru Is.—Subjoined some comparative measurements of specimens from New Guinea and the Aru Islands (any difference in the palatridges between specimens from these two localities has not been found; cf. Matschie, Megachir. p. 100):—

	Dutch and British New Guinea.	Aru Is.
	7 skulls, 8 specim.	5 skulls, 8 specim.
Skull, total length.....	25.8-27.3	25.7-27.3 mm.
Mandible, from condyle ...	18.2-20	19 -20 "
c-m <sup>2</sup> , crowns .....	7.6- 8.8	7.8- 8.8 "
Forearm .....	40 -43	40 -44 "
Third metacarpal .....	30 -33.5	30.5-35 "
Ear, from orifice .....	13 -14	13 -14.5 "
Tibia .....	15.5-17	15.5-17 "

*Type*, in the Berlin Museum, ♂ ad. al., skull extracted, Andai, N.W. New Guinea, collected by D'Albertis, Reg. no. 4699. Skull, total length 26.5, mandible from condyle 19, c-m<sup>2</sup> (crowns) 8.5; p<sup>1</sup>, length 1.2, breadth 0.9; forearm 43, third metacarpal 33; ear, length from orifice 13, greatest breadth (flattened) 9.5; tibia 17 mm.

a. ♂ ad. sk.; skull.	Moari Mt., Geelwink Bay, 3000'.	S. M. Dumas [C.].	98.11.3.22.
b. ♀ ad. al.; skull.	Albert Edward Mt., B. N. G.	H. S. Rohu [C.].	1.11.24.10.
c. ♂ subad. al.; skull.	Dinawa, Owen Stanley Range, B.N.G.	A. E. Pratt [C.].	3.3.5.1.
d. ♂ subad. sk.; skull.	Kokoda, Yodda R., B.N.G.; 19 Sept. 1906.	C. A. Monckton, Esq. [C. & P.].	7.5.22.1.
e, f. 2 ad.sks.; skulls.	Upper Aroa R., B.N.G. ( <i>A. S. Meek</i> ).	Hon. W. Rothschild [P.].	8.11.16.9, 10.
g-k. 2 ♂ ad., 1 ♂ subad., 1 ♀ ad., 1 ♀ subad. al.; skulls.	Aru Is. ( <i>W. Stalker</i> ).	New Guinea Expedition [P.].	10.3.2.39-43.

1 b. *Syconycteris crassa keyensis*, K. *And.*

*Syconycteris crassa keyensis*, K. *Andersen*, *Ann. & Mag. N. II.* (8) vii. p. 643 (1 June, 1911: Key Is.).

*Diagnosis*.—Similar in every respect to *S. c. papuana*, except for the slightly shorter tooth-rows (c-m<sup>2</sup>, crowns, in type 7.1 mm., as against 7.6–8.8 in *papuana*).

*Measurements*. On pp. 782–784.

*Specimens examined*. Those catalogued below.

*Range*. Key Islands.

*Type* in collection.

a, b. ♂ ad., ♀ imm. al.;      Key Is.      Purchased (Rolle). 99.12.4.2-3.  
skulls.      (99.12.4.2, ♂ ad., *Type* of subspecies.)

1 c. *Syconycteris crassa finschi*, *Matschie*.

*Macroglossus* [*Syconycteris*] *finschi*, *Matschie*, *Megachir.* p. 100 (1899: Bismarck Arch.).

*Carponycteris* [*Syconycteris*] *finschi*, *Trouessart*, *Cat. Mamm., Suppl.* p. 66, n. 563 (1904).

*Syconycteris crassa finschi*, K. *Andersen*, *Ann. & Mag. N. II.* (8) vii. p. 643 (1911: revision).

*Diagnosis*.—Similar to *S. c. papuana*, but averaging slightly smaller; see table p. 778 and detailed measurements pp. 782–784.

*Specimen examined*. The type (so far the only specimen on record).

*Range*. Bismarck Archipelago.

*Type*, in the Berlin Museum, ♂ ad. al., skull extracted, New Britain, collected by Dr. O. Finsch, Reg. no. 6070. Originally separated as a distinct species from *papuana* for the following reasons (apart from its slightly smaller size): Cheek-teeth “auffallend klein, schwach und schmal”; rhinarium broader; two posterior palate-ridges “geradlinig und von den übrigen nicht weiter entfernt als von einander.” From a single specimen it is impossible to decide whether the cheek-teeth are relatively a trifle smaller or narrower than in the foregoing forms of the species; the fact that they are matched by those of the smallest-toothed examples of *papuana* renders it certain that the difference, if any, can only be one of average, and the teeth are in any case not quite so narrow as in *S. australis*; if, however, the teeth of *finschi* should prove to average rather narrower than in *papuana*, this form would be intermediate between *S. c. papuana* and *S. australis*, and in that case it would probably be necessary to put also *S. australis* down as a subspecies of *S. crassa*. Whether the rhinarium of *finschi* is really broader than in *papuana* is doubtful: the muzzle of the former, when examined by the writer in Berlin, was filled out with cotton-wool and unnaturally broad. As to the palate-ridges, the only tangible variation from the general rule is that the sixth ridge runs more straightly transverse than usual, but the same variation has been found by the writer in the series examined of *S. c.*

*papuana* (see also Jentink, Notes Leyd. Mus. xxiii. p. 137; 1902). There remains (always judging from the single specimen available) nothing to distinguish *finsehi* from *papuana* but its slightly smaller size, a difference which no doubt is only one of average.

### 1 d. *Syconycteris crassa crassa*, Thos.

*Carponycteris crassa*, *Thomas, Nov. Zool.* ii. p. 163 (June, 1895: Fergusson I.); *id.*, *Nov. Zool.* iii. p. 526 (pt.) (1896: Kiriwina); *id.*, *Ann. Mus. Civ. Genova*, (2) xviii. p. 608 (pt.) (1897: Fergusson I.; Kiriwina); *Heller, Abh. Mus. Dresden*, vi. n. 8, p. 4 (1897).

*Macroglossus crassus*, *Trouessart, Cat. Mamm.* i. p. 90, n. 487 b (1897).

*Macroglossus* [*Syconycteris*] *crassus* (pt.), *Matschie, Megachir.* p. 100 (1899).

*Carponycteris* [*Syconycteris*] *crassa* (pt.), *Trouessart, Cat. Mamm., Suppl.* p. 66, n. 564 (1904).

*Syconycteris crassa* (pt.), *Jentink, Notes Leyd. Mus.* xxviii. p. 172 (1907); *Miller, Fam. & Gen. Bats*, p. 72 (1907).

*Syconycteris crassa crassa*, *K. Andersen, Ann. & Mag. N. H.* (8) vii. p. 643 (1911: revision).

*Diagnosis.*—As *S. c. papuana*, but averaging in every respect larger (see table p. 778 and measurements pp. 782–784). The smallest specimens examined are similar in size to the largest of *papuana*.

*Specimens examined.* Those in collection.

*Range.* Trobriand Islands (Kiriwina); D'Entrecasteaux Islands (Fergusson I.). [The Woodlark Islands are inhabited by a distinct species, *S. naias*.]

*Type* in collection. Skull, total length 28·8, mandible from condyle 21·5, c-m<sup>2</sup> (crowns) 8·7; p<sup>4</sup>, length 1·2, breadth 0·8; forearm 45·5, third metacarpal 33·5; ear, length from orifice 13·5, greatest breadth (flattened) 10·5; tibia 16·5 mm.

a. ♂ ad. al.; skull.	Trobriand Is.	A. S. Meek [C.].	95.11.7.1.
b, c. ♂ pull., ♀ ad. al.; skull of the ad.	Kiriwina I.	A. S. Meek [C.].	96.11.5.9, 10.
d. ♂ ad. al.; skull.	Fergusson I.	A. S. Meek [C.].	95.5.8.2.

(*Type* of subspecies.)

### 1 e. *Syconycteris crassa major*, K. And.

? *Macroglossus minimus* (pt., *nec E. Geoff.*), *Jentink, Cat. Syst. Mamm.* p. 158 (1888: Amboina).

*Syconycteris papuana* (pt., *nec Matschie*), *Jentink, Notes Leyd. Mus.* xxiii. p. 136 (1902: Amboina); *id.*, *op. c.* xxviii. p. 172 (1906).

*Carponycteris* [*Syconycteris*] *papuana* (pt.), *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 562 (1904).

*Syconycteris crassa major*, *K. Andersen, Ann. & Mag. N. H.* (8) vii. p. 643 (1 June, 1911: Amboina; Ceram).

*Diagnosis.*—As *S. c. crassa*, but averaging larger (see table p. 778 and measurements pp. 782–784). This is the largest form of the genus, but in other respects it does not differ appreciably from



the foregoing forms. In point of size there may be an absolute, though in any case small, difference between *major* and its nearest geographical neighbour, *papuana* (New Guinea); but *crassa* (Trobriand and D'Entrecasteaux Islands) is intermediate.

*Specimens examined.* Five, viz. those catalogued below and three specimens from Amboina in the Leyden Museum (*k, l, m*).

*Range.* Probably generally distributed over the Amboina group of islands; so far recorded from Amboina and Ceram.

*Type* in collection. Skull, total length 29·8, mandible from condyle 22·2, c-m<sup>2</sup> (crowns) 9·3; p<sup>1</sup>, length 1·3, breadth 0·9; forearm 49, third metacarpal 38; ear, length from orifice 15, greatest breadth (flattened) 10·5; tibia 19 mm.

- a. ♂ ad. al.; skull. Amboina. F. Muir, Esq. [P.]. 10.7.25.1.  
(Type of subspecies.)  
b. ♂ ad. sk.; skull. Ceram; 1859 (*Dr. A. Toines Coll.* 7.1.1.272.  
*R. Wallace*). ;

## 2. *Syconycteris australis*, *Pet.*

*Macroglossus minimus* (pt.), Dobson, *Cat. Chir. B. M.* p. 96.

*Macroglossus minimus* var. *australis*, *Peters, MB. Ak. Berlin*, 1867 (10 Jan.), p. 13 (Rockhampton).

*Macroglossus australis*, *Peters, MB. Ak. Berlin*, 1867 (19 Dec.), p. 871 ("W. Australia," evidently error for N. Australia); *Ogilby, Cat. Austr. Mamm.* p. 81 (pt.) (1892: "N. and W. Australia," localities copied from Dobson, see below); *Trouessart, Cat. Mamm. i.* p. 90, n. 487 (pt.) (1897).

*Macroglossus* [*Syconycteris*] *australis*, *Matschie, Megachir.* p. 99, pl. xiv. (type: animal, skull, palate-ridges) (1899).

*Carponycteris* [*Syconycteris*] *australis*, *Trouessart, Cat. Mamm., Suppl.* p. 65, n. 561 (1904).

*Syconycteris australis*, *K. Andersen, Ann. & Mag. N. II.* (8) vii. pp. 642, 643 (1911: revision).

*Macroglossus minimus* (pt., nec *E. Geoff.*), *Dobson, Cat. Chir. B. M.* p. 96 (1878: "N. and W. Australia," localities evidently copied from Peters, l. c. 1867); *Collett, Zool. Jahrb. ii.* p. 845 (1887: Mackay); *Noack, Zool. Jahrb., Syst. iv.* p. 212 (1889).

*Diagnosis.*—Similar to *S. crassa papuana*, but cheek-teeth narrower, more linear (as in *Macroglossus*), a character particularly conspicuous in p<sup>1</sup>, m<sup>1</sup>, p<sub>2</sub>, and m<sub>2</sub>, which are only about half as broad as long. Forearm 39 (?)–40·5 mm.

*Measurements.* On pp. 782–784.

*Specimens examined.* Two, the type (skull not seen), and skin with skull of an adult specimen from Mackay, Queensland, in the Christiania Museum (see Collett, l. c.),—apparently the only specimens on record.

*Range.* Queensland (Mackay and Rockhampton).

*Type*, in the Berlin Museum, ♂ subad. al. (nearly, if not quite, full-grown, but with unconsolidated finger joints), skull extracted (*fig. cit.*), Rockhampton, acquired from the Godeffroy Museum; external measurements on p. 782.

Syconycteris: *External measurements.*

	<i>S. c. papuana.</i> 16 ad. New Guinea; Aru Is.		<i>S. c. keyensis.</i> ♂ ad. Type.		<i>S. c. fuschii.</i> ♂ ad. Type.		<i>S. c. crassa.</i> 3 ad. Kiriwina; Pergusson I.		<i>S. c. major.</i> 4 ad. Amboina; Ceram.		<i>S. australis.</i> ♂ subad. Ad. Type. Mackay.		<i>S. naia.</i> ♀ ad. Type.	
	Min.	Max.	mm.	mm.	mm.	mm.	Min.	Max.	Min.	Max.	mm.	mm.	mm.	mm.
Forearm .....	40	44	42.5	47	39	43.5	43.5	47	46	49	39	40.5	41	41
Pollex, total length, c. u. ....	15	18	17	18.5	16.5	18	18	18.5	19	20	16	...	16	16
" metacarpal .....	4	5	4	5	4.5	4.5	4.5	5	5	5	4	...	4.5	4.5
" 1st phalanx .....	8	10	9	10	8.5	9	9	10	9.5	10	9	...	8.5	8.5
2nd digit, metacarpal .....	21	24.5	22.5	24	21	23	23	24	25	25.5	20	20	20.5	20.5
" 1st phalanx .....	3	3.5	3	3.5	3	3	3	3.5	4	4.5	4	4	3.5	3.5
" 2nd-3rd phalanx, c. u. ....	5	6	6	6	4.5	5.5	5.5	6	6	6	5.5	5.5	5.5	5.5
3rd digit, metacarpal .....	30	35	32	33.5	30.5	32.5	32.5	33.5	33	38	29.5	30	31.5	31.5
" 1st phalanx .....	22	25	24	24.5	22.5	24	24.5	25	25.5	27	22	22	23	23
" 2nd phalanx .....	25	28.5	27	29.5	25.5	27.5	29.5	30.5	28.5	31	25.5	25.5	28	28
4th digit, metacarpal .....	29.5	34	30.5	32.5	30.5	32.5	34	34	32	37.5	29	29.5	31	31
" 1st phalanx .....	16	18.5	17	18.5	16.5	17.5	18.5	18.5	18	20	16.5	17	17	17
" 2nd phalanx .....	15.5	18	16.5	18	16	17	18	19.5	18	19.5	16.5	17	18	18
5th digit, metacarpal .....	30	34	31	33	30.5	33	35	35	33	37.5	30.5	31	31	31
" 1st phalanx .....	13	15.5	14	15	13	14	15	16.5	14.5	16	13.5	14.5	14.5	14.5
" 2nd phalanx .....	14.5	17	15	16.5	13.5	16.5	17	17	16	18	14	...	16	16
Ear, length from orifice .....	13	14.5	12.5	13.5	13	13.5	14	15	15	15	13	...	14.5	14.5
" greatest breadth, flattened .....	9.5	10.5	9.5	10.5	9.5	10.5	10.5	10.5	10.5	10.5	10.5	...	10	10
Tail .....	0	+	+	+	0	0	+	+	+	+	0	...	0	0
Tibia .....	15.5	17	15.5	16	15.5	16	17	18	18	19	16	...	15.5	15.5
Foot, c. u. ....	11	13.5	11.5	12.5	11.5	12.5	13	13	...	15	12	...	11.5	11.5
Culcar .....	0.1	1	0.5	0.5	0.5	0.5	0.5	0.5	...	0.5	0	...	0.5	0.5

\* Perceptible by touch, as a small knob.

## Syconycteris: Measurements of skulls and tooth-rows.

	<i>S. c. papuana</i> , 12 ad. New Guinea; Aru Is.		<i>S. c. leycoussis</i> , ♂ ad. Type.		<i>S. c. fuscata</i> , 2 ad. Kiriwina; Fergusson I.		<i>S. c. major</i> , 3 ad. Amboina; Ceram.		<i>S. australis</i> , Ad. Mackay.		<i>S. naia</i> s, ♀ ad. Type.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Skull, total length .....	25.7	27.3	mm.	25.8	mm.	27.6	28.8	mm.	25.5	mm.	26.5	26.5
" condylo-basal length .....	23.5	25.8	24	25.8	25.8	26.7	28.2	28.2	24	24.8	24.8	24.8
" palation to incisive foramina .....	10	11	10.7	10.7	10.8	11.5	11	12.5	10.2	10.5	11.1	11.1
" palation to basion .....	7.2	8.4	7.8	7.8	8	8.5	8.7	9.7	7.8	7.7	7.7	7.7
" rostrum, length orbit to nares .....	10.2	11.8	10.2	10.2	11.2	11.7	11.5	11.7	11	10.5	10.5	10.5
" brain-case, width at zygomatica .....	14.5	16.8	15.2	15.2	16.2	17	17.3	18.2	14.8	14.8	14.8	14.8
" zygomatic width .....	6	7	5.8	5.8	6.7	7.2	7.2	7.5	6.2	6.2	6.2	6.2
" across crowns of m <sup>2</sup> *, externally .....	6.5	7.7	7	7	7.8	8.2	7.8	8.2	7	7	5.1	5.1
" lacrymal breadth .....	5.2	5.9	5.2	5.2	5.8	6	6	6.5	5	5	7	7
" across crowns of canines, externally .....	6.5	7.8	6.7	6.7	6.9	8.2	6.5	7.5	7.7	7.7	5.5	5.5
" post-orbital breadth .....	4.7	6	5.7	6	6	6.2	5.5	6.2	5.2	5.2	3.6	3.6
" inter-orbital breadth .....	3	3.8	3.1	3.5	3.7	3.8	3.5	3.5	3.4	3.4	4.7	4.7
" mesopterygoid fossa, width .....	4.3	4.8	4.2	4.2	4.5	4.8	4.8	5	4.3	4.3	3.2	3.2
" between p <sup>1</sup> -p <sup>1</sup> .....	2.8	3.5	3	3	3	3.2	3.5	3.5	3	3	5.9	5.9
" between bases of canines .....	6	6.5	6.2	6.2	6.2	6.8	6.5	6.7	6	6	19.2	19.2
" orbital diameter .....	18.2	20	18.7	17.7	20	21.5	21	22.2	18.7	18.7	3.7	3.7
Mandible, length from condyle .....	3.7	4.5	3.8	3.5	4	4.6	4	4.8	3.5	3.5	6.8	6.8
" symphysis, length .....	6.6	8.3	7.2	7	8.6	9	8.8	9	7.2	7.2	7.2	7.2
" coronoid height .....	7.6	8.8	7.1	7.2	8.7	8.8	8.8	9.7	7.7	7.7	8.2	8.2
Upper teeth, c-m <sup>2</sup> †, crowns .....	9	10.2	8.8	8.3	9.8	10.5	10	11.5	8.7	8.7		
Lower teeth, c-m <sub>3</sub> †, crowns .....												

\* In *S. naia*s across crowns of m<sup>1</sup>-m<sup>1</sup>.† In *S. naia*s c-m<sup>1</sup> and c-m<sub>2</sub>.

## Syconycteris: Measurements of teeth.

	<i>S. c. papuana</i> , 13. New Guinea; Aru Is.		<i>S. c. keyensis</i> , 2. Key Is.		<i>S. c. fuschii</i> , ♂ ad. Type.		<i>S. c. crassa</i> , 3. Kiriwina; Fergusson I.		<i>S. c. major</i> , 3. Amboina; Ceram.		<i>S. australis</i> , Ad. Mackay.		<i>S. uaias</i> , ♀ ad. Type.	
	Min. mm.	Max. mm.	♂ ad. Type, mm.	♀ imm. Paratype, mm.	mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	mm.	mm.	mm.	mm.	mm.
p <sup>1</sup> , length .....	0.9	1.2	0.9	1.1	1.2	1.1	1.3	1	1.3	1	1	1.1	1.1	1.1
" width .....	0.6	0.8	0.7	0.7	0.6	0.7	0.8	0.8	0.8	0.6	0.6	0.6	0.6	0.6
p <sup>2</sup> , length .....	1	1.5	1.1	1.4	1.2	1.3	1.5	1.3	1.5	1.4	1.2	1.2	1.5	1.5
" width .....	0.7	0.9	0.6	0.7	0.6	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.6
p <sup>3</sup> , length .....	1	1.3	1	1.1	1	1.1	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.2
" width .....	0.7	0.9	0.7	0.8	0.7	0.7	0.8	0.7	0.8	0.8	0.6	0.6	0.6	0.6
m <sup>1</sup> , length .....	0.8	1.2	1	0.9	1	1	1.3	1	1.3	1.1	1.1	1.1	1.1	1.1
" width .....	0.7	0.9	0.7	0.8	0.7	0.7	0.9	0.8	0.9	0.8	0.6	0.6	0.6	0.6
m <sup>2</sup> , length .....	0.7	1	0.8	0.7	0.6	0.6	0.8	0.6	0.8	0.7	0.7	0.7	...	...
" width .....	0.6	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.7	0.6	0.6	0.6	...	...
p <sub>1</sub> , length .....	1	1.2	1	1.2	1.2	1.2	1.4	1.2	1.4	1.3	1	1	1.2	1.2
" width .....	0.6	0.9	0.7	0.8	0.7	0.7	0.8	0.7	0.8	0.8	0.6	0.6	0.7	0.7
p <sub>2</sub> , length .....	1.2	1.6	1.3	1.5	1.5	1.5	1.6	1.5	1.6	1.6	1.4	1.4	1.5	1.5
" width .....	0.7	0.9	0.7	0.8	0.7	0.8	0.9	0.8	0.9	0.9	0.7	0.7	0.7	0.7
p <sub>3</sub> , length .....	1.2	1.6	1.2	1.5	1.2	1.5	1.5	1.5	1.6	1.5	1.4	1.4	1.3	1.3
" width .....	0.7	0.9	0.7	0.8	0.7	0.8	0.9	0.9	1	0.9	0.7	0.7	0.6	0.6
m <sub>1</sub> , length .....	1.1	1.5	1.1	1.2	1.2	1.3	1.6	1.5	1.6	1.5	1.4	1.3	1.1	1.1
" width .....	0.8	0.9	0.7	0.8	0.8	0.9	0.9	0.9	1	1	0.7	0.6	0.6	0.6
m <sub>2</sub> , length .....	0.9	1.3	1	1	1	1.1	1.2	1.1	1.2	1.1	1	1	0.8	0.8
" width .....	0.7	0.9	0.8	0.8	0.8	0.8	0.9	0.9	1	0.9	1	0.7	0.6	0.6
m <sub>3</sub> , length .....	0.7	1	0.9	0.8	0.6	0.8	0.9	0.8	0.9	0.9	0.7	0.7	0.7	0.7
" width .....	0.6	0.7	0.7	0.6	0.6	0.6	0.7	0.6	0.7	0.7	0.5	0.5	...	...

3. *Syconycteris naias*, K. Aud.

*Carponycteris crassa* (pt.), *Thomas, Nov. Zool.* iii. p. 526 (1896: Woodlark Is.); *id.*, *Ann. Mus. Civ. Genova*, (2) xviii. p. 608 (1897).

*Macroglossus* [*Syconycteris*] *crassus* (pt.), *Matschie, Megachir.* p. 100 (1899).

*Carponycteris* [*Syconycteris*] *crassa* (pt.), *Trouessart, Cat. Mamm., Suppl.* p. 66, n. 564 (1904).

*Syconycteris naias*, K. Andersen, *Ann. & Mag. N. H.* (8) v. p. 643 (1 June, 1911: Woodlark Is.).

*Diagnosis.*—As *S. australis*, with the cheek-teeth as narrow (linear, *Macroglossus*-like) as in that species, but without trace of  $m^2$  and  $m_3$ . Forearm 41 mm.

If it were not for the absence of the posterior upper and lower molar, this form would be difficult to distinguish from *S. australis*.  $m_2$  in the type is a little smaller than in any other *Syconycteris* examined. Colour of fur and other external characters unmodified.

*Measurements.* On pp. 782–784.

*Specimen examined.* The type and only specimen known, in collection.

*Range.* Woodlark Island.

*a.* ♀ ad. al. (with foetus): Woodlark Is. A. S. Meek [C.]. 96.11.5.29.  
skull. (Type of species.)

32. *MELONYCTERIS*, Dobson.

*Melonycteris*, Dobson, *Cat. Chir. B. M.* p. 97.

	Type.
1877. <i>Melonycteris</i> , Dobson, <i>P. Z. S.</i> 1877, p. 119 (1 June) .....	M. melanops.
1877. <i>Cheiropteruges</i> , Ramsay, <i>Proc. Linn. Soc. N. S. Wales</i> , ii. p. 17 (subgenus of <i>Pteropus</i> ), p. 19 (full genus) (July) .....	M. melanops.

*Melonycteris*, Dobson, *l. s. c.* (1 June, 1877); *Leche, Lunds Univ. Arsskr.* xiv. pp. 22 & seq. (1878: dental formula); *Thomas, P. Z. S.* 1887, p. 324 (synopsis of *Macroglossine* genera); *Flower & Lydekker, Mamm.* p. 654 (1891); *Winge, E. Mus. Lundii*, ii. pt. 1, pp. 24, 27, 28, 56 (1892: affinities: dental formula); *Matschie, Megachir.* p. 92 (1899); *Miller, Fam. & Gen. Bats*, p. 73 (1907).

*Summary of principal characters.*—Tongue *Macroglossine*. Infra-orbital canal long, premaxillæ much broader above than below, in simple contact with each other; incisors  $\frac{2}{2}$ – $\frac{2}{2}$ , cheek-teeth  $\frac{5}{6}$ ,  $p^1$  rudimentary, cheek-teeth small, sublinear; index clawed, tail absent, fifth metacarpal longest, second phalanx of third digit subequal in length to metacarpal, membranes from third or fourth metatarsal; fur of underside dark, contrasting with golden colour of back. Forearm of single species known 57.5–63 mm. [*Hab.* New Guinea and Bismarck Archipelago.]

By having the underside of the body much darker than the back this genus is at once distinguished from all other *Macroglossinæ* (and indeed from all other Fruit-bats, except certain species of *Pteropus*). The following combinations of characters are absolutely diagnostic: Infraorbital canal long, incisors  $\frac{2}{2}-\frac{2}{2}$  (the infraorbital canal is long only in two other genera of Fruit-bats, *Nesonycteris* and *Notopterus*, both of which have only one pair of lower incisors); or: infraorbital canal long, index clawed (claw absent in *Nesonycteris* and *Notopterus*); or: tongue Macroglossine, forearm more than 50 mm., index clawed (in the other *Macroglossinæ* with the forearm more than 50 mm., viz. *Eonycteris*, *Nesonycteris*, and *Notopterus*, the claw of the index is absent).

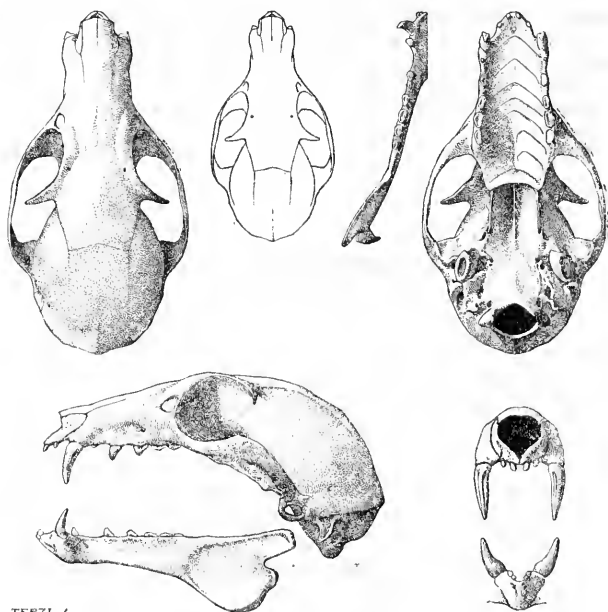


Fig. 75.—*Melonycteris melanops*, ♀. New Britain. No. 94.7.15.1.  
 $\frac{3}{2}$  (linear), front view  $\frac{1}{2}$ , outline of dorsal aspect of skull  $\frac{1}{4}$ .

*Skull* (fig. 75).—Very similar in general shape to that of *Syconycteris* (fig. 73, p. 772), but infraorbital canal much longer (infraorbital foramen almost in the middle between ventral margin of orbital cavity and alveolus of canine, in *Syconycteris* distance from foramen to base of canine at least three times greater than from foramen to ventral margin of orbit); premaxillæ nearly twice

as broad at upper extremities as at alveolus of  $i^1$ , their lower extremities in simple contact (not ankylosed together) or even narrowly spaced; rostrum relatively broader and less distinctly tapering anteriorly; symphysis of mandible longer (rather more, in *Syconycteris* less, than  $\frac{1}{4}$  of the length of mandible from condyle) and more nearly horizontal. Front of orbit above  $m^2$ ; temporal ridges closely approximated or united into a low sagittal crest; symphyseal keel of mandible only slightly indicated.

*Dentition* (fig. 75).—Dental formula unmodified Megachiropteran:

$$\frac{i^1 \ i^2 \ c \ p^1 \ p^3 \ p^4 \ m^1 \ m^2}{i_1 \ i_2 \ c \ p_1 \ p_3 \ p_4 \ m_1 \ m_2 \ m_3} \times 2 = 34.$$

Upper incisors small, terete, subequal in size, distinctly and almost equally spaced, not proclivous,  $i^1$ – $i^1$  slightly converging inferiorly. Lower incisors small and terete,  $i_1$  always distinctly smaller than  $i_2$ ,  $i_1$ – $i_1$  widely spaced (compare *Macroglossus*),  $i_1$ – $i_2$  closely approximated. Canines conspicuously longer than in *Syconycteris*; upper canines with vertical grooves, varying somewhat individually: one deep along front face (always well-developed), two along outer, one along hinder, and two along inner face (all these sometimes shallow and ill-defined: see skull 86.7.9.2); lower canines slanted strongly outward and somewhat backward. All cheek-teeth small and narrow;  $p^1$  and  $p_1$  situated close to canines; a wide diastema between  $p^1$ – $p^3$ ,  $p^3$ – $p^4$ ,  $p_1$ – $p_3$ , and  $p_3$ – $p_4$  (compare *Macroglossus*); posterior cheek-teeth narrowly spaced or in contact.  $p^1$  minute, barely piercing gum (much smaller than an upper incisor);  $p_1$  equal to or a little smaller than  $p_3$ ;  $m_3$  only about half the size of  $m_2$ .

*Palate-ridges* (fig. 75).—Five interdental, three postdental; sixth and seventh divided in middle (fifth sometimes slightly so). Number and arrangement as in *Eonycteris* and *Macroglossus* (figs. 72 A and B, p. 750).

*External characters*.—Naked portion of upper lip, beneath nares, reduced to a narrow raised edge on either side of median vertical groove (character reoccurring in *Nesonycteris*, and developed also in a few genera of *Pteropodinae*, e. g. *Cynopterus*; while *Notopteris* is similar to *Eonycteris*, *Megaloglossus*, and *Macroglossus*, and the majority of *Pteropodinae* in having the median vertical groove bounded on either side by broader naked lobes). External tail absent. Wing-membranes arising from sides of dorsum and inserted posteriorly near end of third or fourth metatarsal; vertical fasciæ of membranes, as usual in *Macroglossinae*, few (about 6–8) and widely spaced; wing-indices (upper row in table below; in lower row those of *Syconycteris* for comparison) differing from those of the foregoing *Macroglossinae* genera chiefly in two points, viz. fifth metacarpal longer than third, this again longer than fourth (in *Eonycteris* and *Megaloglossus* third metacarpal longest, fifth shortest, fourth intermediate; in *Macroglossus* and *Syconycteris* all three metacarpals subequal with a distinct tendency of third or fourth to be the shortest; the two latter genera therefore forming in this respect a transition to *Melonycteris*), and second phalanx of third

digit considerably lengthened, subequal to (in the foregoing *Macroglossinae* much shorter than) metacarpal of same digit; a similar wing-structure reoccurs in *Nesonycteris* and *Notopteris*. Interfemoral well developed along tibiae, scarcely detectable in centre; calcar normal. Forearm practically naked, tibia covered above; colour of fur some tinge of cinnamon above, face and underparts much darker (an unusual feature in Megachiroptera); forearm and fingers pale, irregularly blotched with dark brown; no external secondary sexual characters (males without neck-tufts); general size almost as females of *Eonycteris spelæa*, conspicuously larger than in *Megaloglossus*, *Macroglossus*, and *Syconycteris*.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph. c. u.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	397	510	125	138	743	555	738	717	432	417	765	322	365
1000	409	526	89	129	755	554	643	741	411	407	755	332	371

*Affinities.*—As already noted on page 733, *Melonycteris*, *Nesonycteris*, and *Notopteris* have preserved two primitive (Insectivorous) characters which are quite or nearly lost in all other Fruit-bats, viz. a long infraorbital canal and broad upper extremities of the premaxillæ (in all other genera the infraorbital canal is much shortened, its outer wall in most genera only a narrow bridge of bone, and the premaxillæ are usually subequal in breadth throughout or even conspicuously narrower above than below). With these primitive characters the three genera of this small natural group of *Macroglossinae* combine, however, a relatively high degree of specialization; they have developed essentially along the same lines as *Macroglossus* and *Syconycteris*, but in some respects carried the specialization a few stages farther: the anterior upper premolar (large in *Macroglossus* and *Syconycteris*) is reduced to a mere rudiment or (in *Notopteris*) entirely suppressed; the middle lower incisor is reduced in size (*Melonycteris*) or absent (the two other genera); the fifth metacarpal has become the longest, the fourth the shortest, the third intermediate, and the second phalanx of the third digit is considerably lengthened; they are in fact the longest-winged Fruit-bats known (index of third digit in all three genera from 2023 to 2071, the highest indices in other Fruit-bats being 1952 in *Syconycteris* and about 1900 in *Nyctimene* and *Pteropus*). In dentition and at least one external character *Melonycteris* is the least modified of the three genera:  $i_1$  is present and the second digit clawed (claw lost in *Nesonycteris* and *Notopteris*); but in the colour of the fur *Notopteris* is the most ordinary-looking (sombre tinges like those of *Rousettus*, *Eonycteris*, and many other Fruit-bats), while in *Nesonycteris* the colours are brightened into russet, cinnamon, or wood-brown (compare *Macroglossus*), tinges which reoccur in *Melonycteris* though on the face and underparts considerably darkened with seal-brown.



1. *Melonycteris melanops*, Dobson.*Melonycteris melanops*, Dobson, Cat. Chir. B. M. p. 97.

*Melonycteris melanops*, Dobson, P. Z. S. 1877, p. 119, text-figs. 4-7 (muzzle, ear, upper and lower teeth of paratype), pl. xvii. (animal, from type) (1 June, 1877: Duke of York I.); *id.*, Cat. Chir. B. M. p. 97 (1878: same specimens); *id.*, P. Z. S. 1878, p. 316 (♀ ad., type locality); Trouessart, Rev. & Mag. Zool. (3) vi. p. 209, n. 341 (1879); Peters & Doria, Ann. Mus. Civ. Genova, xvi. p. 691 (1881); Pagenstecher, Jahrb. wiss. Anst. Hamb. ii. pl. —. fig. 2 (palate-ridges; tongue; insertion of membranes) (1885); Jentink, Cat. Syst. Mamm. p. 159 (1888: Duke of York I.; New Britain); Noack, Zool. Jahrb., Syst. iv. p. 212 (1889); Flower & Lydekker, Mamm. p. 655 (1891); Trouessart, Cat. Mamm. i. p. 90, n. 488 (1897); Matschie, Megachir. p. 93 (1899: MacCluer Bay; New Britain; Duke of York I.); Trouessart, Cat. Mamm., Suppl. p. 66, n. 566 (1904); Jentink, Notes Leyd. Mus. xxviii. p. 172 (1907); Miller, Fam. & Gen. Bats, p. 74, pl. vii. fig. 4, pl. viii. fig. 4 (teeth: Duke of York I.) (1907); Elliot, Cat. Mamm. Field Col. Mus. p. 496, n. 875 (1907: Duke of York I.).

*Pteropus* (Cheiropteruges) *alboscapulatus*, Ramsay, Proc. Linn. Soc. N. S. Wales, ii. p. 17 (meeting 29 Jan. 1877) (July, 1877: Duke of York I.).

*Fur*.—Length, back 5 (general mass of hair) and 7 mm. (longest hairs), breast 3 and 5. Forearm almost naked above (but membrane on either side distinctly though rather thinly haired); upperside of tibia and adjoining membranes on either side clothed with long but somewhat thinly spread hairs.

*Colour*.—Type (♂ ad. skin): General colour of back pale cinnamon; individual hairs seal-brown at extreme base (only for a length of a millimetre or less), then light buffy cinnamon; this colour shading at tip into warm golden cinnamon; a small epaulette of white hair at origin of ante-brachial membrane (“*alboscapulatus*”). Underparts, from throat to interfemoral, seal-brown heavily mixed with light grey; individual hairs seal-brown for basal half or two-thirds, with light grey tips (these everywhere allowing the seal-brown colour to show through). Hairs of crown seal-brown with short light cinnamon tips, producing a dark brown colour lightened (powdered) with cinnamon; circumocular region and sides of face seal-brown thinly and finely sprinkled with pale cinnamon (“*melanops*”); extremity of hairy muzzle and a narrow streak continued backward between eyes light greyish or buffy grey. Forearm and digits (in dried condition) yellowish irregularly blotched with dark brown; membranes dark brown with some irregular and ill-defined yellow patches between forearm and fifth metacarpal.

There is probably some individual variation in the tinges. An alcoholic specimen (♀ ad., 86.7.9.2, with colours seemingly well-preserved) is conspicuously richer, almost tawny ochraceous, above, the greyish hair-tips of the underside lighter in tinge, those of the crown more greyish, the seal-brown colour of the sides of the face

more lightened with pale tips to the hairs. The white epaulettes are absent in one female (fully adult, teeth worn, 77.7.18.16), present in the other three specimens examined, two of which are also females.

*Measurements.* On pp. 806–808.

*Specimens examined.* Those in collection.

*Range.* New Guinea (so far recorded only from MacCluer Bay) and Bismarek Archipelago (New Ireland; Duke of York I.; Mioko; New Britain).

*Type*, in collection. Skull, total length 36, mandible from condyle 25.8, c-m<sup>2</sup> (crowns) 12.3, forearm 63, third metacarpal 46, tibia 25 mm.

*Pteropus* (*Cheiropteruges*) *alboscapulatus*.—Type (presumably in the Sydney Museum), ♂ ad., Duke of York I.; forearm (according to Ramsay) 63.5 mm.

a. ♂ ad. sk.; skull.	New Ireland.	Rev. G. Brown [C.].	77.7.18.10.
		(Type of species.)	
b. [♀] ad. sk. in al.; skull.	Duke of York I.	Rev. G. Brown [C.].	77.7.18.16.
c. ♀ ad. al.; skull.	Mioko I.	Dr. O. Finsch [C.].	86.7.9.2.
d. ♀ ad. al.; skull.	New Britain.	Tring Museum [E.].	91.7.15.1.

### 33. NESONYCTERIS, *Thos.*

Type.

1887. *Nesonycteris*, *Thomas*, *Ann. & Mag. N. H.* (5) xix, p. 147 (1 Feb.)..... *N. woodfordi*.

*Nesonycteris*, *Thomas*, *l. s. c.* (1 Feb. 1887: name established, no description of genus); *id.*, *P. Z. S.* 1887, pp. 323, 324 (1 Aug. 1887: description; affinities); *Flower & Lydekker*, *Mamm.* p. 655 (1891); *Winge*, *E. Mus. Lundii*, ii. pt. 1, pp. 24, 27, 28, 56 (1892: affinities; dental formula); *Matschie*, *Megachir.* p. 91 (1899); *Miller*, *Fam. & Gen. Bals.* p. 74 (1907).

*Diagnosis.*—As *Melonycteris*, but incisers  $\frac{2}{1}-\frac{2}{1}$  ( $i_1$  lost), index without claw, and underparts not darker than back. Single species known smaller than *Melonycteris*, but larger than *Macroglossus*, forearm 52–53.5 mm. [*Hab.* Solomon Islands.]

This is the only tailless Fruit-bat without claw on second digit. It is, further, the only Fruit-bat with the full Megachiropteran number of cheek-teeth ( $\frac{5}{6}$ ) and  $\frac{2}{1}-\frac{2}{1}$  incisors. Of the seven genera of Fruit-bats (*Rousettus*, *Pteropus*, *Pteralopex*, *Dobsonia*, *Nyctimene*, *Macroglossus*, *Nesonycteris*) known to occur in the Solomon Islands this is the only form with  $\frac{2}{1}-\frac{2}{1}$  incisors; the claw of the second digit is absent in two of these seven genera, *Dobsonia* (back naked, tail present, subfamily *Pteropodinae*) and *Nesonycteris* (back clothed, tail absent, subfamily *Macroglossinae*).

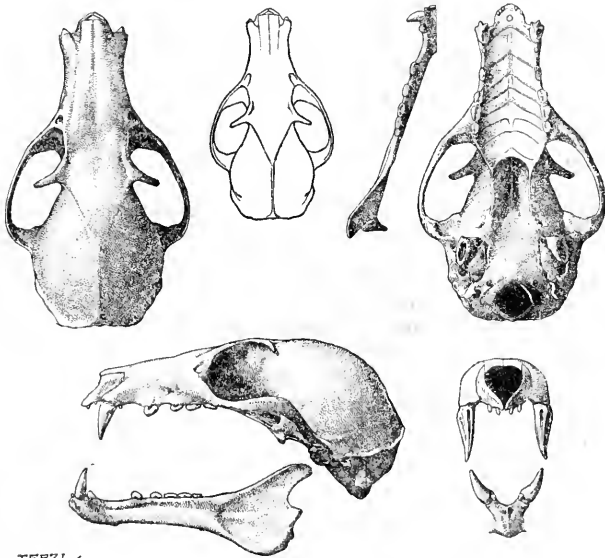
*Skull* (fig. 76).—Rostrum relatively slenderer than in *Melonycteris*; other characters unchanged.

*Dentition* (fig. 76).—Dental formula unmodified Megachiropteran,

except for the loss of the inner pair of lower incisors:—

$$\frac{i^1 i^2 c p^1 p^3 p^4 m^1 m^2}{i_2 c p_1 p_3 p_4 m_1 m_2 m_3} \times 2 = 32.$$

General form of upper incisors as in *Melonycteris*, but  $i^1-i^1$  more widely spaced than  $i^1-i^2$  (as in *Macroglossus*; in *Melonycteris* all upper incisors subequally spaced);  $i_1$  absent,  $i_2$  small, terete, and situated close to canine, thus leaving a wide tooth-less space between  $i_2-i_2$  (compare *Notopterus*). Canines, premolars, and molars as in *Melonycteris* (but root of  $p_1$  sometimes with a deep vertical groove along inner face, as if tending to become double; the character does not appear to be constant, and is occasionally observed in other *Macroglossinæ*, e. g. *Macroglossus* and *Syconycteris*, but, so far as the very limited material goes, not in *Melonycteris*).



TERZI~

Fig. 76.—*Nesonycteris woodfordi*, ♂. Guadalcanar, Solomon Is. No. 8S.1.5.15.  $\frac{2}{3}$  (linear), front view ♀, outline of dorsal aspect of skull ♀.

*Palate-ridges* (fig. 76).—As in *Melonycteris*, but sixth ridge (judging from a single specimen) slightly more anterior in position, situated rather between the posterior molars than (as is the case in *Melonycteris*) immediately behind the tooth-rows.

*External characters*.—Principal distinguishing character, as compared with *Melonycteris*, claw of index absent. Rhinarium as in *Melonycteris* (see p. 787). External tail absent. Wing-

membranes inserted near end of third or fourth metatarsal; wing-structure as in *Melonycteris*, except for a distinct lengthening of the third, fourth, and fifth digits, the indices of which are, respectively, 2071, 1666, and 1496, against 2036, 1566, and 1452 in *Melonycteris* (compare table below, showing in upper row wing-indices of *Nesonycteris*, calculated from three specimens, in lower row those of *Melonycteris*; it will be observed that the greater length of the digits of *Nesonycteris* is due chiefly to a lengthening of all metacarpals and of both phalanges of fourth digit). Inter-femoral as in *Melonycteris*. Distribution of fur and colour of membranes, forearm and digits (in single species) unmodified *Melonycterine*; colour of fur differing only in the pale tinge of the head and underparts, and the absence of white "epaulettes."

Forearm.	Pollex c.u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph.*	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	419	543	132	108	760	566	745	755	458	453	798	340	353
1000	397	510	125	138	743	555	738	717	432	417	765	322	365

*Affinities.*—*Nesonycteris* is the Solomon Islands representative of *Melonycteris*. Its claim to stand as a genus distinct from *Melonycteris* rests solely on the loss of the inner pair of lower incisors and the claw of the second digit. In nearly all other characters (skull, dentition, tongue, palate-ridges, and external appearance, except colour of face and underparts) the two genera are strikingly similar to each other.

### 1. *Nesonycteris woodfordi*, Thos.

*Nesonycteris woodfordi*, Thomas, *Ann. & Mag. N. H.* (5) xix. p. 147 (1 Feb. 1887: Shortland; Fauro); *id.*, *P. Z. S.* 1887, p. 324, text-figs. 1, 2 (skull), pl. xxvi. (animal) (1 Aug. 1887: same specimens); *id.*, *P. Z. S.* 1888, p. 476 (1889: Guadalcanar); Flower & Lydekker, *Mamm.* p. 655 (1891); Lydekker, *R. Nat. Hist.* i. p. 261 (1893-94); Trouessart, *Cat. Mamm.* i. p. 90, n. 490 (1897); Matschie, *Megachir.* p. 91 (1899); Beddard, *Mamm.* p. 526 (1902); Trouessart, *Cat. Mamm., Suppl.* p. 66, n. 569 (1904); Müller, *Fam. & Gen. Bats*, p. 74 (1907).

*Fur.*—Dense and cottony, as in *Melonycteris melanops*. Length, back 5 (general mass of hair) and 8 mm. (longest hairs), breast 3 and 7. Basal fourth of forearm thinly clothed above, upperside of tibia and adjoining membranes on either side more thickly so.

*Colour.*—Type (♂ ad. skin, Shortland I.): General colour of back warm russet (or russet cinnamon); individual hairs wood-

\* In *Melonycteris* with claw.

brown or cinnamon wood-brown (no seal-brown at extreme base) with short russet tips; no white epaulettes (see *Melonycteris melanops*, p. 789). Nape of neck cinnamon wood-brown, paler than back (owing to absence or extreme shortness of russet tips to the hairs). Breast, belly, and flanks uniform wood-brown with a faint tinge of fawn; foreneck similar, but more greyish wood-brown. Head uniform russet, similar to back, but slightly paler. Colour of forearm, digits, and membranes as in *M. melanops*. "Iris brown" (C. M. Woodford).

An adult female from Fauro I. (skin) and an adult male from Guadalcanar (alcoholic) are similar in colour to the type.

*Measurements.* On pp. 806-808.

*Specimens examined.* Those in collection.

*Range.* Solomon Islands. So far recorded from Shortland and Fauro among the western. and Guadalcanar among the eastern islands.

*Type*, in collection. Skull, total length 34, mandible from condyle 24.7, c-m<sup>2</sup> (crowns) 11.6, forearm 53.5, third metacarpal 41, tibia 22 mm.

- |                |                    |                            |             |
|----------------|--------------------|----------------------------|-------------|
| a. ♂ ad. sk.;  | Alu, Shortland;    | C. M. Woodford, Esq. [C.]. | 87.1.18.9.  |
| skull.         | Apr. 1886.         | (Type of species.)         |             |
| b. ♂ pull. al. | Alu, Shortland;    | C. M. Woodford, Esq. [C.]. | 87.1.18.11. |
|                | Apr. 1886.         |                            |             |
| c. ♀ ad. sk.;  | Fauro; May, 1886.  | C. M. Woodford, Esq. [C.]. | 87.1.18.10. |
| skull.         |                    |                            |             |
| d. ♂ ad. al.;  | Aola, Guadalcanar. | C. M. Woodford, Esq. [C.]. | 88.1.5.15.  |
| skull.         |                    |                            |             |

### 34. NOTOPTERIS, Gray.

*Notopteris*, Dobson, Cat. Chir. B. M. p. 92.

Type.

1859. *Notopteris*, Gray, P. Z. S. 1859, p. 36 (29 June). *N. macdonaldi*.

*Notopteris*, Gray, l. s. c. (1859); *Peters*, MB. Ak. Berlin, 1865, p. 256 (list of genera of Chiroptera); *Gray*, P. Z. S. 1866, p. 64 (revision of genera of Chiroptera); *id.*, Cat. Monk. &c. p. 114 (1870); *Dobson*, Ann. & Mag. N. H. (4) xvi. p. 354 (1875: arrangement of genera of Chiroptera); *id.*, Cat. Chir. B. M. p. 92 (1878); *Thomas*, P. Z. S. 1887, p. 324 (synopsis of MacroGLOSSINE genera); *Flower & Lydekker*, Mamm. p. 654 (1891); *Winge*, E Mus. Lundii, ii. pt. 1, pp. 24, 27, 28, 56, 59 (1892: affinities; dental formula; homologies of missing premolars); *Matschie*, Megachir. p. 88 (1899); *Miller*, Fam. & Gen. Bats, p. 74 (1907); *Trouessart*, Bull. Mus. d'Hist. Nat. Paris, 1908, p. 259 (notes on the New Caledonian species).

*Diagnosis.*—Allied to *Nesonycteris* (supraorbital canal long, premaxillæ broad above, i<sub>1</sub> absent, index without claw), but premaxillæ ankylosed together inferiorly, i<sup>1</sup> deciduous, p<sup>1</sup> and p<sub>1</sub> absent (cheek-teeth  $\frac{4}{5}$ ), p<sub>3</sub> unusually large, tail excessively long (subequal to forearm), tibia lengthened (half as long as forearm), membranes from spinal line, "back" (notopatagium) naked in

centre, second phalanx of third digit longer than metacarpal of same digit. Forearm 59 (?)–68.5 mm. [Two species. *Hab.* Western Polynesia.]

*Notopteris* is the only long-tailed Fruit-bat; the only Fruit-bat which has lost both  $p^1$  and  $p_1$ ; and the only one with the tibia equal to or more than half the length of the forearm; each of these characters, taken by itself, is therefore absolutely diagnostic. The same may be said of each of the following combinations:—(1) "Back" (*i. e.* the notopatagium covering the back) naked in centre, forearm less than 72 mm.; (2) index without claw, cheek-teeth  $\frac{4}{5}$ ; (3) tongue Macroglossine, cheek-teeth  $\frac{4}{5}$ ; (4) infraorbital canal long, cheek-teeth  $\frac{4}{5}$ ; (5) infraorbital canal long, premaxillæ ankylosed together inferiorly; (6) premaxillæ much broader above than below and ankylosed together inferiorly. The adult *Notopteris*, without  $i^1$ , is the only Fruit-bat with 26 teeth. The only other genus of Fruit-bats extending to Polynesia is *Pteropus*.

*Skull* (fig. 77).—General shape as in *Melonycteris* and *Nesonycteris*, but premaxillæ more proclivous in lower halves, therefore more projecting in front of canines, and solidly united inferiorly, rostrum thinner and rather more compressed laterally, orbits a little smaller proportionately, sagittal crest more strongly developed, angular process of mandible much smaller, and extremity of mandible (its toothless portion between the single pair of lower incisors) much more projecting and unusually broad. Other characters as in *Melonycteris* and *Nesonycteris* (upper halves of premaxillæ very broad, infraorbital canal long).

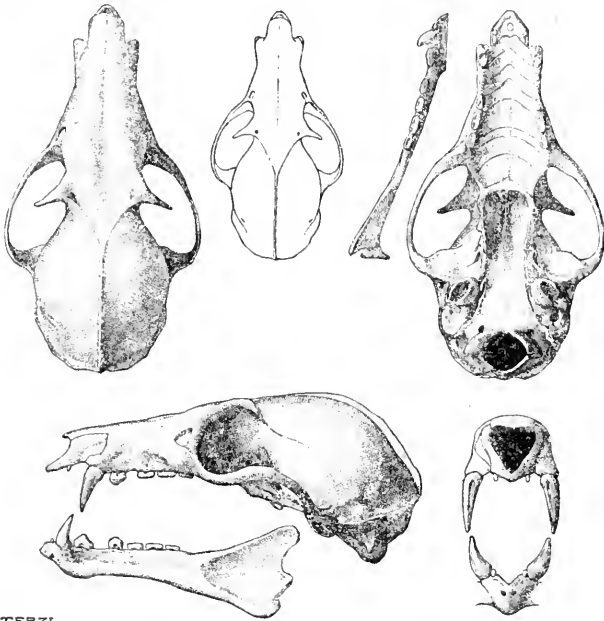
*Dentition* (fig. 77).— $(i^1) i^2 c p^3 p^4 m^1 m^2$   
 $i_2 c p_3 p_4 m_1 m_2 m_3 \times 2 = 28$  (or, in adult individuals, owing to deciduousness of  $i^1$ , as a rule 26). Dental formula differing from that of *Nesonycteris* by absence of  $p^1$  and  $p_1^*$ .

$i^1$  rudimentary, not piercing gum, present in immature individuals, as a rule absent in adults (trace of the alveolus sometimes detectable);  $i^2$  as in *Melonycteris* and *Nesonycteris*.  $i_1$  absent;  $i_2$  small and styliform (as in *Nesonycteris*), and situated close to canine, the mandible projecting considerably in front of it. Upper and lower canines essentially as in *Melonycteris* and *Nesonycteris* (anterior and posterior groove of upper canine distinct, those on external and internal face of tooth much less so and sometimes obsolescent).  $p^1$  and  $p_1$  absent; other cheek-teeth similar to those of *Melonycteris* and *Nesonycteris*, but longer antero-posteriorly (the increase in length proportionately greatest in  $p_3$ , which is the largest lower cheek-tooth);  $p^3$  and  $p_3$  closely behind canines and separated by a relatively wide diastema from  $p^4$  and  $p_4$ ;  $m^2$  and  $m_3$  a little smaller than  $m^1$  and  $m_2$ .

*Palate-ridges* (fig. 77).—Number as in *Melonycteris* (fig. 75, p. 786) and arrangement essentially the same, except for the

\* The missing cheek-teeth in this genus are (as pointed out by Herluf Winge, *l. c.*) without doubt the anterior premolar above and below, not (as usually stated: see Dobson and Miller, *ll. cc.*)  $m^2$  and  $m_3$ .

narrower space between the first and second ridge (owing to the much more anterior position of  $p^3$ ) and the wider space between the fourth and fifth.



TERZU

Fig. 77.—*Notopteris macdonaldi*, ♂. Aneiteum, New Hebrides. No. 60.7.18.79.  
 $\frac{2}{3}$  (linear), front view  $\frac{1}{2}$ , outline of dorsal aspect of skull  $\frac{1}{2}$ .

*External characters.*—Nares less projecting than in *Melonycteris* and *Nesonycteris*; naked portion of upper lip as in *Eonycteris* (see p. 787). Tongue even longer (about  $\frac{3}{2}$  the length of the mandible) than in other *MacroGLOSSINÆ*, but not differing in surface structure. Tibia longer than in any other Fruit-bat, equal to or more than half the length of the forearm (the nearest approximations are found in certain species of *Pteropus* and in *Penthetor*). Tail much longer than in other Fruit-bats, nearly equal in length to forearm (caudal vertebræ ten). Membranes arising from median line of back and inserted posteriorly on base of second (or between first and second) metatarsal; vertical fasciæ of mesopatagium as in other *MacroGLOSSINÆ* (about eight). Second digit without claw, its claw phalanx rudimentary (not distinctly traceable externally), and even the second phalanx a little shorter than usual; metacarpals of long digits considerably shorter than in *Melonycteris* and

*Nesonycteris*, but this shortening in some measure compensated by a conspicuous lengthening of the terminal phalanges of third and fourth digits and a small lengthening of the first phalanx of fourth and fifth, so that the total length of the long digits is not much smaller than in *Nesonycteris*; fifth metacarpal subequal to (tending to be a little longer than) third, which is decidedly longer than fourth (as in *Melonycteris* and *Nesonycteris*, though with the shortening of the fourth even more emphasized); second phalanx of third digit much longer than metacarpal (compare table below, giving in upper row the wing-indices of *Notopteris*, based on two adult specimens, in middle row those of *Nesonycteris*, and in lower row those of *Melonycteris*, for comparison). Notopatagium naked (but shoulders and rump furred); colour of fur recalling the sombre tinges of *Rousettus*, *Dobsonia*, or *Eonycteris* (bright in *Macroglossus*, *Melonycteris*, and *Nesonycteris*); no external secondary sexual differentiation.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph.*	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	385	507	142	64	701	549	773	661	478	497	709	358	358
1000	419	543	132	108	760	566	745	755	458	453	798	340	358
1000	397	510	125	138	743	555	738	717	432	417	765	322	365

*Habits*.—It has been suggested that *Notopteris* "doit se nourrir des fleurs du Niaouli (*Melaleuca viridiflorens*), de l'Érythrine, des fruits du Banian et d'une sorte de *Ficus*" (Trouessart, l. c.), but this seems to be mere conjecture based solely on the fact that these trees are common in the island (New Caledonia) inhabited by one of the forms of the present genus, and there frequented by certain species of *Pteropus*. Actual observations appear to be wanting.

*Affinities*.—*Notopteris* is at the same time one of the most primitive and one of the most highly specialized genera of Fruit-bats. There is no doubt that it is closely related to *Melonycteris* and *Nesonycteris*, with which it accords in all important characters of the skull, dentition, and palate-ridges; as pointed out elsewhere (p. 788) these three genera form a separate small section of *Macroglossinae*, being the only Fruit-bats which have preserved a long infraorbital canal and broad upper extremities of the premaxillæ; but *Notopteris* is in one respect, the remarkably long tail, even lower than *Melonycteris* and *Nesonycteris*, and indeed lower than any other Fruit-bat. In nearly all other respects it has, however, developed along the same lines as the two allied genera, and in certain points it has carried the specialization farther than those. The right and left premaxillæ are in *Melonycteris* and *Nesonycteris*, as in most other Fruit-bats, in simple contact inferiorly, in *Noto-*

\* In *Melonycteris* with claw.



*pterus* ankylosed together; this is a character developed independently in several other Fruit-bats, both *Macroglossinae* (*Megaloglossus*, *Macroglossus*, *Syconycteris*) and *Pteropodinae*, and, though valuable for diagnostic purposes, it is of little or no use for a determination of the affinities of a genus (premaxillæ in simple contact in typical *Rousettus*, but fused in the subgenus *Lissonycteris*; in contact in *Pteropus*, fused in *Pteralopex*; fused in *Hypsignathus*, but in contact in all other Epomophorine bats; in contact in *Balionycteris*, but fused in *Chironax*). The premaxillæ are decidedly more proclivous than in *Melonycteris* and *Nesonycteris*, though scarcely more so than in *Macroglossus*, but the corresponding portion of the mandible (its toothless extremity between  $i_2-i_2$ ) is somewhat expanded laterally, almost spoon-like. The inner pair of lower incisors is in *Melonycteris* smaller than the outer, in *Nesonycteris* and *Notopteris* it has disappeared, and in *Notopteris* also the inner upper pair is on the point of disappearing. These modifications, of the incisors, the premaxillæ, and the extremity of the mandible, are probably interdependent; by the proclivity of the premaxillæ and the broadening of the extremity of the mandible the rostrum becomes remarkably prominent; the fusion of the premaxillæ adds to its firmness; and the total or nearly total disappearance of the incisors from this portion of the extremity of the rostrum renders it peculiarly beak-like.  $p^1$  is remarkably small in *Melonycteris* and *Nesonycteris* (as compared with the same premolar in *Macroglossus* and *Syconycteris*), in *Notopteris* it has been entirely suppressed, as has also the corresponding lower tooth, and the next premolar above and below ( $p^3$  and  $p_3$ ) has moved forward closely behind the canines. In *Melonycteris* and *Nesonycteris* the fifth metacarpal is the longest, the fourth the shortest, the third intermediate; the same is the case in *Notopteris*, only the relative shortness of the fourth metacarpal is more emphasized. In the large majority of Fruit-bats, both *Pteropodinae* and *Macroglossinae* the terminal phalanx of the third finger is conspicuously shorter than the third metacarpal, in *Melonycteris* and *Nesonycteris* subequal to, and in *Notopteris* even longer than the metacarpal. In having the membranes arising from the spinal line and the "back" (notopatagium) naked, *Notopteris* is unique in the subfamily *Macroglossinae*, but there is a close parallel in the *Pteropodinae* (*Dobsonia*).

#### *Synopsis of the Species.*

- |  |                              |
|--|------------------------------|
| a. Forearm 65.5-68.5 mm. (New Hebrides; Fijis) .....                             | [p. 797.                     |
| b. Forearm (only immature specimens known) at least 59 mm. (New Caledonia) ..... | [p. 799.                     |
|  | 1. <i>N. macdonaldi</i> ,    |
|  | 2. <i>N. neocaledonica</i> , |

#### 1. *Notopteris macdonaldi*, Gray.

*Notopteris macdonaldi*, Dobson, Cat. Chir. B. M. p. 93.

*Notopteris macdonaldi*, Gray, P. Z. S. 1859, p. 38, pl. lxxvii. (29 June, 1859: animal; skull; teeth) (Viti Levu); Gerrard, Cat. Bones

*Mamm. B. M.* p. 58\* (1862: Viti Levu); *Gray, P. Z. S.* 1866, p. 64; *Peters, MB. Ak. Berlin*, 1867, p. 872; *Gray, Cat. Monk. Sc.* p. 114 (1870: Viti Levu); *Dobson, Cat. Chir. B. M.* p. 93 (1878: Viti Levu; Aneiteum); *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 209, n. 338 (1879); *Thomas, P. Z. S.* 1880, p. 11 (Fiji Is.: von Hügel Coll.); *Jentink, Cat. Ost. Mamm.* p. 268 (1887: Ponapé); *id.*, *Cat. Syst. Mamm.* p. 158 (1888: Ponapé; Viti Levu); *Flower & Lydekker, Mamm.* p. 654 (1891); *Trouessart, Cat. Mamm.* i. p. 90, n. 491 (1897); *Matschie, Megachir.* p. 88 (1899: Viti Levu); *Trouessart, Cat. Mamm., Suppl.* p. 67, n. 570 (1904); *Miller, Fam. & Gen. Bats*, p. 75 (1907).

*Diagnosis.*—See “Synopsis,” p. 797.

*Fur.*—Notopatagium (membrane covering back from shoulders to rump) so thinly haired as to appear practically naked; shoulders and rump furred; dorsal surface of body, beneath notopatagium, clothed as usual (as in *Dobsonia*). Basal third or fourth of forearm thinly haired above; extremity of femur and upperside of tibia with few and thinly scattered hairs. Length of fur, shoulders 7 (general mass of hairs) and 11 mm. (longest hairs), breast 6 and 9.

*Colour.*—♂ ad. skin, December, Fijis (1.6.25.1): General colour of nape of neck and shoulders between bistre and raw umber; individual hairs of shoulders uniform from base to tip, those of nape of neck warmer brown at concealed bases; rump olive hair-brown; head almost sepia, this tinge shading posteriorly into that of nape, inferiorly into that of throat and foreneck; breast and belly dark drab (or brocoli-brown) slightly tinged with isabella, this colour passing gradually into a duller hair-brown on foreneck and throat.

Two immature skins (Fijis; forearms 59 and 60 mm.) are similar in colour to the above, but distinctly paler, more brownish above (possibly owing to some fading of the fur). A still younger specimen (skin, Fijis; forearm 53 mm., evidently in baby pelage) is uniform brown-drab above, dull drab beneath.

*Measurements.* On pp. 806–808.

*Specimens examined.* Those in collection.

*Range.* New Hebrides (Aneiteum) and Fiji Islands (Viti Levu). Recorded also from the Caroline Islands (Ponapé: two immature specimens in the Leyden Museum).

*Cotypes* in collection (two immature specimens, forearms 53 and 59 mm.; the forearm of an adult topotype measures 68.5 mm.).

<i>a, b.</i> 1 imm., 1 ♀ imm. sks.; skulls.	Viti Levu, Fijis; Sept. 1857 ( <i>Dr. John D. Macdonald</i> ).	Lords of the Admiralty [P.]. ( <i>Cotypes</i> of species.)	58.12.27.5, 6.
<i>c.</i> Imm. skull.	Viti Levu ( <i>Dr. J. D. M.</i> ).	Lords of the Admiralty [P.].	58.12.27.116.
<i>d.</i> Imm. sk.; skull.	Kalambon Cave, R. Waini-manu, Viti Levu; July, 1877.	Baron A. von Hügel [C. & P.].	79.11.15.26.
<i>e.</i> ♂ ad. sk.; skull.	Caves at Kolobo, Fijis; 18 Dec. 1894.	C. M. Woodford, Esq. [C.].	1.6.25.1.
<i>f.</i> ♂ ad. al.; skull.	Aneiteum, New Hebrides.	Purchased (Cuming).	60.7.18.79.

\* Generic name misspelt *Notopterus*.

2. *Notopteris neocaledonica*, Trouess.

*Notopteris macdonaldi neocaledonica*, Trouessart, *Bull. Mus. d'Hist. Nat.* 1908, n. 6, p. 257 (Oct. 1908: New Caledonia).

*Diagnosis*.—Similar in every respect to *N. macdonaldi*, but perhaps smaller (forearms of three cotypes, all immature, 56.5–59 mm.).

Further material is required before the distinctness of this form can be considered satisfactorily established. All the cotypes examined by the present writer, although stated in the original description to be perfectly adult, are decidedly immature, and, apart from their smaller general size, they show no tangible differences from *N. macdonaldi*; even the size of the teeth is practically exactly as in specimens from New Hebrides and Fiji Islands.

*Range*. New Caledonia (Adio Caves, Nekliaï valley, near Poya; “on ne trouve ces animaux que dans les deux roches ruiniformes et cavernueuses dites d'Adio; ils ne sont pas connus dans le reste de la Nouvelle-Calédonie,” Trouessart, *l. c.*).

*Cotypes* in the Paris Museum, four alcoholic specimens (three and skull of one examined), collected by M. Archambault. For measurements see pp. 806–808.

## Subfamily III. HARPYIONYCTERINÆ.

*Diagnosis*.—Premaxillæ, upper incisors, and upper and lower canines more strongly proclivous than in other Fruit-bats; molariform teeth multicuspidate. [One genus.]

*Range*.—The Philippines.

*Affinities*.—See p. 803.

## 35. HARPYIONYCTERIS, Thos.

Type.

1896. *Harpyionycteris*, Thomas, *Ann. & Mag. N. H.*

(6) xviii. p. 243 (1 Sept.)..... *H. whiteheadi*.

*Harpyionycteris*, Thomas, *l. s. c.* (1896: “one of the most isolated of all the genera” of Megachiroptera, but perhaps “most conveniently placed near *Xantharpyia* [i. e. *Rousettus*] and *Boneia*”); Matschie, *Megachir.* p. 70 (1899: “möchte fast vermuthen, dass *Harpyionycteris* in die Nähe von *Styloctenium* und *Pteropus* zu stellen ist und sich zu *Pteralopex* ähnlich verhält, wie *Styloctenium* zu *Sericonycteris* [i. e. *Pteropus*]”!); Miller, *Fam. & Gen. Bats*, p. 77 (1907: distinct subfamily).

*Summary of principal characters* (see also Diagnosis of the subfamily, above). — Premaxillæ ankylosed together in front; incisors  $\frac{1}{1}$ – $\frac{1}{1}$  (lower pair rudimentary), upper canines bicuspidate, lower canines tricuspidate and situated close together at extremity of mandible, cheek-teeth  $\frac{5}{6}$ ; index clawed, tail absent, tibia un-

usually short. Forearm (of single species known) about 82 mm. [*Hab.* Philippines.]

Each of the following single characters appears to be absolutely diagnostic: (1) premaxillæ, upper incisors, and upper and lower canines strongly proclivous (canines crossing each other at nearly right angles when the jaws are closed); (2) lower canines tricuspidate; (3) molariform teeth multicuspidate; (4) tibia less than one-third of forearm (only slightly longer than foot with claws). And each of the following combinations: (1) incisors  $\frac{1}{1}-\frac{1}{1}$ , canines with secondary cusps (*Dobsonia* and the fully adult *Notopterus* are the only other genera of Megachiroptera with a single pair of incisors above and below); (2) incisors  $\frac{1}{1}-\frac{1}{1}$ ,  $p^1$  present (cheek-teeth  $\frac{5}{6}$ ); (3) incisors  $\frac{1}{1}-\frac{1}{1}$ , index clawed; (4) incisors  $\frac{1}{1}-\frac{1}{1}$ , wings from sides (not spinal line) of back; (5) incisors  $\frac{1}{1}-\frac{1}{1}$ , no tail.

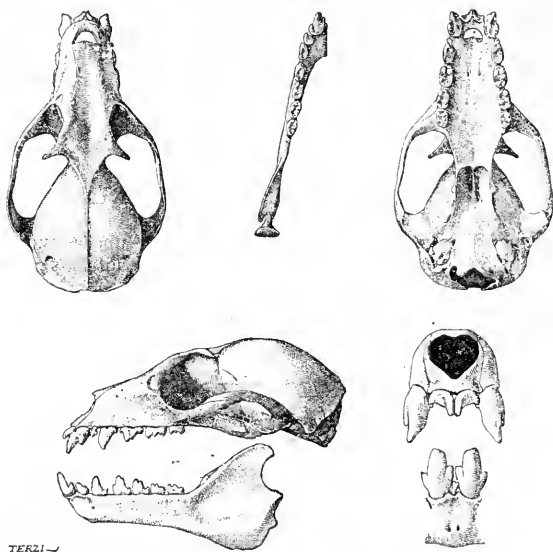


Fig. 78.—*Harpyionycteris whiteheadi*, type of species.  
Front view ♀, other figures ♂.

*Skull* (fig. 78).—General shape *Dobsonia*-like, except for the strong proclivity of the premaxillæ. Deflection of basicranial axis as in *Dobsonia*, alveolar line if projected backward passing through base of zygoma. Rostrum (in profile) longer and somewhat lower anteriorly than in *Dobsonia*, but greater length due entirely to proclivity of premaxillæ, the distance from orbit to nares being

relatively the same in both genera (about one-fourth of total length of skull); front of orbit above middle of  $m^1$  (as in *Dobsonia*). Premaxillæ solidly fused anteriorly, their ascending branches similar in shape to those of *Dobsonia* (narrow, tapering to a point above). Postdental palate as in *Dobsonia*, rather rapidly narrowing behind tooth-rows. Postorbital processes moderate, as in *Dobsonia*; postorbital foramina present. A low sagittal crest. General shape of mandible as in *Dobsonia*, except for greater proclivity of symphyseal region and rather stronger development of angular region; condyle nearly at level with alveolar line.

*Dentition* (figs. 78, 79).  $\frac{i^2 c p^1 p^3 p^4 m^1 m^2}{i_2 c p_1 p_3 p_4 m_1 m_2 m_3} \times 2 = 30$ . Dental formula as in *Dobsonia*, except for presence of  $p^1$ .

$i^2$  \* unusually proclivous, in front view obliquely bilobed (compare *Dobsonia*), inner (medial) lobe hook-like and much longer than outer; posterior basal ledge strongly developed, making antero-posterior at least equal to transverse diameter of crown.  $i_2^*$  rudimentary, styliform, closely wedged in between canines (as in *Dobsonia*), perhaps deciduous (in the single skull known only one lower incisor is present, see fig. 78). Upper canines proclivous, short and heavy as in *Dobsonia*, but with a strong secondary cusp from posterior edge reaching to middle of crown; cingulum well-developed. Lower canines proclivous, situated at extremity of jaw, nearly in contact with each other, both in position and general shape recalling those of *Dobsonia*, but with a strong secondary (cingulum) cusp at lower half of outer edge and a smaller one at middle of inner edge.

$p^1$  small, slightly bicuspidate, the larger anterior cusp ( $e$  in fig. 79) probably corresponding to outer cusp of  $p^3$ , the smaller posterior ( $pe$ ) to postero-external cusp of  $p^3$ .  $p^3$  remarkably similar in structure to  $p^3$  of *Dobsonia*; outer ( $e$ ) and inner cusp ( $i$ ) separated at tip, a small but quite distinct postero-external basal cusp ( $pe$ ), and a low and narrow antero-internal basal ledge ( $a$ ), the rim of which tends to develop one or two minute cusps. Essentially the same elements reoccur in  $p^4$ , but more highly differentiated; the outer cusp, which is simple in  $p^3$ , is in  $p^4$  by a sharp but not very deep notch split into two cusps ( $e^1$ ,  $e^2$ ), there is a faint trace of a similar splitting of the inner cusp ( $i$ ), the antero-internal basal ledge ( $a$ ) is somewhat heavier and its rim raised into a distinct though small cusp, the postero-external basal cusp ( $pe$ ) as in  $p^3$ , but the posterior (or rather postero-internal) corner of the tooth has developed a conspicuous cusp ( $pi$ ).  $m^1$ , again, is essentially similar to  $p^4$ , but a little more complicated; there are four cusps along the external edge, the two anterior and largest ( $e^1$ ,  $e^2$ ) being the bifid outer cusp, the fourth ( $pe^1$ ) the postero-external basal cusp, while the third ( $pe^2$ ) is a small supplementary cusp

\* The homologies of the single pair of upper and lower incisors of *Harpyionycteris* have been determined by comparison with its nearest relative, *Dobsonia* (see p. 452, footnote).

wedged in between  $e^2$  and  $pe^1$  (in the single skull known much smaller on right than on left tooth); along the inner edge of the tooth there are three cusps: the anterior ( $i$ ) is the undivided inner cusp, the posterior ( $pi$ ) the postero-internal basal cusp, while the middle one ( $s$ ) is a surface cusp arising from the crown near its inner edge (compare development of surface cusps in *Dobsonia*); the antero-internal basal ledge ( $a$ ) is reduced to a mere rudiment.  $m^2$  is similar in structure to  $m^1$ , but smaller, and with scarcely any trace of the cusps lettered in  $m^1$   $pe^1$ ,  $pe^2$ , and  $a$  (but  $pi$  is relatively larger, perhaps because representing in reality the fused  $pe$  and  $pi$ ).

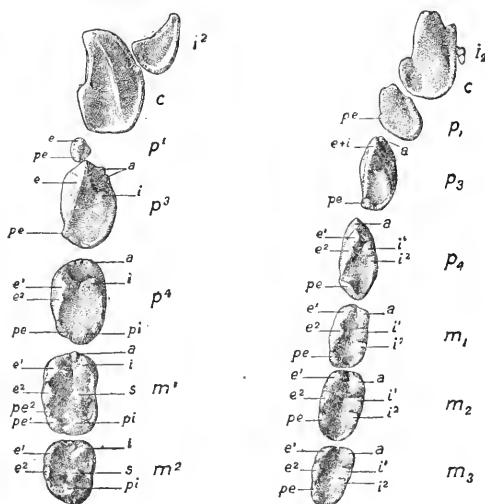


Fig. 79.—*Harpyionycteris whiteheadi*, type of species. Right upper and left lower tooth-row. For explanation of lettering see text. ♂.

$p_1$  relatively large, about two-thirds or three-fourths the bulk of  $p_3$ , and as high as posterior supplementary cusp of canine; it has a broad inner ledge (transverso greater than longitudinal diameter of tooth) and a small postero-external basal cusp ( $pe$ ).  $p_3$  has the outer and inner cusp completely fused ( $e+i$ ), a small anterior ( $a$ ) and a small postero-external basal cusp ( $pe$ ). In  $p_4$  the outer and inner cusps are separated at tip; the outer cusp is by a sharp but not very deep notch divided into two ( $e^1$ ,  $e^2$ ); similarly the inner cusp ( $i^1$ ,  $i^2$ ); anterior ( $a$ ) and postero-external basal cusp ( $pe$ ) as in  $p_3$ , but larger.  $m_1$  shows three cusps along outer, and three along inner edge; the two anterior of the outer set ( $e^1$ ,  $e^2$ ) are

the bifid outer cusp, the posterior (*pe*) the postero-external basal cusp; the anterior of the inner set (*a*) is probably the anterior basal cusp, which in all lower molars has moved from the anterior to the antero-internal corner of the teeth\*, the two posterior (*i*<sup>1</sup>, *i*<sup>2</sup>) represent the bifid inner cusp. *m*<sub>2</sub> is similar in structure and size to *m*<sub>1</sub>. *m*<sub>3</sub> smaller than *m*<sub>2</sub>, but not differing in structure.

*Palate-ridges*.—Unknown.

*External characters*.—Nares prominent, subtubular, as in *Dobsonia* and many other Fruit-bats. Ears moderate, somewhat broadly rounded off above. Tibiæ shorter than in any other Fruit-bat, between one-third and one-fourth of forearm, only a little longer than foot with claws. Interfemoral nearly obsolete in centre; calcar present. Membranes arising from sides of dorsum, and inserted posteriorly on first phalanx of second toe (or junction of first and second toes, as in *Dobsonia*). Second digit with claw; third metacarpal longer than fifth, which is a little longer than fourth, as in *Dobsonia*, but total length of these digits considerably increased (as compared with *Dobsonia*) chiefly by a lengthening of the metacarpals and proximal phalanges (see table below, giving in upper row the wing-indices of *Harpyionycteris*, in lower row those of *Dobsonia* for comparison). Fur of upperside (in single species known) extending on proximal three-fourths of forearm and the whole of the tibia and foot; colour brownish above, dull drab beneath; size as *Dobsonia minor*.

Forearm.	Pollex c. u.	2nd digit.			3rd digit.			4th digit.			5th digit.		
		Mtc.	1st ph.	2-3 ph.†	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.	Mtc.	1st ph.	2nd ph.
1000	400	442	139	158	697	528	655	661	430	436	673	352	352
1000	375	430	111	69	621	456	646	568	390	421	586	311	359

*Habits*.—Unknown.

*Affinities*.—*Harpyionycteris* has no closer relative among living Fruit-bats than *Dobsonia*. So evident is the intimate phylogenetic connection between these two genera that *Harpyionycteris* may be said, almost with certainty, to be the peculiarly modified Philippine representative of the Austro-Malayan *Dobsonia*. It follows that the present genus ought to be classed in the subfamily *Pteropodinae*, immediately after *Dobsonia*, and it would have been so here, if not for the fact that the plan of this Catalogue (subdivision into sub-

\* It looks as if the three inner cusps in *m*<sub>1</sub>, *m*<sub>2</sub>, and *m*<sub>3</sub> of *Harpyionycteris* were simply the tricuspidate inner ridge of the ordinary Megachiropteran molar; a comparison with *m*<sub>1</sub> of *Dobsonia* renders it probable, however, that only the two posterior cusps (*i*<sup>1</sup>, *i*<sup>2</sup>) represent the inner ridge, while the anterior cusp (*a*) is in reality a cusp developed from the antero-internal basal ledge.

† In *Harpyionycteris* with claw.

families) had to be outlined before all the genera and species of Fruit-bats had been worked out in detail by the writer.

If the extremity of the rostrum and mandible of the *Harpyionycteris* skull were covered from view, it would be difficult to point out any cranial character of generic importance to separate it from *Dobsonia*; the *Harpyionycteris* skull is more delicately built, but the general shape as well as all important details (form of brain-case, form of rostrum as far forward as the tip of the nasals, form of postdental palate, position of all foramina, deflection of basi-cranial axis) are unmodified. The dental formula is the same in both genera, except for the loss of  $p^1$  in *Dobsonia*; in both one pair of upper and lower incisors ( $i^1$  and  $i_1$ ) have been suppressed; in both the lower canines have moved forward to the extremity of the jaw, so as to be quite or nearly in contact with each other and leaving only a very narrow space for the rudimentary lower incisor; in both the peculiar shape of the upper incisor (bifid, with inner lobe longer) is essentially the same, only the inner lobe in *Harpyionycteris* is still longer and more hook-like. The external appearance of the two genera is very different indeed, but the difference is due chiefly to the peculiar modification of the notopatagium of *Dobsonia* (naked and continuous across the back); the unimportance of this character for a determination of the probable affinities of a genus is exemplified by *Notopterus*, a Fruit-bat which, though similar to *Dobsonia* in the development of the notopatagium, is undoubtedly closely related to the normal-winged *Melonycteris* and *Nesonycteris*; in the insertion of the membranes on the hind feet *Harpyionycteris* does not differ from *Dobsonia*, and also the relative length of the metacarpals (third longest, fourth shortest) is the same in both; curiously enough, one of the Fruit-bats which approach most closely to *Harpyionycteris* in the shortness of the tibia is the most primitive species of *Dobsonia*, *D. minor* (see p. 460); in many specimens of *Dobsonia* the crown immediately in front of the ears is shaded with a darker colour, and this darker tinge continued backward on the occiput as a more or less distinct short median line; a similar colour pattern reoccurs in *Harpyionycteris*.

The principal modifications which have taken place in the development of *Harpyionycteris* from a *Dobsonia*-like stock are these:—The upper incisors and upper and lower canines are slanted strongly forward; the inner, hook-like lobe of the upper incisor has produced a secondary cusp on the inner edge of the lower canine against which it bites; the low secondary (cingulum) cusp on the external edge of the lower canine is produced by the action of the powerful upper canine against this portion of the tooth: hence the tricuspidate shape of the lower canine; the secondary cusp on the posterior edge of the upper canine acts against the large  $p_1$ ; the fusion of the premaxillæ anteriorly has made the rostrum firmer. In *Dobsonia* there is a pronounced tendency to a development of antero-internal and postero-external basal ledges (cusps) in the cheek-teeth, to a development of surface cusps, and to a splitting of



the outer and inner ridge of certain cheek-teeth into two or more separate cusps (see pp. 450-452); these tendencies it is which have been further developed in *Harpyionycteris*, as explained above in the description of the dentition of this genus.

### 1. *Harpyionycteris whiteheadi*, *Thos.*

*Harpyionycteris whiteheadi*, *Thomas, Ann. & Mag. N. H.* (6) xviii. p. 244 (1 Sept. 1896: Mindoro); *Trouessart, Cat. Mamm.* i. p. 85, n. 455 c\* (1897); *Thomas, Trans. Z. S.* xiv. pt. vi. p. 384, pl. xxx. fig. 1 (animal), pl. xxxv. figs. 1-4 (skull; teeth) (1898: type specimen); *Matschie, Megachir.* p. 70 (1899); *Sanchez, An. Soc. Esp. N. H.* xxix. p. 276 (1900); *Trouessart, Cat. Mamm., Suppl.* p. 61, n. 541 (1904); *Miller, Fam. & Gen. Bats*, p. 78 (1907).

*Fur*.—Forearm clothed above for proximal three-fourths or four-fifths; upperside of tibia and metatarsus covered with long and dense fur, extending more thinly on toes to claws. Length of fur, back 6 (general mass of hair) and 13 mm. (longest hairs), middle of breast 3 and 9.

*Colour* (type, unsexed, December).—General colour of back Prout's brown, becoming paler, more drab-brown on nape of neck and head; individual hairs uniform from base to tip. Circumocular region and a somewhat ill-defined T-formed mark on crown (cross bar immediately in front of ears, vertical bar along median line of occiput) darker brown. Underparts paler than back, drab-brown, warmer in tinge on breast and belly, palest on foreneck.

*Measurements*. On pp. 806-808.

*Specimen examined*. The type, in collection, is the only specimen on record.

*Range*. The island of Mindoro, Philippines, alt. 5000 feet.

a. Ad. sk.; Mindoro, Philippines, 5000'; J. Whitehead [C.]. 97.5.27.  
skull. Dec. 1895. (Type of species.)

## Melonycteris, Nesonycteris, Notopteris, and Harpyionycteris: External measurements.

	<i>M. melanops</i> , 4 ad. Bismarck Arch.		<i>N. woodfordi</i> , 3 ad. Shortland; Fauro; Guadalcanar.		<i>N. macdonaldi</i> , 2 ad.		<i>N. neocaledonia</i> , 3 imm. Cotypes. New Caledonia.		<i>H. whiteheadi</i> , Ad. Type. Mindoro.	
	MIN.	MAX.	MIN.	MAX.	♂ ad. Fiji.	♂ ad. Ancieum.	MIN.	MAX.		
Forearm .....	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Pollex, total length, c. u. ....	57.5	63	52	53.5	68.5	65.5	56.5	59	82.5	
" metacarpal .....	23.5	24	21	23.5	26	25.5	23.5	25	33	
" 1st phalanx .....	6	6.5	6	6	7	6.5	6.5	7.5	11	
" 2nd digit .....	11.5	14	10	12	14.5	13	12.5	13	15	
" 1st phalanx .....	29	33	27	30	35.5	32.5	29	30.5	36.5	
" 2nd phalanx .....	7	8.5	6.5	8	10	9	6.5	7	11.5	
" 2nd-3rd phalanx * .....	8	8.5	5	6.5	4.5	4	2.5	3.5	13	
3rd digit, metacarpal .....	43	46	39	41	48	46	38	40.5	57.5	
" 1st phalanx .....	31.5	34.5	29	32	37.5	36	29.5	30.5	43.5	
" 2nd phalanx .....	44	45	38.5	41	51.5	52	40.5	43	54	
4th digit, metacarpal .....	41.5	44	38.5	41	46	42.5	36.5	38.5	54.5	
" 1st phalanx .....	25	27	23	26	32	32	24.5	26.5	35.5	
" 2nd phalanx .....	24.5	25.5	24	...	33	33.5	25.5	27	36	
5th digit, metacarpal .....	45	47	41	43.5	48	47	39.5	41.5	55.5	
" 1st phalanx .....	19	20	17	20	24.5	23.5	19	20.5	29	
" 2nd phalanx .....	21.5	22.5	18	20	23	25	18	19	29	
Ear, length from orifice .....	15	16.5	12.5	12.5	...	15.5	14.5	15.5	...	
" greatest breadth, flattened .....	11.5	12.5	9	9	...	10.5	10.5	10.5	...	
Tail .....	...	...	...	...	...	58	55.5	58	...	
Tibia .....	22	25	21	22	35	35	29	32	24.5	
Foot, c. u. ....	18.5	21	19	19.5	...	22	20	22.5	23	
Calcaneus .....	5	6.5	4	4	...	4.5	3.5	3.5	4.5	

\* In *Melonycteris* and *Harpyionycteris* including claw.

	<i>M. melanops</i> , 4 ad. Bismarck Arch.		<i>N. woodfordi</i> , 3 ad. Shortland; Fauro; Guadalcanar.		<i>N. macdonaldi</i> , 2 ad.		<i>N. neocaledonia</i> , ♂ imm. Cotype. New Caledonia.		<i>H. whitheadi</i> , Ad. Type. Mindoro.	
	MIN.	MAX.	MIN.	MAX.	♂ ad. Fiji.	♂ ad. Aneiteum.	mm.	mm.	mm.	mm.
Skull, total length .....	33.8	36	32	34	37.2	37.5	34.5	43 *	...	...
" condylo-basal length .....	31	...	30.5	...	...	15	31.8	...	18	16
" palation to incisive foramina .....	13.8	14.8	13.8	14.7	...	14.7	...	...	10	10
" palation to basion .....	14	14.5	12.8	...	...	12.6	11.7	...	16.7	24
" rostrum, length orbit to nares .....	11.2	12.2	11.5	12.2	11.8	13.8	...	...	11.6	9.5
" brain-case, width at zygomatica .....	13.2	14.2	13	13	14.3	19.8	7.2	7.8	7.8	6
" zygomatic width .....	19.8	20.5	19	19.5	...	8	6.2	6.5	...	...
" across crowns of m <sup>2</sup> , externally .....	8.5	9	8	8.8	7.7	8	...	...	...	...
" lachrymal width .....	8.7	9	7.8	8.3	8.8	8.8	7.2	7.8	...	6
" across crowns of canines, externally .....	7.8	8.5	7	7.7	7.7	7.2	7	...	...	...
" postorbital breadth .....	7	8.2	7.2	7.5	7.8	7.8	...	...	...	...
" interorbital breadth .....	7	7	6.5	6.8	7.2	7.6	...	...	...	...
" mesopterygoid fossa, width .....	4.5	4.7	3.8	3.8	3.8	4	...	...	...	...
" between p <sup>1</sup> -p <sup>4</sup> .....	7	6.7	5.5	5.8	5.6	5.2	...	...	...	...
" between bases of canines .....	5	5.2	4.2	4.5	4.5	4.5	4.2	...	...	...
" orbital diameter .....	7.7	7.8	7.5	7.7	7.2	7.2	6.8	...	...	...
Mandible, length from condyle .....	24.2	25.8	23.5	24.8	25.5	25.2	23.8	...	...	...
" symphysis, length .....	6.4	7	5.5	6.5	5.8	5.8	...	...	...	...
" coronoid height .....	12	12.8	10.7	11	8.5	8.6	...	...	...	...
Upper teeth, c-m <sup>2</sup> , crowns .....	10.8	12.3	10.8	11.6	10.8	11	10	...	16.5	17.8
Lower teeth, c-m <sup>3</sup> , crowns .....	12	13.6	12.5	13	12	12.2	11.2	...	19.2	19.2

\* Approximate measurement.

## Melonycteris, Nesonycteris, Notopteris, and Harpyionycteris: Measurements of teeth.

	<i>M. melanos.</i> 4. Bismarek Arch.		<i>N. woodfordi.</i> 3. Shortland; Fauro; Guadalemar.		<i>N. macdonaldi.</i> 7. Pijis; Aneiteum.		<i>N. neocaledonica.</i> Cotype. New Caledonia.		<i>H. whitclendi.</i> Type. Mindoro.	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	mm.		mm.	
p <sup>1</sup> , length .....	0.4	0.5	0.4	0.5	...	...	...		1.1	
" width .....	0.3	0.4	0.3	0.4	...	...	...		0.9	
p <sup>2</sup> , length .....	1	1.3	1.1	1.2	1.5	1.7	1.5		3	
" width .....	0.7	0.7	0.5	0.6	0.5	0.6	0.6		2	
p <sup>3</sup> , length .....	1.3	1.5	1.2	1.3	1.6	1.9	1.6		3.1	
" width .....	0.8	0.9	0.8	0.8	0.7	0.8	0.7		2.1	
m <sup>1</sup> , length .....	1.5	1.7	1.5	1.5	1.5	1.8	1.5		3.3	
" width .....	0.9	1	0.9	1	0.7	0.9	0.8		2.2	
m <sup>2</sup> , length .....	1.2	1.5	1.1	1.1	1.2	1.6	1.2		2.3	
" width .....	0.8	0.9	0.7	0.8	0.7	0.9	0.8		2	
p <sub>1</sub> , length .....	0.8	1	1	1	...	...	...		1.8	
" width .....	0.6	0.7	0.6	0.6	...	...	...		1.7	
p <sub>2</sub> , length .....	1	1.3	1	1.2	1.7	2.2	1.9		2.6	
" width .....	0.7	0.7	0.5	0.6	0.6	0.7	0.5		1.5	
p <sub>3</sub> , length .....	1.1	1.3	1.1	1.3	1.5	1.9	1.5		2.8	
" width .....	0.7	0.7	0.7	0.7	0.5	0.7	0.5		1.6	
m <sub>1</sub> , length .....	1.3	1.6	1.5	1.5	1.5	1.7	1.4		2.7	
" width .....	0.7	0.8	0.7	0.8	0.6	0.8	0.7		1.7	
m <sub>2</sub> , length .....	1.2	1.3	1.3	1.4	1.5	1.7	1.6		2.7	
" width .....	0.8	0.8	0.8	0.8	0.7	0.8	0.8		1.7	
m <sub>3</sub> , length .....	0.8	0.9	0.6	0.8	1.1	1.5	0.8		2.5	
" width .....	0.6	0.7	0.5	0.6	0.7	0.8	0.8		1.7	

## ADDENDA AND CORRIGENDA.

Page 10. *Eidolon helvum*.

Between lines 44 and 45, add to synonymy of species :—

*Pteropus flavus*, Illiger, *Abh. Ak. Berlin*, 1804-11, pp. 90, 98 (1815)  
(nomen nudum).

## Page 22 (footnote).

The name *Cynonycteris gaillardi* dates from Trouessart, *Cat. Mamm.* p. 1277, no. 444 B (1899).

## Page 23.

Line 45, for *Dobsonia paliata* read *Dobsonia peroni*.

## Page 25.

Part of the Synopsis of the Species of *Rousettus* should be modified as follows, to include the two forms described below, *R. shortridgei* and *R. minor*:—

- c<sup>2</sup>. m<sub>3</sub> elliptical (about twice as long as broad).  
 a<sup>3</sup>. Forearm 79-87·5 mm.  
 a<sup>4</sup>. p<sup>1</sup> not deciduous; fur on nape and shoulders not thinner than usual; forearm 80·5-87·5 mm. (India; Himalayas; Indo-China) . . . . . *R. leschenaulti*, p. 35.  
 b<sup>4</sup>. p<sup>1</sup> deciduous; nape and shoulders semi-naked; forearm 79-85·5 mm. (Ceylon) . . . . . *R. seminudus*, p. 38.  
 b<sup>3</sup>. Larger (forearm about 91 mm.), with broader rostrum and palate. (Java) . . . . . *R. shortridgei*, p. 811.  
 d<sup>4</sup>. m<sub>3</sub> subcircular, oval, or elliptical oval (breadth from five-sixths to two-thirds of length) . . . . . *R. amplexicaudatus*.  
 c<sup>3</sup>. Cheek-teeth not broader than usual; forearm 77-87 mm. (Indo-Malaya, excl. Java) . . . . . [p. 40.  
*R. a. amplexicaudatus*,  
 d<sup>3</sup>. Cheek-teeth not broader than usual; forearm 73-81 mm. (Java) . . . . . *R. a. minor*, pp. 43, 811.  
 e<sup>3</sup>. Cheek-teeth averaging broader; size as foregoing. (Austro-Malaya) . . . . . *R. a. brachyotis*, p. 44.

Page 29. *Rousettus leachi*.

Between lines 11 and 12, add the following note:—

*Rousettus sjöstedti*, Lönnberg; 1908.—Type locality, Mkulumusi caves, near Tonga, German East Africa, obtained during Professor Yngve Sjöstedt's Kilimandjaro-Meru Expedition; type in the Stockholm Museum. Described as "most nearly related to *Rousettus angolensis*," owing to the presence of only "three anterior complete, and three posterior mesially interrupted" palate-ridges, but "in addition to these there is a rudiment of a fourth interrupted fold on one side between the last and next last."—By the courtesy of Prof. Dr. Einar Lönnberg the writer has had the type for examination. It is an immature, probably nearly full-grown female, forearm 85 mm. The number of palate-ridges in *R. leachi* is normally  $4+3+1$ , but, as pointed out elsewhere (*antea*, p. 27), the fourth ridge is in some individuals interrupted in the middle, producing the formula  $3+4+1$ ; such is the case in the type of *R. sjöstedti*, but the sixth (the third divided) ridge, though complete on the right side, is on the left not quite distinctly separated from the fifth ridge. This is in fact the only peculiarity of the specimen; in every other respect (skull, dentition, external characters) it is indistinguishable from Cape Town (type locality) and Knysna specimens of *R. leachi*, and it has none of the special characters of *R. (Lissonycteris) angolensis*. The type was taken in a cave swarming with *R. leachi* (nine of which were brought home by Sjöstedt's expedition, and by Lönnberg rightly identified with *R. leachi*); and since the pages of the present Catalogue dealing with *R. leachi* were printed off, the British Museum has received from Dr. S. L. Hinde four perfectly normal specimens of *R. leachi* from Shimoni, nr. Mombasa (9.6.12.1–2 and 5–6), and through the Rudd Exploration one from Mt. Elgon (10.4.1.8). The range of the species is therefore now known to extend from the Cape Colony northward to British East Africa (compare *Epomophorus w. wahlbergi*, p. 526).

Page 36. *Rousettus leschenaulti*.

Add to synonymy, between lines 14 and 15:—

*Pachysoma* affine, *Fitzinger*, *SB. Ak. Wien*, lx. Abth. i. p. 652 (1870).

And between lines 21 and 22:—

*Pteropus taraiyensis*, *Gray (ex Hodgson's Icon. ined.)*, *Cat. Hodgson Coll.*, 2 ed. p. 2 (1863: Seligori) (nomen nudum).

Pages 38–39. *Rousettus seminudus*.

The first description of "*Pteropus seminudus*" was published by Kelaart in *J. Ceylon Branch R. As. Soc.* ii. p. 329 (1850) (first occurrence, as a *nomen nudum*, same volume, p. 316). Kelaart, not

Gray, should therefore stand as the author of the name. The type of the species (Mt. Lavinia, Ceylon, given to Kelaart by the Rev. Dr. Macvicar) is in the Calcutta Museum. The British Museum specimen 52.5.9.10 is a metatype.

Page 39.

Add the following species :—

5 bis. *Rousettus shortridgei*, *Thos. & Wrought.*

*Rousettus shortridgei*, *Thomas & Wroughton*, *Abstr. P. Z. S.* n. 68, p. 19 (23 March, 1909: prelim. description); *ibid.*, *P. Z. S.* 1909, p. 374 (Aug. 1909: Kaliputjang).

*Diagnosis*.—Allied to *R. leschenaulti*, but larger, and with relatively conspicuously broader rostrum and palate. *Hab.* Java (thus far known only from Kaliputjang).

$m_3$  elliptical, almost twice as long as broad (as in *R. leschenaulti*; in *R. amplexicaudatus* and allied forms oval or elliptical oval, *i. e.* breadth of tooth equal to from two-thirds to five-sixths its length).

Skull, total length 42.5 mm. (in *leschenaulti* 37–41.5), across crowns of  $m^2$ – $m^2$  12.8 (11–12), least breadth between  $p^4$ – $p^4$  7.8 (5.8–6.3),  $c$ – $m^2$  (crowns) 16.3 (14–15.7), forearm 91 (80.5–87.5), third metacarpal 59 (49–54). For more detailed measurements of both species see pp. 829–831.

*Colour* (type, ♂ ad. skin, March).—Essentially as *R. leschenaulti*. Back dark brown, approaching mummy-brown, with paler bases to the hairs; rump and nape of neck much paler than back, almost wood-brown; head similar to back or rather darker. Fore-neck isabella; neck-tufts very small and scarcely differing in colour from surrounding fur; breast and belly dull broccoli-brown, flanks suffused with pale fawn.

*Remarks*.—This is the largest eastern species of *Rousettus*, hence easily distinguished from the other form of the genus inhabiting Java, *R. minor*, which is one of the smallest.

α. ♂ ad. sk.; Kaliputjang, Tji-Tandui R., W. E. Balston, Esq. 9.1.5.67.  
skull. S. Java; 5 Mar. 1908 [P.].  
(Guy C. Shortridge). (Type of species.)

Page 43. *Rousettus minor*.

The following is a description from fresh material (see p. 44, footnote, and list of specimens *infra*) of this hitherto imperfectly known form :—

*Diagnosis*.—As *R. amplexicaudatus*, but averaging in every respect conspicuously smaller. Similar in size to (or averaging very little larger than) *R. brachyotis*, which however differs by the greater average breadth of its cheek-teeth (particularly  $p^4$ ,  $m^1$ ,  $p_1$ ,  $m_1$ , and  $m_2$ ). *Hab.* Java.

Subjoined a few comparative measurements of the three forms (for more detailed measurements see tables, pp. 829-831):—

	<i>R. amplexicaudatus</i> , 10 skulls, 10 specim.			<i>R. minor</i> , 11 skulls, 18 specim.			<i>R. brachyotis</i> , Type and topotype.	
	MIN.	MED.	MAX.	MIN.	MED.	MAX.	MIN.	MAX.
Skull, total length .....	35	37.8	39	34	35.6	37	...	36.2 mm.
Mandible, from condyle .....	27	29.2	31.2	26.7	28	29	26	28.5 „
c-m <sup>2</sup> , crowns .....	12.8	13.6	14.2	12	12.7	13.3	11.8	13 „
m <sup>1</sup> , length .....	2.5	2.65	2.8	2.2	2.5	2.8	2.3	2.8 „
„ breadth .....	1.6	1.7	1.8	1.5	1.7	1.8	1.9	2 „
Forearm ... ..	77	81.7	87	73	76.9	81	73.5	75 „
Ear, from orifice .....	18.5	18.9	19.5	16	17.1	18	16	16 „

Membranes inserted in some individuals on postaxial side of first metatarsal, in others between first and second metatarsal or even distinctly on dorsal side of second.

*Colour* (skins, Kaliputjang, February and March: five males, six females, all fully adult).—Essentially as in *R. amplexicaudatus*, but colour of underparts perhaps averaging paler (the material of *R. amplexicaudatus* from Sumatra and Borneo available for comparison is unsatisfactory). General colour of back some tinge of dark and dull brown slightly varying individually, sometimes approaching to dark Prout's brown, sometimes to dark mummy-brown, sometimes again to brownish bistre; individual hairs often narrowly tipped with hair-brown or drab, particularly in shoulder region and on forearms; fur of nape of neck and rump wood-brown narrowly tipped with dark brown. Head similar in colour to back or slightly darker. Neck-tufts (males only) varying from deep tawny-olive to deep tawny, always narrowly tipped with a colour similar to that of surrounding fur (therefore in the arranged fur only little, or not at all, contrasting with colour of neck). Underparts paler than back, some tinge of drab, broccoli-brown, or pale hair-brown, often delicately suffused with isabella or isabella wood-brown on sides of belly.

Immature, but nearly full-grown, individuals are similar in colour to adults. Half-grown individuals are dark brown above lightened with hair-brown tips to the hairs, uniform dark greyish beneath.

*Remarks*.—The three forms compared with each other in the above description are so intimately interrelated as to be distinguishable only by average characters; they are evidently local forms of one species, and ought to stand, respectively, as *R. amplexicaudatus amplexicaudatus* (Indo-Malaya generally, excluding Java), *R. a. minor* (Java), and *R. a. brachyotis* (Austro-Malaya).

*Rousettus* may now be added to the list of genera which bear evidence of the dual origin of the Mammalian fauna of Java. Java is the only East Indian island known to be inhabited by two species of the present genus: one of these, *R. shortridgei*, is closely related to the Indian and Indo-Chinese *R. leschenaulti* (a type of



the genus not represented elsewhere in Indo-Malaya), but apparently sufficiently well differentiated to be considered a distinct species; the other, *R. a. minor*, is, as noted above, a local form of the Indo-Malayan *R. amplexicaudatus*.

- a-o.* 6 ♂ ad., 3 ♂ imm., 5 ♀ ad., 1 ♀ imm. sks.; skulls. Kaliputjang, Tji-Tandui R., S. Java, 28 Feb.—5 Mar. 1908 (*Guy C. Shortridge*). W. E. Balston, Esq. [P.]. 9.1.5.52-66.
- p-y.* 3 ♂ ad., 1 ♂ imm., 4 ♀ ad., 2 ♀ imm. al. Kaliputjang (*G. C. S.*). W. E. Balston, Esq. [P.]. 9.1.5.868-876 bis.

Page 49.

Add the following species:—

#### 10. *Rousettus (Stenonycteris) kemp*i, *Thos.*

*Xantharpyia ægyptiaca* (*nec Geoff.*), *Horsfield, Cat. Mamm. Mus. E. Ind. Co.* p. 29 (1851: Abyssinia).

*Eleutherura ægyptiaca* (pt.), *Gray, Cat. Monk. &c.* p. 117 (1870: Abyssinia).

*Cynonycteris ægyptiaca*, *Dobson, Cat. Chir. B. M.* p. 75, specimen *e* (1878: Abyssinia).

*Cynopterus (Cynonycteris) ægyptiaca* (pt.), *Trouessart, Rev. & Mag. Zool.* (3) vi. p. 206 (1878).

*Rousettus ægyptiacus* (pt.), *Trouessart, Cat. Mamm., Suppl.* p. 60 (1904).

*Rousettus kemp*i, *Thomas, Ann. & Mag. N. H.* (8) iv. p. 543 (1 Dec. 1909: Kirui, Mt. Elgon).

*Diagnosis.*—Similar to *R. (S.) lanosus* (Ruwenzori), but dentition conspicuously heavier (see measurements, p. 831), and fur of back, rump, and interfemoral more lightened with greyish. *Hab.* So far known only from Shoa and Mt. Elgon.

In every respect a genuine *Stenonycteris* (cheek-teeth narrow,  $m_2$  reduced, brain-case much deflected, wings from second toe, fur long), but with the cheek-teeth less reduced, both in length and breadth, than in *R. (S.) lanosus*; in length the cheek-teeth (except  $m_2$ ) are practically equal to those of *R. leachi*, but they are considerably narrower. Palate-ridges 4+3+1. Size probably as *lanosus* (the three specimens known of *R. kemp*i are all more or less immature; forearm of type 85.5 mm.).

- a.* Subad. sk.; skull. Shoa. Sir W. Cornwallis Harris [C.]. 61.2.30.6.
- b, c.* ♂ subad., ♀ juv. sks.; skulls. Kirui, Mt. Elgon. B. East Africa, 6000'. C. D. Rudd, Esq. [P.]. 10.4.1.6, 7. 16 Sept. 1909 (*R. Kemp*). (10.4.1.6, ♂ subad.: *Type of species.*)

#### Pages 49–51. *Rousettus (Stenonycteris) lanosus*.

Page 49, line 1, for “10” read “10 bis.” Same page, delete lines 2–11 (synonymy, belonging to the recently described *Rousettus (S.) kemp*i).

Page 51, line 2, delete “Shoa.” Same page, delete lines 14–15 (the Shoa specimen, which is referable to *Rousettus (S.) kemp*i).

Page 54.

Add the following species :—

11 bis. *Rousettus (Lissonycteris) smithi*, Thos.*Rousettus smithi*, *Thomas, Ann. & Mag. N. H.* (8) ii. p. 375 (1 Oct. 1908: Sierra Leone).

*Diagnosis*.—As *R. (L.) angolensis*, but much smaller, with  $m^2$  and  $m_3$  more reduced (about half the size, in *angolensis* about two-thirds, of respectively  $m^1$  and  $m_2$ ), and the fur considerably shorter and extending more thinly on proximal half of tibia, leaving distal half practically naked. Forearm about 70 mm. (about 78–83 in *angolensis*; for detailed measurements of both species see pp. 832–834); fur of back 6.5 (general mass of hair) and 10 mm. (longest hairs); in *angolensis* the corresponding measurements are 8–11 and 13–15. *Hab.* Guinea Coast; so far known with certainty only from Sierra Leone and Nigeria, but the specimens of “*angolensis*” recorded in literature from Togo (see *antèa* p. 51) may belong to the present species.

*Colour* (type, ♀ subad.).—Duller brown, less suffused with burnt umber or vandyck-brown, on upperside than in the fully adult *R. (L.) angolensis*, but closely approaching an immature skin of the allied species (7.7.8.24). Back and rump dull fawn-brown; nape pale fawn-drab; head similar to back or perhaps more tinged with dull drab; breast and belly between hair-brown and broccoli-brown, flanks suffused with pale fawn.

*Remarks*.—One of the reasons which induced the present writer to give to *Lissonycteris (angolensis)* only the rank of a subgenus of *Rousettus*, in spite of its many and relatively important peculiar characters, was a natural reluctance to add to the already large number of monotypic genera of Fruit-bats. The discovery of a second and perfectly distinct species (*smithi*) showing exactly the same peculiar cranial and dental characters as *angolensis*, without any approximation to *Rousettus s. str.*, renders it probable that future systematists may prefer to consider *Lissonycteris* a distinct genus. Its principal differential characters are these:—Brain-case peculiarly flattened posteriorly, basicranial axis only slightly deflected, both characters giving the skull in profile a rather striking resemblance to that of *Epomophorus*; rostrum conspicuously lower, premaxillæ coossified anteriorly, their ascending branches thinner; frontal sinuses more inflated; postdental palate relatively longer; cheek-teeth shorter and broader, subsquarish, their outer and inner ridges much more cusp-like (shorter antero-posteriorly, and higher vertically), those of  $p_1$  separated (fused in *Rousettus*), those of  $m_1$ ,  $m_2$ , and  $m_3$  even slightly diverging above;  $m^1$  reduced (smaller, in *Rousettus* larger, than  $p^1$ ),  $p_1$  reduced (slightly, in *Rousettus* much, larger than  $i_2$ ). To this may be added the shortness of the tibia and the conspicuously greater length of the fingers (see p. 53). *Stenonycteris (Rousettus kempfi and lanosus)*, though forming a well-marked group, is so intimately connected

with *Rousettus s. str.* as hardly to deserve a higher rank than that of a subgenus; the gap between *Lissonycteris* and *Rousettus* is evidently much greater.

- a. ♀ subad. sk.; Sierra Leone. Canon F. C. Smith 8.9.11.1.  
skull. [P.]. (Type of species.)  
b. ♂ ad. al.; skull. South Nigeria (western A. E. Kitson, Esq. 8.10.25.1.  
province); early in [P.].  
1908.

Page 85.

Lines 26–27, delete “*hypomelanus tomesi*.”

Page 97.

Add to the species of *Pteropus* with the forearm measuring:

- 100–109 mm.:—*Pt. liops* (Amboina group), *pumilus* (Philippines).  
120–129 mm.:—*Pt. ocularis* (Amboina group).  
140–149 mm.:—*Pt. ocularis* (Amboina group).  
150–159 mm.:—*Pt. voeltzkowi* (Pemba I.).  
160–169 mm.:—*Pt. keyensis* (Key Is.), *voeltzkowi* (Pemba I.).

Page 115. *Pteropus hypomelanus lepidus*.

Line 10, delete “?”.

The range of *Pt. h. lepidus* is now known to extend over the Tambelan Islands (Saddle I., Big Tambelan I.) and the following islands along the east coast of the Malay Peninsula: Aor, Tioman, Lantinga, Great Redang, and Perhentian. For an account of the individual variations in colour and size as exhibited in a series of specimens from all these islands see the writer’s “Notes on twenty-three specimens of *Pt. h. lepidus*,” in *Journal of the Federated Malay States Museums*, iv. pp. 212–218 (Nov. 1911).

Page 119.

Add the following form:—

1 γ. *Pteropus hypomelanus robinsoni*, K. And.

*Pteropus* (*hypomelanus*) *tomesi* (nec Pet.), Kloss, *J. Fed. Mal. St. Mus.* ii. p. 153 (1908: Pulo Rumbia, Sembilan Is.).

*Pteropus hypomelanus robinsoni*, K. Andersen, *Ann. & Mag. N. H.* (8) iv. p. 534 (1 Dec. 1909: P. Rumbia).

Similar to *Pt. h. tomesi*, but mantle, breast, and belly considerably lighter in colour. The same character discriminates it from *Pt. h. condorensis*, from which it is further distinguished by the more blackish, less brown colour of the back. From *Pt. h. canus* and *lepidus* it is separable by the much darker colour of the back (greyish sprinkling thin or sometimes practically absent), the lighter colour of the mantle, breast, and belly, and the perfectly normal size of the teeth. Finally, it is easily recognizable from *Pt. h. annectens* by the much darker colour of the back.

*Range.* Thus far known only from the Sembilan Islands (Pulo Rumbia), Straits of Malacca, off the western coast of the Malay Peninsula.

a-d. 1 ♂ ad., 3 Pulo Rumbia, Sembilan Government, Federated (8.1.25.32.  
 ♀ ad. sks.; Is.; 7 Aug. 1906, 5-7 Malay States [P.]. { 9.11.1.7-9.  
 skulls. March, 1909. (9.11.1.8, ♀ ad.: *Type* of subspecies.)

Pages 120, 121. ***Pteropus hypomelanus tomesi*.**

Page 120, line 31, delete "Sembilan Islands (off N.E. Sumatra)."

Page 121, delete lines 42-46 (specimen 8.1.25.32, which is the recently described *Pt. h. robinsoni*).

Page 140. ***Pteropus griseus*.**

Add to list of specimens :—

d. ♂ juv. sk.; skull. E. Timor (*Dr. A. R. Wallace*). *Tomes Coll.* 7.1.1.250.

Page 140.

Add the following species :—

5 bis. ***Pteropus pumilus*, Miller.**

*Pteropus pumilus*, *Miller, Proc. U.S. Nat. Mus.* xxxviii. p. 394 (19 Aug. 1910: Palmas I.).

*Diagnosis.*—Similar to *Pt. griseus* (Timor, Bonerato, Dyampea), but smaller, and with the back, breast, and belly somewhat darker in colour. *Hab.* Known only from the type locality, Palmas Island, S.E. of Mindanao, Philippines.

The following measurements to show the smaller size of *Pt. pumilus*, as compared with *Pt. griseus*: forearm about 109 mm. (114.5-118 in *griseus*), third metacarpal 70.5 (79-81.5), mandible 37.5-39.2 (44), c-m<sup>2</sup> (crowns) 18.2 (21.2). For detailed measurements see the tables pp. 832-834.

*Fur.*—Distribution, length, and quality as in *Pt. griseus*. Length, at middle of back about 14 (longest hairs) and 7 mm. (general mass of hair).

*Colour* (paratype, ♀ subad. skin, U.S. N. Mus. 144759).—Very similar to specimen B.M. 97.1.3.4 (Dyampea I.) of *Pt. griseus*, as described p. 139, but a little darker on back and rather more conspicuously so on breast and belly. Back hair-brown, rather thickly sprinkled partly with silvery greyish and partly with wood-brown, the latter predominant on rump, femur, and tibia; base of fur dark slate. Breast, belly, and flanks pale mars-brown, mixed with shiny wood-brown tips to some of the hairs, particularly on centre of breast; base of fur dark slate. Mantle pale buffy, shading into deeper buff on sides of neck; hair of foreneck tipped with pale mars-brown (paler than breast); base of fur of neck everywhere dark slate. Crown and muzzle light olive-buff, conspicuously mixed

with slate-coloured hairs, the latter becoming predominant on chin and throat.

*Type and paratype*.—The type ( $\sigma$  ad., skin and skull, no. 144758) and the paratype described above, both in the U.S. National Museum, seem to be so far the only specimens on record. Only the paratype has been examined by the writer.

*Remarks*.—See *infra*, under *Pteropus liops*.

Page 164.

Add the following species :—

15 bis. *Pteropus liops*, *Thos.*

*Pteropus liops*, *Thomas, Ann. & Mag. N. H.* (8) v. p. 383 (1 Apr. 1910; Burn).

*Diagnosis*.—Very similar to *Pt. dasymallus* and *formosus*, but much (*i.e.* in every respect about one-fifth) smaller. *Hab.* Amboina group (thus far recorded only from Burn).

Skull, total length about 49.8 mm. (in *dasymallus* and *formosus* 60.2–64.2); e–m<sup>2</sup> (crowns) 18.2 (23–25), forearm 101 (125.5–137), third metacarpal 70.5 (87.5–96). See also tables of measurements, pp. 832–834).

*Fur*.—Long, dense, and silky, as in the allied species; tibia thickly covered above nearly to heel; length of fur on back 20 mm. (longest hairs) and 10 (general mass of hair).

*Colour* (type and paratypes, as catalogued below, all slightly immature).—As *Pt. dasymallus*, but head and underparts decidedly paler. Back isabella more or less conspicuously lightened with pale golden buffy wood-brown, in some specimens the isabella, in others the pale buffy wood-brown tinge predominant; base of hairs always dark brown. Breast, belly, and flanks dark isabella (isabella tinged with brown), more or less thinly lightened with pale wood-brown hair-tips. Mantle, sides of neck, and foreneck almost cream-buff with strongly contrasting concealed dark brown bases to the hairs, the cream-buff tinge shading gradually on occiput and crown into golden buff. Muzzle, sides of head, chin, and throat brownish isabella (similar to breast and belly).

*Remarks*.—The affinities of *Pt. dasymallus* (South Lin-kiu Is.) and the closely allied, perhaps not more than subspecifically distinct, *Pt. formosus* (Formosa) were hitherto somewhat obscure. Though in skull and dentition undoubtedly of the *hypomelanus* pattern, they presented some external characters (unusually heavy coat, thickly furred tibiae, peculiar coloration) not closely approached by any other member of the *Pt. hypomelanus* group. The discovery of *Pt. liops* carries the *dasymallus* type as far south as the centre of Austro-Malaya, and at the same time seems to link it more intimately to *Pt. griseus* and *pumilus*. The skull and teeth of the recently described *Pt. pumilus* (p. 816) are in every respect so similar to those of *Pt. liops* as to differ only in trivial details, while its external appearance is decidedly that of *Pt. griseus*. The

probable affinities of the five species here under discussion may be briefly summed up as follows:—*Pt. griseus* (Timor, Boncrato, Dyampea) is in the Philippine group represented by *Pt. pumilus*, and both are probably closely allied to *Pt. liops* (Amboina group), which in Formosa is represented by *Pt. formosus* and in the South Liu-kius by *Pt. dasymallus*. To these may perhaps be added, as an aberrant form of the *dasymallus* type, the Mascarene *Pt. subniger*.

*a-d.* 1 ♂ imm., 3 ♀ Kayeli, Buru; Aug. New Guinea Expe- 10.3.3.14-17.  
subad. s's.; 1909 (*Stalker*). dition [P.].  
skulls of nos. (10.3.3.16, ♀ subad.:  
14 and 16. *Type of species.*)

Page 210.

Add the following species:—

29 bis. *Pteropus voeltzkowi*, *Matschie*.

*Pteropus* (Spectrum) *voeltzkowi*, *Matschie*, *SB. Ges. nat. Fr.* 1909, p. 486 (Pemba I.).

*Diagnosis*.—Closely allied to *Pt. comorensis*, but skull differing in a few details (see below), ears much shorter, and mantle, sides of neck, and underparts much darker. Size as *Pt. comorensis*, forearm about 151-161 mm. *Hab.* Pemba Island (north of Zanzibar).

*Skull and dentition*.—General size of skull as in *Pt. comorensis*, characters the same with the following modifications: Rostrum relatively somewhat broader, postdental palate a little longer, mesopterygoid fossa conspicuously broader (8.5-9.7 mm., against 7.2-8 in *Pt. comorensis*), orbits slightly smaller (12.2-12.8, against 12.8-13.2), supraoccipital more sloping downward-and-backward (practically vertical in *Pt. comorensis*), occiput therefore more strongly tubular. Teeth scarcely differing from those of *Pt. comorensis*, not even in size.

*Palate-ridges* (examined in two individuals).—5+5+3, in one skull with an incomplete additional ridge between the ninth and tenth (*i.e.* between the fourth and fifth of the divided set).

*Ears*.—Much shorter than in *Pt. comorensis*, but not differing in shape (subacutely pointed); length from orifice 21.5-23 mm., against 31.5 in *Pt. comorensis*.

*Colour*.—Paratype (aged, Murch, skinned from alcohol, Berlin Museum): Back and rump nearly uniform blackish with a tinge of seal-brown; a few silvery greyish white hairs detectable on close examination. Breast and belly some tinge of russet or vandyck-brown, palest (approaching cinnamon-rufous) on sides of belly, darkest (very nearly vandyck-brown) on breast and middle of belly; flanks seal-brown; concealed subapical portion of hairs on breast and belly ochraceous-buff, extreme base dark brown. Mantle russet, somewhat clouded with vandyck-brown, shading into darker vandyck-brown on sides of neck and foreneck; concealed portions of hairs of mantle, sides of neck, and foreneck ochraceous-buff, extreme base seal-brown. Upside of head dark vandyck-brown,

approaching seal-brown, heavily mixed with silvery greyish buff hairs; sides of head similar, but more thinly sprinkled with pale hairs; chin and throat blackish seal-brown.

Topotype (♂ ad. skin, 9.10.14.1): Differing chiefly in the considerably lighter tinges of all the bright-coloured portions of the fur. Back blackish, shading into dark vandyck-brown on rump, femur, and lateral interfemoral. Breast and belly warm russet (tips of the hairs), with the paler ochraceous-buffy subapical portion of the fur showing through in most places; dark brown bases of hairs absent or extremely short. Mantle tawny cinnamon-rufous, this tinge becoming gradually deeper (between cinnamon-rufous and light chestnut, but still with a deep tawny gloss) on sides of neck and foreneck; bases of hairs of mantle ochraceous or ochraceous-buff, those of foreneck rather tawny-ochraceous; extreme posterior margin of mantle ochraceous, forming an almost straight transverse line across shoulders between mantle and blackish back. Occiput, crown, forehead, and sides of head similar to mantle and sides of neck, but conspicuously sprinkled with glossy ochraceous-buff hairs; muzzle, chin, and throat blackish, similarly sprinkled all over.

So far as colour is concerned the principal difference from *Pt. comorensis* is the darkening of all bright-coloured portions of the fur into cinnamon-rufous, russet, or even vandyck-brown; but this darkening of the colour is confined to the tips of the hairs, the concealed (or semi-concealed) bases or subapical portions of the mantle, breast, and belly being ochraceous or ochraceous-buff as in the related species.

*Measurements.* On pp. 832-834.

*Type* (♂ ad.) and paratypes, in the Berlin Museum, six specimens (five skulls), obtained at Fufuni, south coast of Pemba Island, by Dr. A. Völzow, 17th March, 1903. When these specimens were examined by the writer (1907), five were preserved in alcohol, one skinned from alcohol; all are aged individuals with the teeth much worn, but nearly all the teeth had dropped from their alveoli, and those of different individuals become mixed together; the measurements of the teeth on p. 834 are therefore taken only from the two British Museum skulls.

*Remarks.*—The discovery of a species of *Pteropus* in the island of Pemba, separated from the coasts of British and German East Africa by a channel only 35 to 40 miles wide, renders the fact difficult to explain that the genus thus far has never been recorded from the continent of Africa. That the Pemba species originated from the Malagasy region (*Pt. comorensis* or an allied form) is, from its cranial, dental, and external characters, scarcely open to doubt, but the nearest Malagasy islands known to be inhabited by the genus are the Comoros and the Seychelles, about 450 to 500 miles from Pemba. Only one colony of *Pteropus voeltzkowi* is said to exist in Pemba, at Fufuni, at the middle of the south coast.

a. ♂ ad. sk.; no skull.	Pemba I.	A. Gunning, Esq. [P.],	9.10.14.1.
b. c. ♂ ad., ♀ ad. al. : skulls.	Pemba I.	A. Gunning, Esq. [P.],	10.3.24.1. 2.

Page 227. *Pteropus tytleri*.

The type of this form has not been available for examination, and the original description (by Geo. E. Mason), though long and detailed enough, leaves one in doubt as to the only point of importance, viz., its differential characters as compared with *Pteropus melanotus*. Lately, however, the British Museum has received a specimen (10.7.26.1) which agrees in every respect with the description of *Pt. tytleri*, was collected on the same island (Rutland I., South Andamans), on the same date (5 March, 1907), by the same collector (B. B. Osmaston), and is of the same sex (♂ ad.), thus for all practical purposes as good as the type. This specimen is in all points (skull, dentition, external characters), except one, precisely similar to *Pt. melanotus* (Nicobar Islands); even the measurements are identically the same. The one distinguishing character is the nearly uniform dark colour of the breast and belly. In *Pt. melanotus* the centre of the breast and belly is tinged with a brighter colour (ochraceous-buff, rich tawny, or some deeper tinge), contrasting with the blackish flanks and sides of the breast and belly; but this bright-coloured area is sometimes reduced to a relatively small spot (e. g. specimen 111738, U.S. National Museum). In *Pt. tytleri* (both the type and the topotype) the bright-coloured central area is practically entirely suppressed (though, at least in the topotype, indicated by a seal-brown "wash" of the hairs); but the mantle is as pale-coloured (ochraceous-buff) as in the palest examples of *Pt. melanotus*.

After this it becomes doubtful whether the three specimens catalogued, on p. 229, as *Pt. tytleri*, and on which the description of this form as printed on pp. 227-228 was based, are really referable to *Pt. tytleri*. In those three specimens not only the underparts but the whole of the pelage, including the mantle, sides of neck, and foreneck, are blackish or seal-brown. Dobson, who had seen similar, quite or nearly uniform blackish, specimens from the Andamans and Nicobars, believed the difference to be sexual, the bright-mantled individuals, according to him, being males, those with dark mantles and underparts females; and Mason unhesitatingly accepts that view. But so far as Nicobar individuals (*Pt. melanotus*) are concerned, Dobson was almost certainly mistaken; in a series of seven fully adult skins of *Pt. melanotus* examined by the present writer, all well-preserved and properly labelled (Tillanehong, Trinkut, and Great Nicobar; U.S. National and British Museums), two are females, with the mantle and centre of breast and belly as pale, and as sharply defined against the dark-coloured portions of the fur, as in the five males; in this small series, in any case, there is no sexual (but a considerable amount of individual) difference in colour. As to the three uniform blackish specimens from the Andamans (p. 229), one is a male (immature), one a female (adult), and one (immature) of doubtful sex, showing that the blackish or seal-brown colour of the mantle and underparts is by no means characteristic of females only; and the single adult



specimen (♀, S5.8.1.98, "Andamans") is, in addition, distinctly smaller than any specimen of *Pt. melanotus* (see tables, pp. 230-231).

The present state of our knowledge of the bats of the *Pt. melanotus* group inhabiting the Nicobars and Andamans may be briefly epitomized as follows:—

(1) All specimens (ten) examined by the writer from the Nicobars (Tillanchong, Trinkut, Great Nicobar) are *Pt. melanotus*, and all are characterized by a bright mantle and a more or less extended area of bright colour on the centre of the underparts. In the series examined females are indistinguishable in colour from males. No uniform blackish specimens from the Nicobars have been seen by the writer.

(2) Four specimens have been examined from the Andamans, viz.:—

one, from Rutland I. (South Andamans), with bright mantle, but practically uniform dark underparts, this latter being the *only* point in which it differs from *Pt. melanotus*. This is "*Pt. tytlerei*." It may be a distinct species, or a local race of *Pt. melanotus*, or merely an individual variety:

three practically uniform blackish specimens, representing both sexes, two of which are labelled "Andamans," one Ross I., Port Blair, South Andamans. They might be considered without much hesitation merely melanistic varieties of *Pt. melanotus* or "*Pt. tytlerei*," if not for the fact that the single fully adult specimen differs from both not only in colour but also by its smaller size.

#### Page 246. *Pteropus keyensis*.

Subjoined a description of the colour of the fur from fresh skins, Key Islands (three males, three females; Tamogil village, Elat, and Ara, collected by W. Stalker, presented by the British New Guinea Expedition; 10.3.1.1-6):—

Adult males (two).—Back and rump cream or yellowish cream, shading into cream-grey towards membranes. Fur of breast, belly, and flanks cream with buff or pale ochraceous-buff tips to the hairs. Mantle ochraceous, sides of neck somewhat deeper in tinge; or tawny ochraceous, shading into tawny on sides of neck. Colour of mantle shading gradually into warm buff or ochraceous-buff on occiput, crown, and sides of head, this again into yellowish buff on face and throat.

Adult females (three).—Similar to males, but even paler, more silvery cream on back and rump.

Immature (one male, nearly full-grown).—Not differing in colour from adults.

Measurements (five adults).—Forearm 167-180.5, third metacarpal 116.5-129, tibia 73-77; skull, total length (from lambda) 77-81.5, condylo-basal length 75-80, orbit to tip of nasals 24.8-26.5, mandible (from condyle) 60.7-65, e-m<sup>r</sup> (crowns) 29-31.3 mm.

Page 317. *Pteropus temmincki*.

The following is a description from freshly collected topotypes (six skins, collected by W. Stalker and C. B. Kloss, presented by the British New Guinea Expedition, nos. 10.3.4.109-110 and 11.7.12.1-4) of the colour of the fur and the palate-ridges of this species:—

Adult males (four, Amboina, December and April).—General colour of back brownish isabella slightly lightened with pale wood-brown, more conspicuously so on rump, and shaded on sides of back and on tibiae with pale Prout's brown (darkest extreme); or, owing to a much stronger development of the pale element, almost buffy wood-brown, deeper (more tawny or light russet) along sides of back and on tibiae (the others); concealed base of fur in any case dark brown.—Underside of body greyish buff, yellowish buff, or cream buff, with strongly contrasting (but in the arranged fur concealed) dark brown bases to the hairs.—Mantle, sides of neck, and foreneck ochraceous buff, or cream buff, or these two tinges mixed, the ochraceous tinge, if present, confined to the extreme tips of the hairs, the subapical portion in any case buff or cream buff, the base always strongly contrasting dark brown. Occiput and crown similar to nape of neck; sides of head, chin, and throat more greyish in tinge; lores and a narrow circumocular ring dark brownish.

Adult females (two, Amboina, April).—Distinctly paler than males, but whether the difference is more than accidental is perhaps doubtful. Back shiny cream-white (one), or this colour distinctly tinged with pale isabella (the other), the creamy tinge becoming deeper along sides of back and on tibiae; base of fur dark brown.—Underside of body dull greyish white slightly washed with cream-buff; base of fur dark brown.—Mantle, sides of neck, and foreneck cream-white, lighter than back, with or without a slight buffy wash on foreneck, and with dark brown bases to the hairs. Occiput similar to mantle, but with golden buff tips to the hairs; crown cream-white or cream-buff; sides of head, chin, and throat similar, but somewhat shaded with greyish; lores and circumocular ring as in males.

*Palate-ridges* (examined in two skulls), 4 + 5 + 3, the fourth ridge either entirely undivided (one skull) or conspicuously notched at middle so as to indicate a beginning splitting (the other).

For a series of *measurements* of the topotypes see pp. 832-834.

Page 319. *Pteropus temmincki*.

Delete lines 30-31 (specimen "c"), and the reference to this specimen in the paragraph "Remarks."

Page 363. *Pteropus aterrimus*.

Extends to the Kangean Islands. Six specimens (as catalogued below) from the latter locality are indistinguishable from Bawean

specimens (types and topotypes). The amount of greyish (or perhaps rather drab wood-brown) admixture to the blackish colour of the back varies considerably individually; in some specimens it is so thin as to make the general colour of the back appear blackish, the pale sprinkling being only noticeable on closer inspection; in others so thick as to produce the general effect of a dark hair-brown. Mantle varying from light cinnamon to a tinge so dark as to approach burnt-umber.

Measurements (four adults).—Forearm 160–165, third metacarpal 109–116; skull, total length (from lambda) 70·2–75, condylo-basal length 68·5–72·2, orbit to tip of nasals 24·2–25·5, mandible (from condyle) 55–60, c-m<sup>2</sup> (crowns) 27·5–28·7 mm.

a-f. 3 ♂ ad., 1 ♂ subad., 1 ♀ ad., 1 ♀ subad. skins; skulls.	Kangean Is., Java Sea, 4'; 11, 12 Nov. 1909 ( <i>Guy</i> <i>C. Shortridge</i> ).	Oldfield Thomas, 10.4.65–10. Esq. [P.].
--	---	--

Page 379. *Pteropus conspicillatus*.

Line 46, for "Eight" read "Nine."

Page 381. *Pteropus ocularis*.

Notes on eight additional specimens of this rare species, skins with skulls, all males, five adult, three immature, collected at Kayeli, Buru, by W. Stalker, and presented by the British New Guinea Expedition (10.3.3.6–13):—

Colour of fur as described p. 381, with but inconspicuous individual variation. "Spectacles" often occupying the whole of the sides of the head (rather than forming a ring round eyes), and varying from russet through mars-brown to a darker tinge of brown (near vandyck-brown). Immature, but nearly full-grown, specimens are similar in colour to adults.

Forearm 129–141, third metacarpal 89·5–95·5, tibia 55–59·5; skull, total length (from lambdoid crest) 62·5–66·5, condylo-basal length 60·5–64, orbit to tip of nasals 20·5–22·7, mandible (from condyle) 48·5–51·2, c-m<sup>2</sup> (crowns) 24–25·7 mm.

Page 385. *Pteropus papuanus*.

The description of *Pt. papuanus*, as given on pp. 385–386, was taken from the single immature alcoholic specimen then in collection (Grange Island, Baxter Bay, S.E. New Guinea). Since then, three skins with skulls from Mimika River, Dutch New Guinea, have been added to the collection (♂ ad., ♀ ad., ♀ juv., collected near Wakatimi, by C. H. B. Grant, presented by the British New Guinea Expedition). It was not without much hesitation that the writer decided provisionally to keep *Pt. papuanus* (New Guinea) separate from *Pt. neohibernicus* (Bismarek Archipelago), and the now available fresh specimens of the former only add strength to the doubt. The only character by which *papuanus* was distinguished from *neohibernicus*,

the apparently darker colour of the back, seems to break down; the individual variation in colour is in *neohibernicus* greater than usual (see p. 388), and the new material seems to indicate a similar variation in *papuanus*. If this is confirmed by a larger series of specimens, the name *papuanus* will have definitely to be put down as a mere synonym of *neohibernicus*.

*Colour*.—♂ ad. (25 Feb. 1911, near Wakatimi, Mimika R.). Back from shoulders to pelvis practically naked; rump light buffy wood-brown at centre and posteriorly, Prout's brown anteriorly and laterally. Back of neck and occiput (as far as a line between fronts of ears) yellowish wood-brown, shading on sides of neck rather rapidly into deep russet, this again on foreneck, throat, chest, and middle of belly into deep vandyck-brown sprinkled with buffy and buff-grey hairs. Sides of belly, flanks, and crissum light buff-grey, strongly contrasting with dark brown chest and centre of belly. A narrow line of vandyck-brown separating pale nape of neck from naked back. Crown (in front of ears) and sides of head similar to throat and foreneck; muzzle practically naked.

♀ ad. (same date and place). Similar to the above described adult male, with the following differences: Dark brown colour of crown confined to a narrow median longitudinal line. No dark brown line bordering pale nape of neck posteriorly. Sides of belly, flanks, and crissum much warmer in colour, approximately wood-brown somewhat washed with pale russet.

♀ juv. (same date and place). Much darker. Back (furred along spinal tract) and rump dark vandyck-brown. Mantle and occiput russet mars-brown, changing to russet vandyck-brown on sides of neck, this again into chestnut seal-brown on foreneck. Crown (in front of ears) and sides of head dark vandyck-brown thinly sprinkled with buffy hairs. Throat and the whole of the underside of the body, from foreneck to interfemoral, seal-brown thinly sprinkled with pale, shiny hairs. (Judging from other species of *Pteropus*, there is no reason to suppose that the dark colour of this individual is due to its immaturity; it is probable that the colour would have remained essentially the same, if the animal had lived to acquire the adult pelage; but note the nakedness of the dorsum of the adults.)

*Measurements*. On pp. 832-834.

Page 406. *Pteropus scapulatus*.

Line 26, for "Nineteen" read "Twenty-one."

Page 429. *Acerodon jubatus jubatus*.

Line 2, for "Seventeen" read "Twenty."

Page 460. *Dobsonia minor*.

A specimen from Mimika River, South Dutch New Guinea (as catalogued below) is indistinguishable from the type (Amberbaki.

N.W. New Guinea). Head and back of neck brownish drab, with pale drab (fawn-drab) bases to the hairs; underside pale fawn-drab, tinged with dull tawny-olive in a small patch at centre of breast and belly.

Forearm 76.5, first digit (total length, c.u.) 33, second (metacarpal, first phalanx, second-third phalanx) 37+8+6, third 52+36+47, fourth 47+31+31, fifth 50+26.5+28, tibia 29, foot (c.u.) 22 mm.

Skull—total length 36, condylo-basal length 34.8, orbit to tip of nasals 9.8, width of brain-case at zygomata 15.5, zygomatic width 13.2, across  $m^1$ - $m^1$  externally 10.8, between  $p^4$ - $p^4$  6.5, orbit 9.5, mandible 29.2,  $c$ - $m^2$  (crowns) 14,  $c$ - $m_3$  (crowns) 15.3 mm.

$p^3$  (length, breadth)  $2.7 \times 2.2$ ,  $p^4$   $2.8 \times 2.1$ ,  $m^1$   $3 \times 1.8$ ,  $m^2$   $1.6 \times 1.2$ ,  $p_1$   $0.7 \times 0.9$ ,  $p_3$   $2.6 \times 1.0$ ,  $p_4$   $2.7 \times 2$ ,  $m_1$   $2.6 \times 1.6$ ,  $m_2$   $2.1 \times 1.4$ ,  $m_3$   $1.3 \times 0.8$  mm.

a. ♂ ad. sk.; skull, Parima, Mimika R., Dutch New Guinea, 250'; 10 Oct. 1910 (Guy C. Shortridge). New Guinea Expedition [P.]. 11.11.11.6.

#### Page 466. *Dobsonia magna*.

Additional material of *D. moluccensis* and *D. magna*, from Buru, Amboina, Ceram, and Dutch New Guinea (Mimika River), obtained during the British New Guinea Expedition, shows (as might indeed be expected) that these two very closely related forms had better be considered only subspecifically distinct. They differ only in size, and, as proved by the subjoined measurements, this difference, though in most cases conspicuous, is in the whole series only one of average. The specimens measured of *D. moluccensis moluccensis* are from Buru (2), Amboina (4), Ceram (2), and Aru Islands (6); those of *D. m. magna* (10) from the places enumerated p. 477 and from Mimika River. It is easy to see that some of the measurements of both forms are still far from representing the real minima and maxima, so that with more complete material the "overlapping" may be found even greater.

	<i>D. m. moluccensis</i> .	<i>D. m. magna</i> .
	MIN. MAX.	MIN. MAX.
Skull, total length .....	58.5- 60.5	59.2- 63.8 mm.
Mandible from condyle .....	46.8- 48.8	47.8- 51.5 "
$c$ - $m^2$ , crowns .....	24.5- 26.3	25.2- 27.8 "
Forearm .....	133.5 146	146 -152.5 "
Third metacarpal .....	78.5- 88	88.5- 95.5 "

#### Page 471. *Dobsonia viridis*.

The species has been divided into two geographical races, as follows:—

##### 8 a. *Dobsonia viridis umbrosa*, *Thos.*

*Dobsonia viridis umbrosa*, *Thomas, Ann. & Mag. N. H.* (8) v. p. 384 (1 Apr. 1910: Buru; Ceram; "Aru" is a misprint for "Buru").

Synonyms and description as printed *antea*, pp. 471-473, excluding all references to Key Island specimens.

*Range.* Amboina Group (Buru, Amboina, Cēram); Ban da Islands.

a. ♀ imm. sk.;	Kayeli, Buru; Aug. 1909 ( <i>W. Stalker</i> ).	New Guinea Expedition [P.].	10.3.3.19.
b. ♀ imm. al.;	Amboina, (Voy. 'Sulphur').	Sir E. Belcher [P.].	Not reg.
c. ♀ ad. al.	Pokko, Amboina; Apr. 1911 ( <i>C. B. Kloss</i> ).	New Guinea Expedition [P.].	11.7.12.13.
d. ♂ ad. sk.;	Ceram.	Dr. A. R. Wallace [C.].	61.12.11.4.
e-h. 2 ♂ subad., 1 ♀ ad., 1 ad. sks.; skulls.	Ceram; 1859 ( <i>Dr. A. R. Wallace</i> ).	Tomes Coll. (7.1.1.259, ♀ ad.: <i>Type</i> of subspecies.)	7.1.1.258-261.
i-l. 1 ♂ ad., 2 ♀ ad., 1 ♀ imm. sks.; skulls.	Wahai, Ceram; Oct., Nov. 1909 ( <i>W. Stalker</i> ).	New Guinea Expedition [P.].	10.3.4.5-8.

### 8 b. *Dobsonia viridis viridis*, *Heude*.

*Cephalotes peroni* (pt., *nec E. Geoff.*), *Peters & Doria, Ann. Mus. Civ. Genova*, xvi. p. 691 (1881: Key Is.).

*Cephalotes viridis*, *Heude, Mém. Hist. Nat. Emp. Chin.* iii. p. 176, footnote, pl. v. fig. 1 (dentition) (1896: Key Is.).

*Dobsonia viridis* (pt.), *K. Andersen, Ann. & Mag. N. H.* (8) iv. pp. 530, 533 (1909: specific characters; affinities).

*Cephalotes palliatus* (pt.), *Matschie, Megachir.* p. 87 (1899: Key Is.).

*Dobsonia palliata*, *Beaufort, Abh. Senck. Nat. Ges.* xxxiv. p. 108 (1911: Key Dulah).

*Diagnosis.*—As specimens from the Amboina group (*D. v. umbrosa*), but colour averaging brighter throughout. *Hab.* Key Islands.

*Colour.*—Adult males (nine skins, 10.3.1.7-14, 19). Back of neck varying from light yellowish tawny-olive (palest extreme) to deep raw-umber. Head darker, some tinge of mummy-brown, often darkened with bistre. Underparts pale yellowish drab or light tawny-olive drab, always with centre of breast and belly conspicuously tinged with tawny raw-umber.

Adult females (four skins, 10.3.1.15-18). Yellowish, tawny-olive, and raw-umber elements of coloration much less developed. Back of neck isabella drab, as a rule tinged with dull raw-umber or dark tawny-olive anteriorly, at or near occiput. Crown bistre. Underparts essentially similar to back of neck (pale drab with some leaning toward isabella), with centre of breast and belly tinged with tawny-olive, or raw-umber, or tawny raw-umber, but these tinges as a rule considerably paler and more restricted than in adult males.

Immature females (two skins, 10.3.1.20-21). Similar to adults of same sex, but duller, owing to almost total absence (except in a narrow line along middle of breast and belly) of brighter (tawny-olive, raw-umber, &c.) tinges.

*Remarks.*—Attention was called on pp. 472–473 to the remarkable bright colours (“golden and tawny olive, with an indefinite hue of greenish,” hence the name *viridis*) of specimens from the Key Islands, but the then available material did not seem quite sufficient to warrant a splitting of the species into two races. The additional specimens sent home by the British New Guinea Expedition removed the hesitation on this point. It should be emphasized, however, that the colour difference between *v. umbrosa* and *v. viridis* (and no other difference seems to exist) is decidedly only one of average; specimens of *v. umbrosa* do occur (*e. g.* 10.3.4.5, ♂ ad., Ceram) which are indistinguishable from *v. viridis*.

<i>a-l.</i>	8 ♂ ad., 4 ♀ ad. sks.; skulls.	Tamogil, Key Is.; July, 1909 ( <i>W.</i> <i>Stalker</i> ).	New Guinea Ex- pedition [P.].	10.3.1.7–18.
<i>m-o.</i>	1 ♂ ad., 2 ♀ imm. sks.; skulls.	Elat, Key Is.; July, 1909 ( <i>W.</i> <i>S.</i> ).	New Guinea Ex- pedition [P.].	10.3.1.19–21.
<i>p-s.</i>	1 ♂ ad., 2 ♀ ad., 1 ♀ imm. ad.	Key Is.; July, 1909 ( <i>W.</i> <i>S.</i> ).	New Guinea Ex- pedition [P.].	10.3.1.57, 90–92.

Page 485. *Plerotes anchietæ*.

Line 23, after “*Epomophorine bats*” add “except *Scotonycteris* and *Casi nycteris*.”

Page 505. *Hypsignathus monstrosus*.

Line 2, after “*Epomophorine bats*” add “except *Scotonycteris*.”

Page 525. *Epomophorus wahlbergi haldemani*.

Line 28, for “*H. L. Laglaize*” read “*L. Laglaize*.”

Page 536. *Epomophorus crypturus*.

Line 12, for “*Pteropus gambianus*” read “*Epomophorus gambianus*.”

Page 632. New name for *Cynopterus horsfieldi minor*.

The name “*minor*” proposed for this form by Marcus W. Lyon is preoccupied by the combination “*Cynopterus (Cynaonycteris) minor*” used by Trouessart (Rev. & Mag. Zool. (3) vi. p. 206; 1878) for the species otherwise known as *Rousettus minor* (see *antea*, p. 43). That it has to be dropped is so far not to be regretted, as “*minor*” happens to be the larger of the two subspecies of *C. horsfieldi*. The present subspecies may be renamed *Cynopterus horsfieldi lyoni*. The type remains of course the same.

Page 703.

Add the following species :—

5 bis. *Nyctimene certans*, K. And.*Nyctimene certans*, K. Andersen, *Ann. & Mag. N. H.* (8) ix. p. 95 (1 Jan. 1912).

*Diagnosis*.—An eastern representative of *N. cyclotis* (Arfak Mts.), distinguished by its much heavier dentition and the much darker colour of its fur. *Hab.* So far known from Mt. Goliath, S.E. Dutch New Guinea, and Aroa River, B. New Guinea.

*Dentition*.—Molariform teeth, as in *cyclotis*, subcircular in outline, with  $m^1$  and  $m_1$  conspicuously smaller than, respectively,  $p^1$  and  $p_1$ , but all cheek-teeth much heavier, particularly broader, than in the related species :— $p^3$  (length and breadth) of type (between parentheses corresponding measurements of the type of *cyclotis*, for comparison)  $2.2 \times 2.1$  ( $2.0 \times 1.7$ ),  $p^4$   $2.0 \times 1.8$  ( $1.8 \times 1.6$ ),  $m^1$   $1.8 \times 1.6$  ( $1.6 \times 1.3$ ),  $p_3$   $2.5 \times 2.0$  ( $2.3 \times 1.7$ ),  $p_4$   $2.3 \times 2.0$  ( $2.1 \times 1.7$ ),  $m_1$   $2.0 \times 1.7$  ( $1.9 \times 1.5$ ),  $m_2$   $1.3 \times 1.2$  ( $1.2 \times 1.1$ ).

*Ears*.—As in *cyclotis*, unusually broad, semicircularly rounded off above, and narrowly edged all round with yellow, this yellow edge interrupted here and there by the dark central colour of the ear conch extending to the margins of the ear.

*Colour of fur* (type).—Peculiarly mottled above, as in *N. cyclotis*, but much darker. Individual hairs of back seal-brown at extreme base (for about 5 mm.), then very pale wood-brown (for 5–6 mm.), with short (2 mm.) dark brown tips, the mottled appearance of the colour of the head and back due to the dark brown tips of the hairs being too short to cover completely the paler middle portion of the hairs; a narrow and somewhat ill-defined dark brown spinal stripe along posterior half of back; breast and belly pale greyish drab in centre, flanks fawn.

*Measurements* (of type).—Forearm 58, second digit (metacarpal, first phalanx, second–third phalanx c. u.)  $27 + 5.5 + 9.5$ , third  $37.5 + 32 + 40.5$ , fourth  $35 + 24 + 26.5$ , fifth  $36.5 + 21.5 + 23$ , tibia 20.5, foot (c. u.) 16 mm.

*Skull*—across crowns of  $m^1$ – $m^1$  (externally) 8.8, across canines (externally) 6.5, between  $p^4$ – $p^4$  5.7, between bases of canines 2, mandible 22.8, c– $m^1$  (crowns) 9.8, c– $m_2$  (crowns) 11.2 mm.

*Specimens examined*. Those in collection.

a. Ad. sk.; skull.	Mt. Goliath, S.E. Dutch New Guinea;	A. S. Meek [C.]; (Type of species.)	11.11.29.1. 20 Jan. 1911.
b, c. 2 ad. sks.; skull of no. 7.	Upper Aroa R., B. N. G. (A. S. Meek).	Hon. W. Rothschild [P.].	8.11.16.7, 8.



Roussetius : External measurements.

	<i>R. leschenaulti</i> .		<i>R. shortridgei</i> .		<i>R. a. anplexiundatus</i> .		<i>R. a. minor</i> .		<i>R. a. brachydactylus</i> .	
	7 ad.	India ; Himalayas ; Burma ; Laos Mts.	♂ ad.	Type.	10 ad.	Localities see pp. 42-43.	18 ad.	Java.	Type and topotype.	
	Min.	Max.	mm.		Min.	Max.	Min.	Max.	Min.	Max.
Forearm .....	80.5	87.5	91		77	87	75	81	75.5	75
Pollex, total length, c. u. ....	26.5	29.5	31		25.5	30	25	28.5	24	24.5
2nd digit, metacarpal .....	32	37.5	40.5		31	35	28	34	28	31.5
" 1st phalanx .....	8	8.5	9.5		6	8	6	8	6	6
" 2nd-3rd phalanx, c. u. ....	8	9	10		7.5	9	7	9	7	7
3rd digit, metacarpal .....	49	54	59		46.5	52	45	48.5	43	45
" 1st phalanx .....	34	37	38		30	35.5	29	32	29	31.5
" 2nd phalanx .....	41	46	51		39	47	39	43.5	40	41
4th digit, metacarpal .....	47.5	53	57		44.5	51	43.5	46.5	41	44
" 1st phalanx .....	26	28.5	30		23	26.5	22	24.5	21.5	22
" 2nd phalanx .....	29	31.5	33		26	32	24.5	29	...	...
5th digit, metacarpal .....	47	52	54.5		43	51	42	45.5	40	42.5
" 1st phalanx .....	24	27	28		21	24	19.5	22.5	20	20
" 2nd phalanx .....	25.5	29.5	30		24	29.5	22	26.5	25	25
Far, length from orifice .....	19	20.5	22*		18.5	19.5	16	18	16	16
" greatest breadth, flattened ..	14.5	15.5	...		12	13	10.5	12	10	11
Tail .....	13	17.5	17*		14	19.5	15.5	20	...	...
Tibia .....	35	40	41.5		33	37	30.5	34	29	32
Foot, c. u. ....	20	23.5	25		20	23	18	21	18	19

\* Collector's measurements (in flesh).

## Rousettus: Measurements of skulls and tooth-rows.

	<i>R. leschenaulti</i> , 6 ad. Himalayas; Bengal; Barua; Laos Mts.	<i>R. shortridgei</i> , ♂ ad. Type.	<i>R. a. amplexicaudatus</i> , 10 ad. Localities see pp. 42-43.	<i>R. a. minor</i> , 11 ad. Java.	<i>R. a. brachyotis</i> , Type and topotype.
	Min.    Max.	Min.    Max.	Min.    Max.	Min.    Max.	Type, Topotype, 78.2-5.5.
Skull, total length .....	mm.    mm.	mm.	mm.	mm.	mm.
" condylo-basal length.....	37    41.5	42.5	35    39	37	...
" palation to incisive foramina .....	35.2    39	41.7	33.5    37	35.2	...
" palation to basion.....	17.2    19	20.2	16    17.7	16.5	14.3    16
" orbit to tip of nasals .....	13    15	15.8	14.2    15.8	13	...
" brain-case, width at zygomatic.....	11.8    13.8	14	11.7    13.2	11.2    12.5	10.8    12.8
" zygomatic width .....	15.5    17	17	14    15.8	13.7    15	13.8    14.8
" across crowns of m <sup>2</sup> , externally ..	22.3    23.7	26.5	21    24.5	20.2    23.5	...    23.7
" lachrymal breadth.....	11    12	12.8	10.3    11.8	9.8    10.7	9.7    10.7
" across crowns of canines, externally	10.2    11.2	11.2	9.2    10.7	9    10	9.2    9.5
" postorbital breadth .....	7    8.5	10	6.7    8.7	6.7    7.7	6.7    7
" interorbital breadth .....	8.2    9.6	8.2	7.2    9	6.6    8.2	7    7.8
" mesopterygoid fossa, breadth .....	7.2    8	9	7.2    8.7	7    8.5	7.6    8.5
" between p <sup>1</sup> -p <sup>2</sup> .....	5.2    6.2	6.2	5.2    6.2	4.3    4.8	4.4    4.4
" between bases of canines .....	5.8    6.3	7.8	5.2    6.2	4.8    5.3	4.6    4.8
" orbital diameter .....	4    4.5	5.8	3.7    4.8	3.7    4.2	3.5    4
" orbital diameter .....	8.8    9.3	9.5	8    8.5	7.7    8.5	7.8
Mandible, length from condyle .....	28.8    32.7	33.8	27    31.2	26.7    29	26    28.5
" symphysis, length .....	4.6    5.7	6.3	4.2    5.8	4.5    5.2	5    5.2
" coronoid height.....	11.2    13.2	14.8	10.5    13	11    12.8	...    13
Upper teeth, c-m <sup>2</sup> , crowns .....	14    15.7	16.3	12.8    14.2	12    13.3	11.8    13
Lower teeth, c-m <sup>3</sup> , crowns .....	15.2    17	18.2	14.2    15.8	13.2    15	13.2    14.3

## Roussettus : Measurements of teeth.

	<i>R. leschenaulti</i> , 6. Himalayas ; Bengal ; Laos Mts.		<i>R. shortridgei</i> , ♂ ad. Type.		<i>R. a. amplexicaudatus</i> , 13. Localities see pp. 42-43.		<i>R. a. minor</i> , 14. Java.		<i>R. a. brachyotis</i> , Type, paratype, and topotype.		<i>R. (S.) kempi</i> , 3. Shoa ; Mt. Elgon.		<i>R. (S.) lausius</i> , 2. Ruvenzori.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
p <sup>3</sup> , length	2.5	2.6			2.2	2.7	2.2	2.7	2.1	2.4	2.6	2.8	2.3	2.6
" width	1.3	1.5			1.2	1.6	1.1	1.6	1.2	1.3	1.3	1.5	1.2	1.2
p <sup>4</sup> , length	2.6	2.8	3		2.3	2.7	2.1	2.6	2.1	2.5	2.9	3	2.5	2.6
" width	1.7	1.8	2		1.6	1.9	1.5	1.9	1.4	2	1.6	1.6	1.3	1.4
m <sup>1</sup> , length	2.8	2.9	3.2		2.5	2.8	2.2	2.8	2.3	2.8	2.8	2.9	2.3	2.6
" width	1.7	1.8	2		1.6	1.8	1.5	1.8	1.9	2	1.6	1.7	1.3	1.3
m <sup>2</sup> , length	1.9	2.2	2		1.7	2.2	1.6	1.9	1.5	1.6	1.3	1.4	1.3	1.5
" width	1.4	1.5	1.6		1.3	1.7	1.2	1.6	1.4	1.6	1.2	1.2	0.8	1
p <sub>0</sub> , length	2.1	2.5	2.5		2	2.5	2	2.5	2	2.5	2.1	2.5	2	2.2
" width	1.4	1.5	1.7		1.1	1.5	1	1.3	1.1	1.3	1.2	1.2	1	1
p <sub>1</sub> , length	2.5	2.6	2.7		2.2	2.7	2	2.6	2.5	2.7	2.1	2.7	2.4	2.4
" width	1.4	1.6	1.9		1.4	1.8	1.3	1.7	1.6	1.7	1.3	1.4	1.1	1.3
m <sub>1</sub> , length	2.5	2.8	2.9		2.2	2.8	2.1	2.9	2.5	2.6	2.8	3	2.6	2.6
" width	1.4	1.6	1.8		1.5	1.7	1.3	1.8	1.6	1.8	1.5	1.5	1.1	1.2
m <sub>2</sub> , length	2.2	2.6	2.9		2	2.7	1.8	2.2	2	2.1	1.7	1.9	1.7	1.8
" width	1.4	1.5	1.8		1.4	1.7	1.3	1.6	1.5	1.8	1.2	1.3	1.1	1.1
m <sub>3</sub> , length	1.7	2.1	2.2		1.2	1.7	1.1	1.7	1.2	1.3	1.3	1.4	1.4	1.5
" width	0.9	1.2	1.3		1	1.2	0.9	1.2	1	1	1.1	1.1	0.9	0.9

## Roussettus (Lissonycteris) and Pteropus : External measurements.

	<i>R. (L.) angolensis</i> , 10 ad. Ruwenzori.		<i>R. (L.) smithi</i> , Type and no. 8.10.25.1.		<i>Pt. pumilus</i> , ♀ ad. (paratype, 144759).		<i>Pt. biops</i> , ♀ subad. Type.		<i>Pt. voeltzkowi</i> , 4 ad. Pemba I.		<i>Pt. temminckii</i> , 9 ad. Topotypes (Amboina).		<i>Pt. papuanus</i> , 2 ad. Mimika R.	
	Min.	Max.	♀ subad. Type. S. Nigeria.	♂ ad. Type. S. Nigeria.	mm. ? *	mm.	mm.	mm.	Min.	Max.	Min.	Max.	♂ ad.	♀ ad.
Forearm .....	78	83	68.5	70.5	?	44	101	151	161	96.5	104	203	203	mm.
Pollex, total length, c. u. ....	32.5	37.5	28	29	44	11	42.5	64	66	40.5	44.5	80	80	mm.
" metacarpal .....	...	...	...	...	22.5	53	23.5	14	15	9.5	11	19	19	mm.
" 1st phalanx .....	40	47	35	35.5	11	11	51	33	37	21.5	25	44.5	44.5	mm.
" 2nd digit, metacarpal .....	8.5	11.5	8	8.5	10	10	12.5	17	19	14	14	39.5	39.5	mm.
" 1st phalanx .....	9	11.5	49.5	49.5	70.5	70.5	70.5	97	107.5	64.5	70	135.5	135.5	mm.
2nd-3rd phalanx, c. u. ....	54.5	61	49.5	49.5	52.5	52.5	52.5	75	84.5	50	55	101.5	101.5	mm.
3rd digit, metacarpal .....	38	43.5	33	34.5	73	73	68	104	116	68	76	139.5	139.5	mm.
" 1st phalanx .....	48	55	41.5	45.5	70.5	70.5	70.5	95.5	105.5	63.5	69	131	131	mm.
2nd phalanx .....	53.5	59	47	47	42.5	42.5	42.5	58	64	39	43.5	82.5	82.5	mm.
4th digit, metacarpal .....	29	33	23	25.5	41.5	41.5	39.5	59.5	61.5	38	45	81	81	mm.
" 1st phalanx .....	29	33.5	25.5	28	75	75	70.5	103	113	69.5	75.5	136	136	mm.
2nd phalanx .....	53	59	45	46	30	30	28	43.5	49	30	32	65	65	mm.
5th digit, metacarpal .....	26	30	20.5	22.5	31	31	28	46	48	28	31	56	56	mm.
" 1st phalanx .....	20	30.5	23	24.5	19.5	19.5	21.5	23	23	21	21.5	53	53	mm.
" 2nd phalanx .....	22	24	19.5	14	...	...	...	16	16.5	14	14.5	...	...	mm.
Far, length from orifice .....	15	16.5	...	...	...	...	...	4	6.5	...	...	...	...	mm.
" greatest width, flattened .....	...	...	...	...	...	...	...	...	...	...	...	...	...	mm.
Intermemoral, depth in centre .....	...	...	...	...	...	...	...	...	...	...	...	...	...	mm.
Tail .....	8.5	13	...	9.5	...	...	...	...	...	...	...	...	...	mm.
Tibia .....	29	33	28	28.5	...	...	...	...	...	...	...	...	...	mm.
Foot, c. u. ....	22	25	19	20	35	35	35.5	43	47	31	34.5	68.5	68.5	mm.
Calcus .....	...	...	...	...	...	...	...	19.5	20	9.5	11	...	...	mm.

\* Forearm of type of *Pt. pumilus*, according to Miller, 109 mm.

## Ronsettus (Lissonycteris) and Pteropus: Measurements of skulls and tooth-rows.

	<i>R. (L.) angolensis</i> , 6 ad. Ruweuzori.		<i>R. (L.) smithi</i> , Type and no. 8.10.25.1.		<i>Pt. panilius</i> , ♀ ad. (paratype, 144733).		<i>Pt. liops</i> , ♀ subad. Type.		<i>Pt. woltzkovi</i> , 7 ad. Pemba I.		<i>Pt. roaninchi</i> , 5 ad. Topotypes (Amboina).		<i>Pt. papuanus</i> , 2 ad. Mimika R.	
	Mix.	MAX.	♀ subad. Type, S. Nigeria.	♂ ad. Type, S. Nigeria.	mm.	mm.	mm.	mm.	Mix.	MAX.	Mix.	MAX.	mm.	♀ ad. mm.
Skull, total length .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...
condylo-basal length .....	42.5	44	37.5	...	...	49.8	63.7	68.5	49.2	52.2	49.2	52.2	90	86
palation to incisive foramina .....	41.5	43.2	36.3	...	...	47	63	67.5	46	49	46	49	89	84
palation to basion .....	20.6	22.2	18.8	18.2	22	...	32.8	34.8	22.8	...	...	...	46.5	44.8
orbit to tip of nasals .....	16	16.8	13.5	...	...	16.7	22	25.2	17.7	19	17.7	19	30	29.5
brain-case, width at zygomata .....	13.8	14.8	11.7	12	...	15.8	21.5	23.5	14.8	16.5	14.8	16.5	31.8	29.8
zygomatic width .....	16.8	17.2	14.8	...	...	19.2	22.7	25	18.8	20.2	18.8	20.2	28.5	28.8
across crowns of m <sup>1</sup> , externally .....	24.8	27.5	20.6	...	13.3	27	32	33.5	29	29.7	29	29.7	46.5	45
across crowns of m <sup>2</sup> , externally .....	...	...	...	...	...	13.7	17.7	18.3	14.2	15	14.2	15	25.2	24.3
lacrimal breadth .....	12.7	14.5	11.2	11.2	...	...	14.7	14.8	...	...	...	...	...	...
across crowns of canines, externally .....	11	12.5	9.8	10.2	...	11.2	12.2	12.8	10.2	10.8	10.2	10.8	19.2	17.3
postorbital breadth .....	8.2	9.6	7.2	7.2	...	10.6	7.5	8.8	8.6	10.6	8.6	10.6	8.2	8.2
interorbital breadth .....	7.7	8.5	9.5	9.5	...	...	7.2	9.2	7.2	7.8	7.2	7.8	10	10.2
mesopterygoid fossa, width .....	6.8	8	6.6	7.5	...	7	8.5	9.7	6.2	7	6.2	7	9.8	9.8
between p <sup>1</sup> , p <sup>1</sup> .....	5.7	6	4.8	...	...	7.2	10.2	11	7.8	8.7	7.8	8.7	14.2	15
between bases of canines .....	6.7	7.5	6.2	5.7	7.8	7.6	6.2	7	5	5.8	5	5.8	10.5	10
orbital diameter .....	4.5	5.5	3.5	3.8	5.7	5.7	12.2	12.8	12	13	12	13	17.7	17.2
mandible, length from condyle .....	9.7	10.3	8.2	...	11	11	51.2	54	37.5	39.2	37.5	39.2	72.2	70
symphysis, length .....	33.2	34.8	29.3	28.8	38.3	38.3	...	...	...	...	...	...	72.2	70
coronoid height .....	4.7	5.7	4.7	4.2	8.2	8.2	25	27	18.2	19.8	18.2	19.8	17.7	15.8
Upper teeth, c-m <sup>2</sup> , crowns .....	13.5	15.8	10.2	12	17.7	17.7	24.8	26.5	19	20.2	19	20.2	36.7	33.5
Lower teeth, c-m <sup>3</sup> , crowns .....	16	17	14.5	13.8	18.2	18.2	26.2	28	20.7	21.8	20.7	21.8	41.5	38.3

*Ronseffus (Lissonycteris) and Pteropus: Measurements of teeth.*

<i>R. (L.) angolensis</i> , S. Angola (type); Kovenzori; Welle district.	<i>R. (L.) smithi</i> , Type and no. S.10.25.1.	<i>Pt. pumilus</i> , Paratype, 144759.	<i>Pt. liops</i> , Type.	<i>Pt. voeltzkowi</i> , 2. Pemba I.	<i>Pt. temminckii</i> , S. Topotypes (Amboua).	<i>Pt. papuanus</i> , 2. Mimika R. (11.11.1.1, 3).
Mix.      Max.	mm.      mm.	mm.	mm.	Mix.      Max.	Mix.      Max.	Mix.      Max.
p <sup>3</sup> , length .....	2.5      2.8	3.5	3.2	mm.      mm.	mm.      mm.	mm.      mm.
" width .....	1.8      2.1	2.6	2.5	4.1      4.3	3.2      3.5	5.5      5.7
p <sup>1</sup> , length .....	2.6      3	3.3	3.3	3.2      3.2	2.2      2.5	4      4.5
" width .....	2.1      2.4	2.6	2.7	4.2      4.8	3.5      3.8	5.5      5.8
m <sup>1</sup> , length .....	2.2      2.7	4	4.3	3.2      3.3	2.4      2.8	4.6      5
m <sup>2</sup> , length .....	2.2      2.2	2.3	2.5	5      5	4.2      4.5	6.1      6.2
m <sup>3</sup> , length .....	1.9      2.2	1.9	1.6	2.8      2.8	2.2      2.6	4.4      4.5
" width .....	1.8      2.2	1.6	1.5	2.7      2.7	1.8      2	3.8      4
" width .....	1.7      2	1.6	1.5	2      2	1.5      1.7	2.5      3.5
p <sup>1</sup> , length .....	0.8      1	1.8	1.8	1.9      2	1.3      1.7	1.8      2.5
" width .....	1      1.1	1.6	1.6	2      2	1.3      1.7	1.8      2.6
p <sup>3</sup> , length .....	2.2      2.6	3.7	3.5	4.5      4.8	3.2      3.3	4.8      5.8
" width .....	1.7      1.8	2.2	2	2.7      2.8	1.8      2	3.7      3.7
p <sup>1</sup> , length .....	3      3.3	3.5	3.6	4.5      4.7	3.8      3.8	5.5      6.1
" width .....	2      2.2	2.2	2.3	2.9      2.8	2      2.2	4.1      4.3
m <sup>1</sup> , length .....	2.7      3	3.4	3.6	4.5      4.7	3.2      3.9	6.2      6.2
" width .....	1.9      2.2	2.1	2.3	2.8      2.8	2      2.2	4      4.2
m <sup>2</sup> , length .....	2      2.5	2.8	2.9	3.3      3.5	2.6      2.8	4.7      5
" width .....	1.8      2.1	2	2	2.6      2.6	1.9      2	3.6      3.7
m <sup>3</sup> , length .....	1.7      1.8	1.3	1.3	2.2      2.2	1.3      1.5	3.2      3.3
" width .....	1.5      1.7	1.3	1.5	1.8      1.8	1.2      1.5	2.7      2.8

# LIST OF ILLUSTRATIONS.

Fig. I, p. xviii.—Typical molar structure of Megachiroptera (*Rousettus aegyptiacus*) compared with that of Insectivora (*Tupa europæa*).

- " II, " lii.—Interrelations of the genera of the *Rousettus* section.  
 " III, " lvi.—Interrelations of the genera of the *Epomophorus* section.  
 " IV, " lxi.—Interrelations of the genera of the *Cynopterus* section.  
 " V, " lxiv.—Interrelations of the genera of the subfamily *Macroglossinae*.  
 " VI, " lxx.—General view of the interrelations of the subfamilies, sections, and subsections of Megachiroptera.

Fig. 1, p.	3.— <i>Eidolon helvum</i> .....	Skull and dentition.
" 2, "	17.— <i>Rousettus aegyptiacus</i> .....	" " "
" 3, "	49.— <i>Rousettus (Stenonycteris) lanosus</i> (type) .....	" " "
" 4, "	52.— <i>Rousettus (Lissonycteris) angolensis</i> .....	" " "
" 5, "	55.— <i>Boneia bidens</i> (type of <i>B. menadensis</i> ) .....	" " "
" 6, "	62.— <i>Pteropus hypomelanus tomesi</i> .....	" " "
" 7, "	64.— <i>Pteropus hypomelanus tomesi</i> .....	Profiles of skulls.
	<i>Pteropus anetianus</i> .....	
	<i>Pteropus scapulatus</i> .....	
" 8, "	65.— <i>Pteropus hypomelanus tomesi</i> .....	Profiles of lower jaws.
	<i>Pteropus pselaphon</i> .....	
	<i>Pteropus scapulatus</i> .....	
" 9, "	68.— <i>Pteropus hypomelanus luteus</i> .....	p <sup>3</sup> , p <sup>4</sup> , m <sup>1</sup> : profiles and palate views.
	<i>Pteropus pselaphon</i> .....	
	<i>Pteropus neohibernicus</i> (type of <i>Pt. coronatus</i> ) .....	
	<i>Pteropus scapulatus</i> .....	
" 10, "	69.— <i>Pteropus hypomelanus luteus</i> .....	p <sub>3</sub> , p <sub>4</sub> , m <sub>1</sub> , m <sub>2</sub> : profiles and upper views.
	<i>Pteropus pselaphon</i> .....	
	<i>Pteropus anetianus</i> .....	
	<i>Pteropus neohibernicus</i> (type of <i>Pt. coronatus</i> ) .....	
" 11, "	71.— <i>Pteropus hypomelanus tomesi</i> .....	Palate-ridges.
" 12, "	217.— <i>Pteropus niger</i> .....	Skull and dentition.
" 13, "	270.— <i>Pteropus solitarius</i> (type) .....	" " "
" 14, "	289.— <i>Pteropus anetianus</i> .....	" " "
" 15, "	302.— <i>Pteropus pselaphon</i> .....	" " "
" 16, "	312.— <i>Pteropus leucopterus</i> (type of <i>Pt. chinensis</i> ) .....	" " "
" 17, "	394.— <i>Pteropus epularius</i> .....	" " "
" 18, "	404.— <i>Pteropus scapulatus</i> .....	" " "
" 19, "	408.— <i>Pteropus woodfordi</i> .....	" " "
" 20, "	413.— <i>Acerodon jubatus jubatus</i> .....	" " "
" 21, "	433.— <i>Pteralopex atrata</i> (type) .....	{ Upper and lower tooth-rows, profiles of p <sub>4</sub> and m <sub>1</sub> .
" 22, "	438.— <i>Pteralopex anceps</i> (type) } <i>Pteralopex atrata</i> (type) }	
" 23, "	443.— <i>Styloctenium wallacei</i> .....	Skull and dentition.
" 24, "	449.— <i>Dobsonia magna</i> .....	" " "





Fig. 66, p. 730.—	<i>Eonycteris spelea</i>	Skull and dentition.
„ 67, „ 731.—	<i>Ransattus laachi</i> }	Palate-ridges.
	<i>Eonycteris spelea</i> }	
„ 68, „ 739.—	<i>Megaloglossus woermanni</i>	Skull and dentition.
„ 69, „ 749.—	<i>Eonycteris spelea</i> }	Palate-ridges.
	<i>Megaloglossus woermanni</i> }	
„ 70, „ 748.—	<i>Macroglossus minimus sobrius</i> (type)	Skull and dentition.
„ 71, „ 749.—	<i>Eonycteris spelea</i>	Rostrum.
	<i>Megaloglossus woermanni</i>	
	<i>Macroglossus minimus sobrius</i> (type)	
„ 72, „ 750.—	<i>Eonycteris spelea</i>	Palate-ridges.
	<i>Macroglossus minimus sobrius</i> (type)	
	<i>Megaloglossus woermanni</i>	
„ 73, „ 772.—	<i>Syconycteris crassa major</i> (type)	Skull and dentition.
„ 74, „ 773.—	<i>Macroglossus minimus sobrius</i> (type)	Palate-ridges.
	<i>Syconycteris crassa major</i> (type)	
„ 75, „ 786.—	<i>Melonycteris melanops</i>	Skull, dentition, palate-ridges.
„ 76, „ 791.—	<i>Nesonycteris woodfordi</i>	Skull, dentition, palate-ridges.
„ 77, „ 795.—	<i>Notopteryx macdonaldi</i>	Skull, dentition, palate-ridges.
„ 78, „ 800.—	<i>Harpyionycteris whiteheadi</i> (type)	Skull and dentition.
„ 79, „ 802.—	<i>Harpyionycteris whiteheadi</i> (type)	Tooth-rows.



## ALPHABETICAL INDEX.

[Principal references are printed in black-faced type, except when there is only a single reference under a name. Pages in which the technical status of a name is discussed are marked with an asterisk.]

- Acérodon*, 412.  
*Acerodon*, 412.  
*Acerodon alorensis*, 423.  
     " *aurinuchalis*, 428.  
     " *batchianus*, 194.  
     " *celebensis*, 417.  
     " *floresianus*, 420.  
     " *floresii*, 420.  
     " *gilvus*, 423.  
     " *humilis*, 424.  
     " *jubatus*, **426** (species), **427**  
         (subsp.), 430, 824.  
     " *lucifer*, 432.  
     " *mackloti*, **418** (species),  
         **419** (subsp.), 420.  
     " *mindanensis*, **429**, 430.  
     " *vanikorensis*, **184**, 309.  
*admiralitatum* (Pteropus), 144.  
     " (Spectrum), 144.  
*ægyptiaca* (Cynonycteris), **30**, 49, 51,  
     813.  
     " (*Eleutherura*), **30**, 49, 813.  
     " (*Xantharpyia*), **30**, 33, 49,  
         813.  
*ægyptiacum* (Pachysoma), 30.  
*ægyptiacus* (Cynopterus), **30**, 49, 813.  
     " (Pteropus), **29**, 31\*.  
     " (*Rousettus*), **29**, 30, 49,  
         813.  
     " (*Rousettus*), 30.  
*ægyptius* (Pteropus), 29.  
*aëlio* (*Bdelygma*), 715.  
     " (*Cephalotes*), 715.  
     " (*Gelasinus*), 715.  
     " (*Nyctimene*), 715.  
     " (*Nyctimene*), 715.  
*affine* (*Pachyscma*), 810.  
*affinis* (Cynopterus), **36**, 37\*.
- affinis* (Pteropus), **194**, 196\*.  
*albiventer* (*Cephalotes*), 698, **700**.  
     " (*Cynopterus*), 700.  
     " (*Gelasinus*), 700.  
     " (*Harpyia*), 700.  
     " (*Nyctimene*), 700.  
     " (*Nyctimene*), 698, **700**.  
     " (*Uronycteris*), 700.  
*albiventris* (*Gelasinus*), 700.  
*alboscapulatus* (*Cheiropteruges*), **789**,  
     790\*.  
     " (Pteropus), **789**, 790\*.  
*aldabrensis* (Pteropus), 213.  
*alecto* (Pteropus), **363**, **365**, 367\*,  
     375, 379, 381.  
*alecto* group (Pteropus), 363.  
*alecton* (Pteropus), 363, **366**.  
*alorensis* (*Acerodon*), 423.  
*amplexicaudata* (*Cynonycteris*), 26, 33,  
     35, 36, 38, **40**, 41,  
     43, 45, 46.  
     " (*Xantharpyia*), 33, 35,  
         39, **40**, 43, 45, 471.  
*amplexicaudatum* (*Pachysoma*), 49.  
*amplexicaudatus* (Cynopterus), 33, 36,  
     38, **41**, 45, 46.  
     " (Pteropus), 26, 35,  
         36, **40**, 41, 42\*, 43,  
         44.  
     " (*Rousettus*), 33, 36,  
         **40**, 41, 43, 46, 812.  
*anceps* (*Pteralopex*), 437.  
*anchietæ* (*Epomophorus*), 486.  
     " (*Plerotes*), **486**, 827.  
*andamanensis* (Cynopterus), **626**.  
     627\*.  
*aneitanum* (Spectrum), 288.  
*aneitanus* (Pteropus), 288.  
     3 K

- aneiteanus (Pteropus), 288.  
 anetianum (Spectrum), 288.  
 anetianus (Pteropus), 288.  
 angolensis (Cynonycteris), 51.  
     " (Epomophorus), 523, 536,  
         542.  
     " (Lissonycteris), 51.  
     " (Myonycteris), 51.  
     " (Rousettus), 51.  
     " (Xantharpyia), 51.  
 angulatus (Cynopterus), 611, 612.  
 annectens (Pteropus), 116.  
 anurus (Epomophorus), 532.  
     " (Pteropus), 532.  
 arabicus (Rousettus), 33.  
 Archæopteropus, xxxvii.  
 Archæopteropus transiens, xxxvii.  
 argentatus (Pteropus), 197, 241,  
     242\*, 246, 385.  
 argynnis (Casinycteris), 572.  
 ariel (Pteropus), 335, 336\*.  
 aruensis (Pteropus), 241, 243\*, 246.  
 assamense (Spectrum), 339.  
 assamensis (Pteropus), 333, 334\*, 359.  
 aterrimus (Pteropus), 363, 365\*, 366,  
     822.  
 atrata (Pteralopex), 439.  
 atratus (Pteropus), 439.  
 auratus (Pteropus), 156.  
 auriculis patulis (Pteropus), 86, 219\*.  
 aurinuchalis (Acerodon), 428.  
     " (Pteropus), 428, 429\*.  
 australis (Carponycteris), 763, 766, 781.  
     " (Macroglossus), 763, 767, 781.  
     " (Syconycteris), 781.  
  
 Balionycteris, 651, 654.  
 Balionycteris maculata, 654, 657.  
 batchianus (Acerodon), 194.  
     " (Pteropus), 194, 196\*.  
 baveanus (Pteropus), 364, 365\*.  
 Bdelygma, 681, 683, 695\*.  
 Bdelygma aëlio, 715.  
     " majus, 709, 710, 711, 713.  
 bedfordi (Scotonycteris), 567, 568\*.  
 bidens (Boneia), 58, 59\*.  
 blanfordi (Cynopterus), 674.  
     " (Sphaerias), 674.  
     " (Thoopterus), 674.  
 bocagei (Cynonycteris), 41, 42\*.  
     " (Rousettus), 41.  
 Boneia, 55.  
 Boneia bidens, 58, 59\*.  
     " menadensis, 58, 59\*.  
 brachiotis (Pachysoma), 615.  
 brachycephala (Cynonycteris), 582.  
     " (Myonycteris), 582.  
     " (Phygetis), 582.  
     " (Xantharpyia), 582.  
 brachycephalus (Rousettus), 582.  
  
 brachyotis (Cynonycteris), 45, 46.  
     " (Cynopterus), 45, 609  
         (species), 612, 614  
         (subsp.), 615, 616.  
     " (Pachysoma), 615, 619\*.  
     " (Pteropus), 615.  
     " (Rousettus), 44, 45, 46,  
         812.  
     " (Xantharpyia), 45, 46.  
 brachyotum (Pachysoma), 615.  
 brachyotus (Cynopterus), 615, 626.  
 brachysoma (Cynopterus), 622, 626.  
 brevicaudatum (Pachysoma), 600, 611,  
     615, 619\*.  
 brevicaudatus (Cynopterus), 26, 606,  
     611, 615,  
     624.  
     " (Pteropus), 615.  
 breviceps (Pteropus), 275, 278\*.  
 brunneum (Spectrum), 149.  
 brunneus (Pteropus), 149.  
 büttikoferi (Epomophorus), 499.  
 büttikoferi (Epomops), 499.  
 büttikoferi (Leiponyx), 11, 13\*.  
     " (Pterocyon), 11.  
  
 Cabug, 359, 427.  
 cælano (Vespertilio), 349.  
 cagayanus (Pteropus), 121, 122, 123\*.  
 caleno (Vespertilio), 349.  
 Callinycteris, 728, 729, 733\*.  
 Callinycteris rosenbergi, 737.  
 caniceps (Pteropus), 194, 196\*.  
 caniceps group (Pteropus), 192.  
 caninus (Vespertilio), 10, 165, 204,  
     215, 220\*, 349.  
 Canis volans Ternatanus Orientalis,  
     349, 352\*.  
  
 canus (Pteropus), 113.  
 capistrata (Sericonycteris), 319.  
 capistratus (Pteropus), 319, 321\*.  
 Carponycteris, 746, 747, 771.  
 Carponycteris australis, 763, 766, 781.  
     " crassa, 777, 780, 785.  
     " finschi, 779.  
     " lagochilus, 761, 764.  
     " minima, 758, 761, 763,  
         766, 777.  
     " nana, 764, 766, 767.  
     " papuana, 777, 780.  
     " sp., 761.  
 Casinycteris, 568.  
 Casinycteris argynnis, 572.  
 celano (Pteropus), 106, 343, 347, 349,  
     353, 356, 358, 360.  
     " (Vespertilio), 349, 352\*.  
 celebensis (Acerodon), 417.  
     " (Pteropus), 417, 418\*.  
     " (Rousettus), 46.  
 Céphalote, 704.

- Cephalotes*, 448, 458\*, **681**, 695\*, 698, 700.  
*Cephalotes aëlio*, 715.  
 „ *cephalotes*, 698, 700, **704**, 708\*.  
 „ *major*, 709, **710**, 711.  
 „ *minor*, 460.  
 „ *molluccensis*, 464.  
 „ *pallasi*, **705**, 708\*.  
 „ *palliat*, 461, 464, 466, **467**, 472, 474, 826.  
 „ *peroni*, 460, 461, 464, 466, **468**, 469\*, 471, 473, 474, 475, 476, 826.  
 „ *viridis*, **471**, 826.  
*cephalotes* (*Cephalotes*), 698, 700, **704**, 708\*.  
 „ (*Gelasinus*), 698, 700, **704**, 708\*.  
 „ (*Harpya*), 704, 709.  
 „ (*Harpyia*), 698, 700, **704**, 708\*, 709, 711.  
 „ (*Harpyja*), 704.  
 „ (*Nyctemene*), 698.  
 „ (*Nyctimene*), **703**, 707\*, 709.  
 „ (*Nyctymene*), 704.  
 „ (*Pteropus*), 467, **704**, 707\*.  
 „ (*Uronycteris*), 698, **704**, 708\*.  
 „ (*Vespertilio*), **703**, 707\*.  
*cephalotis* (*Harpyia*), 704.  
*Céphalotte*, 681, 704.  
*ceramensis* (*Pteropus*), **381**, 382\*.  
*Cercopteropus*, **16**, 23\*.  
*certans* (*Nyctimene*), 828.  
*ceylonensis* (*Cynopterus*), 624.  
*Chauve-souris de forte race*, 329.  
*Cheiropteruges*, 785.  
*Cheiropteruges alboscapulatus*, **789**, 790\*.  
*Chien-volant*, **215**, 219\*.  
*chinensis* (*Pteropus*), **311**, 315\*.  
*Chironax*, 658.  
*Chironax melanocephalus*, 660.  
*chrysargurus* (*Pteropus*), **246**, 247\*.  
*chrysaeben* (*Pteropus*), **375**, 377\*, 381.  
*chrysoproctus* (*Pteropus*), 197, **260**, 263\*.  
*cognatus* (*Pteropus*), 251.  
*collaris* (*Cynonycteris*), **25**, 26, 30, 31, 51.  
 „ (*Cynopterus*), **26**, 31, **581**\*.  
 „ (*Eleutherura*), 26.  
 „ (*Myonycteris*), 580, **581**.  
 „ (*Pteropus*), 25, 28\*, **166**, 169\*.  
 „ (*Rousettus*), **26**, 31, 51.  
 „ (*Xantharpyia*), **26**, 31, 33, 51.  
*collo rubro* (*Pteropus*), 219\*.  
*colonus* (*Pteropus*), 147.  
*comorensis* (*Pteropus*), **208**, 209\*.  
*comptus* (*Epomorphus*), 496, **497**, 498\*, 562.  
 „ (*Epomops*), 496, **498**.  
*condorensis* (*Spectrum*), 110.  
*condorensis* (*Pteropus*), **110**, 111\*.  
*conspicillatus* (*Pteropus*), **378**, 823.  
*conspicillatus group* (*Pteropus*), 375.  
*coronatus* (*Pteropus*), **387**, 389\*.  
*crassa* (*Carponycteris*), **777**, **780**, 785.  
 „ (*Syconycteris*), **775** (species), **780** (subsp.), 785.  
*crassus* (*MacroGLOSSUS*), **780**, 785.  
*crenulata* (*Dobsonia*), **473**, 474.  
*crypturum* (*Pachysoma*), 536.  
*crypturus* (*Epomorphus*), 523, 526, **535**, 827.  
 „ (*Pteropus*), 536.  
*cumingi* (*Cynopterus*), **616**, 620\*.  
*euvieri* (*MacroGLOSSUS*), 759\*.  
*cyclotis* (*Nyctimene*), 703.  
*Cynonictis*, 9.  
*Cynonycteris*, **16**, 21\*, 576, 587.  
*Cynonycteris ægyptiaca*, **30**, 49, 51, 813.  
 „ *amplexicaudata*, 26, 33, 35, 36, 38, **40**, 41, 43, 45, 46.  
 „ *angolensis*, 51.  
 „ *bocagei*, **41**, 42\*.  
 „ *brachycephala*, 582.  
 „ *brachyotis*, **45**, 46.  
 „ *collaris*, **25**, 26, 30, 31, 51.  
 „ *dupreana*, 8.  
 „ *dupressa*, 8.  
 „ *gaillardi*, 809.  
 „ *geoffroyi*, 30.  
 „ *grandidieri*, **616**, 620\*.  
 „ *infusca*, **36**, 37\*.  
 „ *leschenaulti*, **35**, 38.  
 „ *minor*, **43**, 46.  
 „ *straminea*, 7, 8, **9**, 10, 15.  
 „ *straminia*, 9.  
 „ *sp.*, 22, 31, 51.  
 „ *torquata*, 580, **581**.  
 „ *unicolor*, 51.  
*Cynoptères*, 586.  
*Cynopterus*, 576, **586**, 596\*, 646, 651, 654, 658, 662, 671.  
*Cynopterus ægyptiacus*, **30**, 49, 813.  
 „ *affinis*, **36**, 37\*.  
 „ *albiventer*, 700.  
 „ *amplexicaudatus*, 33, 36, 38, **41**, 45, 46.  
 „ *andamanensis*, **626**, 627\*.  
 „ *angulatus*, **611**, 612.  
 „ *blanfordi*, 674.

- Cynopecterus brachyotus*, 45, **609** (species), 612, 614 (subsp.), 615, 616.  
 „ *brachyotus*, 615, 626.  
 „ *brachysoma*, 622, **626**.  
 „ *brevicaudatus*, 26, 606, 611, **615**, 624.  
 „ *ceylonensis*, 624.  
 „ *collaris*, 26, 31, **581\***.  
 „ *cumingi*, **616**, 620\*.  
 „ *diardi*, 605.  
 „ *dupreanus*, 8.  
 „ *duvaucelli*, 614.  
 „ *ecaudatus*, 650.  
 „ *elliotti*, **600**, 602\*.  
 „ *gangeticus*, 604.  
 „ *grandidieri*, 616.  
 „ *harpax*, 633.  
 „ *horsfieldi*, 600, 612, 622, **630** (species), **631** (subsp.).  
 „ *insularum*, 623.  
 „ *jagori*, 645.  
 „ *javanicus*, 622.  
 „ *latidens*, 665.  
 „ *lucasi*, 669.  
 „ *lucassii*, 669.  
 „ *luzoniensis*, 616.  
 „ *lyoni*, 827.  
 „ *maculatus*, 654.  
 „ *major*, 629.  
 „ *marginatus*, 36, **599**, 600, 604, 606, 611, 616, 622, 624, 626, 627, 629, 631, 632.  
 „ *melanocephalus*, 661.  
 „ *minor*, **43**, **632**, 827.  
 „ *minutus*, 625.  
 „ *montani*, 612, **617**.  
 „ *montanoi*, 600, 612, **616**, 617, 620\*.  
 „ *nigrescens*, 665.  
 „ *pagensis*, **612**, 613\*.  
 „ *philippensis*, **616**, 620\*.  
 „ *princeps*, 633.  
 „ *scherzeri*, 606, **627**, 628, 629.  
 „ *spadicicus*, 654.  
 „ *sphinx*, **598**, 612, 617.  
 „ *stramineus*, 10.  
 „ *tithæcheilus*, 605.  
 „ *tittæcheilus*, 605.  
 „ *tithæcheilus*, 600, **605**, 611, 616.  
 „ *tittæcheilus*, 605.  
 „ *tittæochilus*, 605.  
 „ *tittæoecheilus*, 605.  
 „ *torquatus*, 581.  
*dasymallus* (*Pteropus*), **159**, 161\*.  
*degener* (*Eunyceteris*), 387.  
 „ (*Pteropus*), **387**, 389\*.  
*Desmalopex*, **61**, 79\*.  
*Desmalopex leucopterus*, 311.  
*desmaresti* (*Pteropus*), 458, **469**.  
 „ (*Tribonophorus*), **469**, 470\*.  
*diardi* (*Cynopecterus*), 605.  
 „ (*Pachysoma*), **605**, 608\*.  
 „ (*Pteropus*), 605.  
*dobsoni* (*Epomophorus*), 500.  
 „ (*Epomops*), 560.  
 „ (*Pteropus*), 192.  
*Dobsonia*, **448**, 459\*.  
*Dobsonia crenulata*, **473**, 474.  
 „ *exoleta*, 461.  
 „ *inermis*, 475.  
 „ *magna*, **466**, 825.  
 „ *minor*, **460**, 824.  
 „ *moluccensis*, **464**, 825.  
 „ *nesea*, 476.  
 „ *pallata*, 461, 465, 466, **468**, 472, 474.  
 „ *pallata*, **468**, 826.  
 „ *peroni*, 461, **467**, 468, 471, 473, 474, 475.  
 „ *prædatrix*, 474.  
 „ *sumbana*, 471.  
 „ *umbrosa*, 825.  
 „ *viridis*, **471**, 472, 825, 826.  
*doriae* (*Epomophorus*), **533**, 534\*.  
*dupreana* (*Cynonycteris*), 8.  
 „ (*Xantharpyia*), 8.  
*dupreanum* (*Eidolon*), 7.  
*dupreanus* (*Cynopecterus*), 8.  
 „ (*Pterocyon*), 8.  
 „ (*Pteropus*), 7.  
 „ (*Rousettus*), 8.  
*dupressa* (*Cynonycteris*), 8.  
*dussumieri* (*Pteropus*), **184**, 185\*.  
*duvauceli* (*Pachysoma*), **614**, 619\*.  
 „ (*Pteropus*), 614.  
*duvaucelli* (*Cynopecterus*), 614.  
 „ (*Pachysoma*), 614.  
 „ (*Pteropus*), 614.  
*Dyacopterus*, 651.  
*Dyacopterus spadiceus*, 654.  
*ecaudata* (*Megæra*), 649.  
 „ (*Megæra*), 649.  
*ecaudatum* (*Pachysoma*), 649.  
*ecaudatus* (*Cynopecterus*), 650.  
 „ (*Megærops*), **649**, 650.  
 „ (*Ptenochirus*), 650.  
 „ (*Pteropus*), 649.  
*edulis* (*Pteropus*), 110, 224, 229, 330, 331, 334, 343, 346, 347, 350, 353, **356**, 357\*.  
 „ 358, 359, 371.

- edwardsi (Pteropus), **204**, 206\*, 208,  
212, 216, 247, 330, 331,  
332\*, 334, 339, 398.
- edwardsii (Pteropus), 205, 331.
- egyptiacus (Pteropus), 29.
- Eidolon, **2**, 7\*, 586, 746.
- Eidolon dupreanum, 7.
- „ helvum, **8**, 12\*, 809.
- „ sabæum, 15.
- Eleutherura, **16**, 24\*, 587.
- Eleutherura ægyptiaca, **30**, 49, 813.
- „ collaris, 26.
- „ fuliginosa, **36**, 37\*.
- „ fusca, **36**, 37\*.
- „ infumata, **41**, 42\*.
- „ marginata, 36, **600**.
- „ philippinensis, **41**, 42\*.
- „ unicolor, **30**, 32\*.
- elliotti (Cynocephalus), **600**, 602\*.
- elseyi (Pteropus), **403**, 406\*.
- Empomophorus, 514.
- enganus (Pteropus), **107**, 109\*.
- Eonycteris, 728.
- Eonycteris major, 736.
- „ rosenbergi, 737.
- „ spelæa, **734**, 736, 737.
- Epomophorus, 483, 487, **514**, 554,  
559.
- Epomophorus anchietæ, 486.
- „ angolensis, 523, 536,  
**542**.
- „ anurus, 532.
- „ büttikoferi, 499.
- „ comptus, 496, **497**,  
498\*, 562.
- „ crypturus, 523, 526,  
**535**, 827.
- „ dobsoni, 500.
- „ doriae, **533**, 534\*.
- „ franqueti, 496, **497**,  
499, 507.
- „ gambianus, 498, 499,  
523, 526, 533, 536,  
**538**, 542, 827.
- „ guineensis, **539**, 541\*.
- „ haldemanni, 507, **522**,  
827.
- „ haldemanni, 523.
- „ labiatus, 523, **529**, 533.
- „ macrocephalus, 496,  
507, 523, 526, **538**,  
542, 543.
- „ minor, 530, **531**, 533.
- „ monstrosus, **506**, 507.
- „ neumanni, **523**, 525\*,  
527.
- „ ponsarguesi, 543.
- „ pusillus, **557**, 558\*,  
562.
- „ schoensis, **530**, 533,  
557.
- Epomophorus schovanus, 530.
- „ sp., 486, 523, 543.
- „ stuhlmanni, **526**, 527\*.
- „ unicolor, **526**, 527\*.
- „ veldkampii, 562.
- „ wahlbergi, **521** (spe-  
cies), **526** (subsp.).
- „ whitei, 523, 526, **539**.
- „ zeechi, **539**, 541\*.
- „ zenkeri, 500, **523**, 524\*,  
536.
- epomophorus (Pteropus), **539**, 541\*.
- Epomops, 487.
- Epomops büttikoferi, 499.
- „ comptus, 496, **498**.
- „ dobsoni, 500.
- „ epularius, 392.
- „ franqueti, **494** (species),  
496, 497 (subsp.), 499.
- „ strepitans, 496.
- epularium (Spectrum), 392.
- epularius (Epomops), 392.
- „ (Pteropus), **392**, 395\*.
- erachii (Pteropus), 26.
- Eonycteris, **61**, 73\*.
- Eonycteris degener, 387.
- „ melanopogon, **238**, 385,  
387.
- „ neohibernica, 387.
- „ papuana, 385.
- „ phaiops, **238**, 261, 351,  
352\*.
- exoleta (Dobsonia), 461.
- facie canina (Vespertilio), 204.
- Fani, 206.
- Fanihy, 206.
- Fanii, 206.
- Fanny, 206.
- Fany, 204.
- fannulus (Pteropus), **143**, 144\*.
- fibulatus (Vespertilio), **598**, 602\*.
- finschi (Carponycteris), 779.
- „ (Macroglossus), 779.
- „ (Synonycteris), 779.
- Fladermöss, 349.
- flavicollis (Pteropus), **186**, 188\*.
- flatus (Pteropus), 809.
- floresianus (Acerodon), 420.
- „ (Pteropus), 420.
- floresii (Acerodon), 420.
- „ (Pteropus), 420.
- Flughunde, 379.
- formosanus (Pteropus), 163.
- formosum (Spectrum), 163.
- formosus (Pteropus), **163**, 164\*.
- franqueti (Epomophorus), 496, **497**,  
499, 507.
- „ (Epomops), **494** (species),  
496, 497 (subsp.), 499.

- Fruit Bat, Large, 233.  
*fuliginosa* (Eleutherura), **36**, 37\*.  
*lunigatus* (Pteropus), **242**, 243\*.  
*funereus* (Pteropus), 186, 346, 347,  
     351, **356**, 357\*,  
     358, 359, 370.  
*fusca* (Eleutherura), **36**, 37\*.  
*fuscollois* (Pteropus), 284.  
*fuscum* (Spectrum), 192.  
*fuscus* (Pteropus), 165, 169\*, **192**,  
     193\*, **215**, 220\*,  
     347.  
*gaillardi* (Cynonycteris), 809.  
     (Rousettus), 22.  
*gambianum* (Pachysoma), 538.  
*gambianus* (Epomophorus), 498, 499,  
     523, 526, 533, 536, **538**,  
     542, 827.  
     (Pteropus), **538**, 541\*, 827.  
*gangeticus* (Cynopterus), 604.  
*geddiei* (Pteropus), 189.  
*Gelasinus*, **681**, 682, 695\*.  
*Gelasinus aëlo*, 715.  
     *albiventer*, 700.  
     *albiventris*, 700.  
     *cephalotes*, 698, 700, **704**,  
         708\*.  
         *major*, 709, **710**, 711, 713.  
*geminorum* (Pteropus), **106**, 107\*.  
*geminus* (Nyctimene), 709.  
*geoffroyi* (Cynonycteris), 30.  
     (Pteropus), **30**, 32\*.  
*germaini* (Pteropus), 155\*.  
     (Spectrum), 155.  
*gigantea* (Vespertilio), **329**, 332\*.  
*giganteum* (Pachysoma), 343.  
*giganteus* (Pteropus), **326** (species),  
     **329** (subsp.), 334.  
*gilvus* (Acerodon), 423.  
*gouldi* (Pteropus), **370**, 372\*.  
*Grande Rousette*, 206.  
*grandidieri* (Cynonycteris), **616**, 620\*.  
     (Cynopterus), 616.  
*grandis* (Pteropus), 255, **259**.  
*Great Bat from Madagascar*, **204**,  
     215.  
*griseum* (Spectrum), 138.  
*griseus* (Pteropus), 126, **137**, 139\*,  
     316, 318\*, 816.  
*Grosse chauve-souris noire et jaune*,  
     206.  
*guineensis* (Epomophorus), **539**, 541\*.  
  
*haldemani* (Epomophorus), 507, **522**,  
     827.  
     (Hypsignathus), 507.  
     (Pachysoma), 522.  
     (Pteropus), 522.  
*haldemanni* (Epomophorus), 523.  
  
*harpax* (Cynopterus), 633.  
     (Niadius), 633.  
*Harpya*, 682.  
*Harpyia*, **681**, 682, 695\*.  
*Harpyia albiventer*, 700.  
     *cephalotes*, 698, 700, **704**,  
         708\*, 709, 711.  
     *cephalotis*, 704.  
     *major*, 709, **710**, 711, 713,  
         715.  
     *pallasi*, **705**, 708\*, 711.  
     *pallassii*, 705.  
*Harpyiinae*, 693.  
*Harpyionycterinae*, 799.  
*Harpyionycteris*, 799.  
*Harpyionycteris whiteheadi*, 805.  
*Harpyia*, 682.  
*helvum* (Eidolon), **8**, 12\*, 809.  
*helvus* (Pterocyon), 9.  
     (Vespertilio), **9**, 12\*.  
*heudei* (Pteropus), 266.  
     (Sericonycteris), 266.  
*horsfieldi* (Cynopterus), 600, 612, 622,  
     **630** (species),  
     **631** (subsp.).  
     (Macroglossa), 759.  
     (Macroglossa), **759**, 760\*.  
     (Pachysoma), 631.  
*hottentotta* (Xantharpyia), 26.  
*hottentottus* (Pteropus), **26**, 28\*.  
*hottentotus* (Pteropus), 26.  
*humilis* (Acerodon), 424.  
*Hypoderma*, **448**, 458\*.  
*Hypoderma moluccense*, 464.  
     *peroni*, 464, **468**, 471.  
*Hypodermis*, 448.  
*hypomelannum* (Spectrum), 107, 110,  
     113, 116, 121, 124, **127**,  
     128, 147, 233, 266, 381.  
*hypomelanus* (Pteropus), **101** (species),  
     107, 110, 113, 116, 119,  
     121, 124, **127\*** (subsp.),  
     128, 133, 136, 133, 147,  
     192, 194, 233, 266, 381.  
*hypomelannus* group (Pteropus), 98.  
*hypomelas* (Pteropus), 242.  
*Hypsignathus*, 501.  
*Hypsignathus haldemani*, 507.  
     *monstrosus*, **506**, 507,  
         827.  
  
*indica* (Vespertilio), 329.  
*inermis* (Dobsonia), 475.  
*infumata* (Eleutherura), **41**, 42\*.  
*infusata* (Cynonycteris), **36**, 37\*.  
*ingens* (Vespertilio), **215**, 219\*.  
*insignis* (Pteropus), 396\*.  
*insulare* (Spectrum), 295.  
*insularis* (Pteropus), 173, 174, **295**,  
     297\*.



- insularum (Cynopterus), 623.  
 intermedius (Pteropus), 310.  
  
 jagori (Cynopterus), 645.  
   " (Pachysoma), 645.  
   " (Ptenochirus), 645.  
 javanicus (Cynopterus), 622.  
   " (Pteropus), 340, 346, **350**,  
     352\*.  
 jubatus (Acerodon), **426** (species),  
   **427** (subsp.), 430, 824.  
   " (Pteropus), 359, **427**, 429\*.  
   " (Vespertilio), 427.  
  
 kelharti (Pteropus), **331**, 332\*, 351.  
 kempi (Rousettus), 813.  
   " (Stenonycteris), 813.  
 Keraudren, 179.  
 keraudren (Pteropus), 177, **178**, 179\*,  
   189.  
 keraudreni (Pteropus), 173, 174, **179**,  
   181, 184, 186, 189, 295,  
   306.  
 keraudrenius (Pteropus), 177, **179**,  
   180\*, 186.  
 keraudrensis (Pteropus), 179.  
 keyensis (Pteropus), **246**, 247\*, **821**.  
   " (Nyctonycteris), 779.  
 Kiodote, 760.  
 kiodotes (Macroglossa), 759.  
   " (Macroglossus), 759\*.  
 Kiodotus, **746**, 747, 771.  
 Kiodotus lagochilus, 764.  
   " minimus, **758**, 761.  
 Koidotus, 747.  
  
 labiatum (Pachysoma), 529.  
 labiatus (Epomophorus), 523, **529**,  
   533.  
   " (Pteropus), **529**, 533.  
 labrosus (Sphyrocephalus), 507.  
   " (Zygocephalus), 507.  
 lagochilus (Caronycteris), 761, **764**.  
   " (Kiodotus), 764.  
   " (Macroglossus), 761, **762**  
     (species), 763 (subsp.),  
     764.  
 lanensis (Pteropus), **359**, 360, 361\*.  
 laniger (Pteropus), **295**, 297\*.  
 lanosa (Stenonycteris), **49**, 813.  
 lanosus (Rousettus), **49**, 813.  
 Large Fruit Bat, 233.  
 latidens (Cynopterus), 665.  
 lavellanus (Pteropus), 258.  
 leachi (Pteropus), **26**, **28\***, **810**.  
   " (Rousettus), **25**, 26.  
   " (Xantharpyia), 26.  
 Leiponyx, 2.  
 Leiponyx büttikoferi, **11**, 13\*.  
 leucocephalus (Pteropus), 333.  
 lepidus (Pteropus), **115**, **815**.  
 leptodon (Myonycteris), 580.  
 leschenaulti (Cynonycteris), **35**, 38.  
   " (Pteropus), **35**, 37\*, 38.  
   " (Rousettus), **35**, 810.  
   " (Xantharpyia), **35**, 38.  
 Lesser Ternate Bat, **8**, 12\*.  
 leucocephalus (Pteropus), **333**, 334\*.  
 leucomelas (Xantharpyia), **10**, 13\*.  
 leucopterus (Spectrum), 311.  
 leucopterus (Desmalopex), 311.  
   " (Pteropus), **311**, 315\*.  
 liops (Pteropus), 817.  
 Liponyx, 2.  
 Lissonycteris, **23**, **814**.  
 Lissonycteris angolensis, 51.  
   " smithi, 814.  
 livingstonei (Pteropus), 247.  
   " (Spectrum), 247.  
 lombocense (Spectrum), 266.  
 lombocensis (Pteropus), 266.  
 lombocensis group (Pteropus), 265.  
 loochoënsis (Spectrum), 181.  
 loochoënsis (Pteropus), 181.  
 loochooënsis (Pteropus), 181.  
 lucasi (Cynopterus), 669.  
   " (Penthetor), 669.  
   " (Ptenochirus), 669.  
 lucasii (Cynopterus), 669.  
 luehuensis (Pselaphon), 181.  
 lucifer (Acerodon), 432.  
   " (Pteropus), 432.  
 lullulæ (Nyctimene), 713.  
   " (Nyctimene), 713.  
 luteus (Pteropus), 128.  
 luzoniense (Pachysoma), **616**, 619\*.  
 luzoniensis (Cynopterus), 616.  
 lylei (Pteropus), 339.  
 lyoni (Cynopterus), 827.  
  
 macassaricum (Spectrum), 121.  
 macassaricus (Pteropus), **124**, 125\*.  
 macdonaldi (Notopterus), 797.  
 mackloti (Acerodon), **418** (species),  
   **419** (subsp.), 420.  
   " (Pteropus), 119, 194, 266,  
     417, **419**, 420\*.  
 macioti (Pteropus), 419.  
 macrocephalum (Pachysoma), 538.  
 macrocephalus (Epomophorus), 493,  
   507, 523, 526, **538**,  
   542, 543  
   " (Pteropus), 529, **538**,  
     541\*.  
 Macroglossa, 747.  
 Macroglossa horsfieldi, 759.  
   " kiodotes, 759.  
   " minima, 758.

- Macroglossa rostrata*, 759.  
*Macroglosse*, 747.  
*Macroglossinae*, 723.  
*Macroglossum*, 747.  
*Macroglossus*, 723, **746**, 747, 771.  
*Macroglossus australis*, 763, 767, **781**.  
   " *crassus*, **780**, 785.  
   " *cuvieri*, 759\*.  
   " *finshi*, 779.  
   " *horsfieldi*, **759**, 760\*.  
   " *kiodotes*, 759\*.  
   " *lagochilus*, 761, **762**  
     (species), **763** (subsp.),  
     764.  
   " *microtus*, 767.  
   " *unimus*, **755** (species),  
     **757** (subsp.), 758, 760,  
     761, 763, 765, 777,  
     780, 781.  
   " *nanus*, 764, **765**, 766,  
     767.  
   " *novæ-guinææ*, 766.  
   " *papuanus*, 777.  
   " *pygmaeus*, 767.  
   " *rostratus*, 759.  
   " *sobrinus*, **760**, 761.  
   " *spelæus*, 734.  
*macrotis* (Pteropus), 393, **396\***.  
   " (Spectrum), 396.  
*macrotis* group (Pteropus), 392.  
*maculata* (Balionycteris), 654, **657**.  
*maculatus* (Cynopterus), 654.  
   " (Megarops), 654.  
*madagascariensis* (Pteropus), **205**,  
   207\*.  
*magna* (Dobsonia), **466**, 825.  
*major* (Bdelygma), 709, **710**, 711,  
   713.  
   " (Cephalotes), 709, **710**, 711.  
   " (Cynopterus), 629.  
   " (Eoulycteris), 736.  
   " (Gelasinus), 709, **710**, 711,  
     713.  
   " (Harpyia), 709, **710**, 711, 713,  
     715.  
   " (Nyctimene), 710.  
   " (Nyctymene), 710.  
   " (Syconycteris), 780.  
   " (Uronycteris), 709.  
*majus* (Bdelygma), 709, **710**, 711,  
   713.  
*malaccensis* (Pteropus), **346**, 347.  
*marginata* (Eleutherura), 36, **600**.  
*marginatum* (Pachysoma), **600**, 606,  
   616, 631.  
*marginatus* (Cynopterus), 36, **599**,  
   600, 604, 606, 611,  
   616, 622, 624, 626,  
   627, 629, 631, 632.  
   " (Pteropus), **598**, 600,  
     602\*, 606, 616, 631.  
   " *mariannum* (Spectrum), 173, 174,  
     **178**.  
   " *mariannus* (Pteropus), 173, 174, **178**,  
     179\*.  
   " *mariannus* group (Pteropus), 172.  
   " *marianus* (Pteropus), 178.  
   " *mascarinus* (Pteropus), **273**, 275\*.  
   " *mauritanum* (Spectrum), 215.  
   " *mauritanus* (Pteropus), 215.  
   " (Vespertilio), **215**, 220\*.  
   " *medius* (Pteropus), **329**, 330, 331,  
     332\*, 333, 334,  
     335, 339, 340.  
   " *megacephalus* (Pteropus), **539**, 541\*.  
*Megachiroptera*, 1.  
*Megara*, 646.  
*Megara ecaudata*, 649.  
*Megarops*, **646**, 649\*, 654, 658.  
*Megarops ecaudatus*, **649**, 650.  
   " *maculatus*, 654.  
   " *melanocephalus*, 661.  
*Megaloglossus*, 738.  
*Megaloglossus woerimanni*, 742.  
*Megera*, 646.  
*Megera ecaudata*, 649.  
*melanocephalum* (Pachysoma), **660**,  
   661.  
*melanocephalus* (Chironax), 660.  
   " (Cynopterus), 661.  
   " (Megarops), 661.  
   " (Pteropus), **660**, 661.  
   " (Thoopterus), 661.  
*melanonotus* (Pteropus), 227.  
*melanopogon* (Eulycteris), **238**, 385,  
   387.  
   " (Pteropus), **238**, 241\*,  
     242, 246, 385, 387.  
*melanopogon* group (Pteropus), 237.  
*melanops* (Melonycteris), 789.  
*melanotus* (Pteropus), **224**, 227\*.  
*melanotus* group (Pteropus), 223.  
*melas* (Pteropus), 233.  
*melinus* (Vespertilio), **704**, 707\*.  
*Melonycteris*, 785.  
*Melonycteris melanops*, 789.  
*menadensis* (Bonia), **58**, 59\*.  
*meyeri* (Odontonycteris), **764**, 765\*.  
*Micropteropus*, 554.  
*Micropteropus pusillus*, **557**, 558.  
*Micropterus*, 554.  
*microtus* (Macroglossus), 767.  
*minus* (Pteropus), 133.  
*mindanensis* (Acrodon), **429**, 430.  
*minima* (Carponycteris), **758**, 761,  
   763, 766, 777.  
   " (Macroglossa), 758.  
   " *minimus* (Kiodotus), 758, 761.  
   " (Macroglossus), **755** (species),  
     **757** (subsp.), 758, 760, 761,  
     763, 765, 777, 780, 781.  
   " (Pteropus), **757**, 761.

- minor (Cephalotes), 460.  
 „ (Cynonycteris), 43, 46.  
 „ (Cynopterus), 43, 632, 827.  
 „ (Dobsonia), 460, 824.  
 „ (Epomophorus), 530, 531, 533.  
 „ (Niadius), 632.  
 „ (Rousettus), 43, 811.  
 „ (Xantharpyia), 46.  
 minutus (Cynopterus), 625.  
 „ (Nyctimene), 701.  
 modiglianii (Pteropus), 232.  
 mollipilosus (Pteropus), 10, 12\*.  
 molossina (Sericonycteris), 275.  
 molossinus (Pteropus), 275, 277\*.  
 Molucca Bat, 704.  
 moluccense (Hypoderma), 464.  
 moluccensis (Cephalotes), 464.  
 „ (Dobsonia), 464, 825.  
 „ (Pteropus), 464.  
 monstrosus (Epomophorus), 506, 507.  
 „ (Hypsignathus), 506, 507, 827.  
 „ (Pteropus), 506.  
 montani (Cynopterus), 612, 617.  
 montanoi (Cynopterus), 600, 612, 616, 617, 620\*.  
 morio (Pteropus), 370.  
 morsus (Pteropus), 163.  
 Mycket stoor Nattblackor, 329.  
 Myonycteris, 576, 578\*.  
 Myonycteris angolensis, 51.  
 „ brachycephala, 582.  
 „ collaris, 580, 581.  
 „ leptodon, 580.  
 „ torquata, 580, 581.  
 „ wrightoni, 580.  
 mysolensis (Pteropus), 376, 278\*, 381.  
  
 naias (Syconycteris), 785.  
 Nalivatan, 190, 293.  
 nana (Carponycteris), 764, 766, 767.  
 Nanonycteris, 559.  
 Nanonycteris veldkampii, 562.  
 nanus (Macroglossus), 764, 765, 766, 767.  
  
 natale (Spectrum), 233.  
 natalis (Pteropus), 233.  
 Nattblackor, Mycket stoor, 329.  
 natunæ (Pteropus), 358.  
 nawalensis (Pteropus), 230, 233\*.  
 Nawathelgan, 190, 293.  
 Nekrei, 190.  
 neocaledonica (Notopteris), 799.  
 neohibernica (Eumycteris), 387.  
 neohibernicus (Pteropus), 387, 389\*.  
 neohibernicus group (Pteropus), 384.  
 nesea (Dobsonia), 476.  
 Nesonycteris, 790.  
 Nesonycteris woodfordi, 792.  
  
 neuhausi (Epomophorus), 523, 525\*, 527.  
  
 Niadius, 587.  
 Niadius minor, 632.  
 niadicus (Pteropus), 229.  
 Niadius, 586, 587, 597\*.  
 Niadius harpax, 633.  
 „ minor, [632].  
 „ princeps, 633.  
 nicobaricus (Pteropus), 106, 110, 115, 224, 227\*, 229, 232, 363, 366.  
 niger (Pteropus), 215, 220\*.  
 „ (Vespertilio), 215.  
 nigrescens (Cynopterus), 665.  
 „ (Thoopterus), 665.  
 Notopteris, 793.  
 Notopteris macedonaldi, 797.  
 „ neocaledonica, 799.  
 Notopteris, 798.  
 novæ-guinæ (Macroglossus), 766.  
 nudus (Pteropus), 350.  
 „ (Vespertilio), 350, 352\*.  
 Nyctemene, 681.  
 Nyctimene, 681, 694\*.  
 Nyctimene æello, 715.  
 „ albiventer, 700.  
 „ cephalotes, 703, 707\*, 709.  
 „ certans, 828.  
 „ cyclois, 703.  
 „ geminus, 709.  
 „ lullulæ, 713.  
 „ major, 710.  
 „ minutus, 701.  
 „ palliatus, 465, 472.  
 „ papuanus, 698.  
 „ robinsoni, 714.  
 „ scitulus, 711.  
 „ varius, 702.  
 Nyctimenina, 693.  
 Nyctimene, 681.  
 Nyctimene æello, 715.  
 „ albiventer, 698, 700.  
 „ lullulæ, 713.  
 „ major, 710.  
 „ robinsoni, 714.  
  
 ochrophæus (Pteropus), 420\*.  
 oculare (Spectrum), 381.  
 ocularis (Pteropus), 381, 382\*, 823.  
 Odontonycteris, 746, 747, 754\*.  
 Odontonycteris meyeri, 764, 765\*.  
 ornatus (Pteropus), 153.  
  
 Pachysoma, 514, 586, 587, 597\*, 628, 646, 658.  
 Pachysoma ægyptiacum, 30.  
 „ affine, 810.  
 „ amplexicaudatum, 40.

- Paehysoma* brachiotis, 615.  
 „ brachyotis, **615**, 619\*.  
 „ brachyotum, 615.  
 „ brevicaudatum, 600, 611,  
     **615**, 619\*.  
 „ crypturum, 536.  
 „ diardi, **605**, 608\*.  
 „ duvauceli, **614**, 619\*.  
 „ duvaucelli, 614.  
 „ ecaudatum, 649.  
 „ gambianum, 538.  
 „ giganteum, 343.  
 „ haldemani, 522.  
 „ horsfieldi, 631.  
 „ jagori, 645.  
 „ labiatum, 529.  
 „ luzoniense, **616**, 619\*.  
 „ macrocephalum, 538.  
 „ marginatum, **600**, 606,  
     616, 631.  
 „ melanocephalum, **660**,  
     661.  
 „ scherzeri, 627.  
 „ schoënsse, 529.  
 „ titthæcheilum, **605**, 616.  
 „ walilbergi, 526.  
 „ whitei, 539.  
*pagensis* (Cynopterus), **612**, 613\*.  
*paleaceus* (Pterocyron), **10**, 12\*.  
*paliata* (Dobsonia), 461, 465, 466, **468**,  
     472, 474.  
*paliatus* (Pteropus), **467**, 470\*.  
*pallasi* (Cephalotes), **705**, 708\*.  
 „ (Harpyia), 700, 705.  
 „ (Harpyia), **705**, 708\*, 711.  
*pallassii* (Harpyia), 705.  
*palliata* (Dobsonia), **468**, 826.  
*palliatum* (Cephalotes), 461, 464, 466,  
     **467**, 472, 474, 826.  
 „ (Nyctimene), 465, 472.  
 „ (Pteropus), **467**, 470\*.  
*pallidum* (Spectrum), 136.  
*pallidus* (Pteropus), **136**, 137\*.  
*palmarum* (Pteropus), **10**, 12\*.  
 „ (Xantharpyia), 10.  
*Panicui*, 359, 427.  
*papua* (Carponycteris), **777**, 780.  
 „ (Eunycteris), 385.  
 „ (Syconycteris), **777**, 780.  
*papuanus* (Macroglossus), **777**.  
 „ (Nyctimene), 698.  
 „ (Pteropus), **385**, 387\*, **823**.  
*pelewensis* (Pteropus), 173.  
*Penthetor*, **665**, 669.  
*Penthetor lucasi*, 669.  
*peroni* (Cephalotes), 460, 461, 464, 466,  
     **468**, 469\*, 471, 473,  
     474, 475, 476, 826.  
 „ (Dobsonia), 461, **467**, 468, 471,  
     473, 474, 475.  
 „ (Hypoderma), 464, **468**, 471.  
*peroni* (Pteropus), 468.  
*personata* (Sericonycteris), 321.  
*personatus* (Pteropus), **321**, 324\*,  
     445.  
*petersi* (Pteropus), 266, **316**, 318\*.  
 „ (Sericonycteris), 316.  
*phæcephalus* (Pteropus), 298.  
*phæops* (Pteropus), 206, 238.  
*phaiops* (Eunycteris), **238**, 261, 351,  
     352\*.  
 „ (Pteropus), **205**, 207\*, 238.  
*phaliops* (Pteropus), 206.  
*philippensis* (Cynopterus), **616**, 620\*.  
 „ (Rousettus), 41.  
*philippinensis* (Eleutherura), **41**, 42\*.  
 „ (Pteropus), 41.  
 „ (Rousettus), 41.  
*Phygetis*, 579.  
*Phygetis brachycephala*, 582.  
*pilosus* (Pteropus), 306.  
*pirivarus* (Pteropus), 36.  
*Plerotes*, 488.  
*Plerotes anchietæ*, **486**, 827.  
*pluto* (Pteropus), **353**, 359.  
*pluton* (Pteropus), **353**, 354\*.  
*poliocephalum* (Spectrum), 398.  
*poliocephalus* (Pteropus), **397**, 400\*.  
*polycephalus* (Pteropus), 397.  
*pomsarguesi* (Epomophorus), 543.  
*prædatrix* (Dobsonia), 474.  
*princeps* (Cynopterus), 633.  
 „ (Niadius), 633.  
 „ (Pteropus), 208.  
*Pselaphon*, **61**, 79\*.  
*Pselaphon luchuensis*, 181.  
 „ ursinus, **301**, 305\*.  
*pselaphon* (Pteropus), 301.  
 „ (Spectrum), 301.  
*pselaphon group* (Pteropus), 293.  
*Ptenochirus*, **643**, 645\*, 665.  
*Ptenochirus ecaudatus*, 650.  
 „ jagori, 645.  
 „ lucasi, 669.  
*Pteralopex*, 432.  
*Pteralopex anceps*, 437.  
 „ atrata, 439.  
*Pterocyron*, 2.  
*Pterocyron büttikoferi*, 11.  
 „ dupreanus, 8.  
 „ helvus, 9.  
 „ paleaceus, **10**, 12\*.  
 „ sabaeus, 15.  
 „ stramineus, 10.  
*Pteronotus*, **448**, 458\*.  
*pteronotus* (Pteropus), **351**, 352\*.  
*Ptérope olive*, 598.  
*Pteropodidæ*, 1.  
*Pteropodina*, 1.  
*Pteropus*, **61**, 77\*, 412, 442, 448, 514,  
     586, 658, 681, 746.  
*Pteropus admiralitatum*, 144.

- Pteropus aegyptiacus*, 29, 31\*.  
 „ *aegyptius*, 29.  
 „ *affinis*, 194, 196\*.  
 „ *alboscapulatus*, 789, 790\*.  
 „ *aldabrensis*, 213.  
 „ *alecto*, 363, 365, 367\*, 375, 379, 381.  
 „ *alecto group*, 363.  
 „ *alecton*, 363, 366.  
 „ *amplexicaudatus*, 26, 35, 36, 40, 41, 42\*, 43, 44.  
 „ *aneitanus*, 288.  
 „ *aneiteanus*, 288.  
 „ *anetianus*, 288.  
 „ *annectens*, 116.  
 „ *aurus*, 532.  
 „ *argentatus*, 197, 241, 242\*, 246, 385.  
 „ *ariel*, 335, 336\*.  
 „ *aruensis*, 241, 243\*, 246.  
 „ *assamensis*, 333, 334\*, 339.  
 „ *aterrimus*, 363, 365\*, 366, 822.  
 „ *atratus*, 439.  
 „ *auratus*, 156.  
 „ *auriculis patulis*, 86.  
 „ *aurinuchalis*, 428, 429\*.  
 „ *batchianus*, 194, 196\*.  
 „ *baveanus*, 364, 365\*.  
 „ *brachyotis*, 615.  
 „ *brevicaudatus*, 615.  
 „ *breviceps*, 275, 278\*.  
 „ *brunneus*, 149.  
 „ *caguyanus*, 121, 122, 123\*.  
 „ *caniceps*, 194, 196\*.  
 „ *caniceps group*, 192.  
 „ *canus*, 113.  
 „ *capistratus*, 319, 321\*.  
 „ *celeno*, 106, 343, 347, 349, 353, 356, 358, 360.  
 „ *celebensis*, 417, 418\*.  
 „ *cephalotes*, 467, 704, 707\*.  
 „ *ceramensis*, 381, 382\*.  
 „ *chineusis*, 311, 315\*.  
 „ *chrysargurus*, 246, 247\*.  
 „ *chrysauchen*, 375, 377\*, 381.  
 „ *chrysoproctus*, 197, 260, 263\*.  
 „ *cognatus*, 251.  
 „ *collaris*, 25, 28\*, 166, 169\*.  
 „ *collo rubro*, 219\*.  
 „ *colonus*, 147.  
 „ *comorensis*, 208, 209\*.  
 „ *condorensis*, 110, 111\*.  
 „ *conspicillatus*, 378, 823.  
 „ *conspicillatus group*, 375.  
 „ *coronatus*, 387, 389\*.  
 „ *crypturus*, 536.  
 „ *dasyvallus*, 159, 161\*.  
 „ *degener*, 387, 389\*.  
 „ *desinaresti*, 458, 469.  
 „ *diardi*, 605.  
 „ *dobsoni*, 192.  
 „ *dupreanus*, 7.  
 „ *dussumieri*, 184, 185\*.  
 „ *duvauceli*, 614.  
 „ *duvaucelli*, 614.  
 „ *ecaudatus*, 649.  
 „ *edulis*, 110, 224, 229, 330, 331, 334, 343, 346, 347, 350, 353, 356, 357\*, 358, 359, 371.  
 „ *edwardsi*, 204, 206\*, 208, 212, 216, 247, 330, 331, 332\*, 334, 339, 398.  
 „ *edwardsii*, 205, 331.  
 „ *egyptiacus*, 29.  
 „ *elseyi*, 403, 406\*.  
 „ *enganus*, 107, 109\*.  
 „ *epomophorus*, 539, 541\*.  
 „ *epularius*, 392, 395\*.  
 „ *erachii*, 26.  
 „ *faunulus*, 143, 144\*.  
 „ *flavicollis*, 186, 188\*.  
 „ *flavus*, 809.  
 „ *floresianus*, 420.  
 „ *floresii*, 420.  
 „ *formosanus*, 163.  
 „ *formosus*, 163, 164\*.  
 „ *fumigatus*, 242, 243\*.  
 „ *funereus*, 186, 346, 347, 351, 356, 357\*, 358, 359, 370.  
 „ *fuscicollis*, 284.  
 „ *fuscus*, 165, 169\*, 192, 193\*, 215, 220\*, 347\*.  
 „ *gambianus*, 538, 541\*, 827.  
 „ *geddiei*, 189.  
 „ *geminorum*, 106, 107\*.  
 „ *geoffroyi*, 30, 32\*.  
 „ *germaini*, 155.  
 „ *giganteus*, 326 (species), 329 (subsp.), 334.  
 „ *gouldi*, 370, 372\*.  
 „ *grandis*, 255, 259.  
 „ *griseus*, 136, 137, 139\*, 316, 318\*, 816.  
 „ *haldemani*, 522.  
 „ *heudei*, 266.  
 „ *hottentottus*, 26, 28\*.  
 „ *hottentotus*, 26.  
 „ *hypomelanus*, 101 (species), 107, 110, 113, 116, 119, 121, 124, 127\* (subsp.), 128, 133, 136, 138, 147, 192, 194, 233, 266, 381, hypomelanus group, 98.  
 „ *hypomelas*, 242.  
 „ *insignis*, 396\*.

- Pteropus insularis*, 173, 174, **295**, 297\*.  
 .. *intermedius*, 340.  
 .. *javanicus*, 340, 346, **350**, 352\*.  
 .. *jubatus*, 359, **427**, 429\*.  
 .. *kelaarti*, **331**, 332\*, 351.  
 .. *keraudren*, 177, **178**, 179\*, 189.  
 .. *keraudreni*, 173, 174, **179**, 181, 184, 186, 189, 295, 306.  
 .. *keraudrenius*, 177, **179**, 180\*, 186.  
 .. *keraudrensis*, 179.  
 .. *keyensis*, **246**, 247\*, **821**.  
 .. *labiatus*, **529**, 533.  
 .. *lanensis*, **359**, 360, 361\*.  
 .. *laniger*, **295**, 297\*.  
 .. *lavellanus*, 258.  
 .. *leachi*, **26**, 28\*.  
 .. *lencoecephalus*, 333.  
 .. *lepidus*, **115**, **815**.  
 .. *leschenaulti*, **35**, 37\*, 38.  
 .. *lencoecephalus*, **333**, 334\*.  
 .. *leucopterus*, **311**, 315\*.  
 .. *lops*, 817.  
 .. *livingstonei*, 247.  
 .. *lombocensis*, 266.  
 .. *lombocensis* group, 265.  
 .. *lochoënsis*, 181.  
 .. *lochooënsis*, 181.  
 .. *lucifer*, 432.  
 .. *luteus*, 128.  
 .. *lylei*, 339.  
 .. *macassaricus*, **124**, 125\*.  
 .. *mackloti*, 119, 194, 266, 417, **419**, 420\*.  
 .. *macloti*, 419.  
 .. *macrocephalus*, 529, **538**, 541\*.  
 .. *macrotis*, **393**, 396\*.  
 .. *macrotis* group, 392.  
 .. *madagascariensis*, **205**, 207\*.  
 .. *malaccensis*, **346**, 347.  
 .. *marginatus*, **598**, 600, 602\*, 606, 616, 631.  
 .. *marianus*, 173, 174, **178**, 179\*.  
 .. *marianus* group, 172.  
 .. *marianus*, 178.  
 .. *masarinus*, **273**, 275\*.  
 .. *mauritanus*, 215.  
 .. *medius*, **329**, 330, 331, 332\*, 333, 334, 335, 339, 340.  
 .. *megacephalus*, **539**, 541\*.  
 .. *melanocephalus*, **660**, 661.  
 .. *melanonotus*, 227.  
 .. *Pteropus melanopogon*, **238**, 241\*, 242, 246, 385, 387.  
 .. *melanopogon* group, 237.  
 .. *melanotus*, **224**, 227\*.  
 .. *melanotus* group, 223.  
 .. *melas*, 233.  
 .. *mimus*, 133.  
 .. *minimus*, **757**, 761.  
 .. *modiglianii*, 232.  
 .. *mollipilosus*, **10**, 12\*.  
 .. *molossinus*, **275**, 277\*.  
 .. *moluccensis*, 464.  
 .. *monstrosus*, 506.  
 .. *morio*, 370.  
 .. *morsus*, 163.  
 .. *mysolensis*, **376**, 378\*, 331.  
 .. *natalis*, 233.  
 .. *natunæ*, 358.  
 .. *nawaiensis*, **280**, 283\*.  
 .. *neohibernicus*, **387**, 389.  
 .. *neohibernicus* group, 384.  
 .. *niadicus*, 229.  
 .. *nicobaricus*, 106, 110, 115, **224**, 227\*, 229, 232, 363, 366.  
 .. *niger*, **215**, 220\*.  
 .. *nudus*, 350.  
 .. *ochrophæus*, 420\*.  
 .. *ocularis*, **381**, 382\*, **823**.  
 .. *ornatus*, 153.  
 .. *paliatus*, **467**, 470\*.  
 .. *palliatu*, **467**, 470\*.  
 .. *pallidus*, **136**, 137\*.  
 .. *palmarum*, **10**, 12\*.  
 .. *papuanus*, **385**, 387\*, **823**.  
 .. *pelewensis*, 173.  
 .. *peroni*, 468.  
 .. *personatus*, **321**, 324\*, 445.  
 .. *petersi*, 266, **316**, 318\*.  
 .. *phæcephalus*, 298.  
 .. *phæops*, 206, 238.  
 .. *phaiops*, **205**, 207\*, 238.  
 .. *phaliops*, 206.  
 .. *philippinensis*, 41.  
 .. *pilosus*, 306.  
 .. *pirivarus*, 36.  
 .. *pluto*, **353**, 359.  
 .. *pluton*, **353**, 354\*.  
 .. *poliocephalus*, **397**, 400\*.  
 .. *polycephalus*, 397.  
 .. *princeps*, 208.  
 .. *pselaphon*, 301.  
 .. *pselaphon* group, 293.  
 .. *pteronotus*, **351**, 352\*.  
 .. *pteropus*, **216**, 223\*.  
 .. *pumilus*, 816.  
 .. *pusillus*, **598**, 602\*.  
 .. *pyrivorus*, **36**, 37\*.  
 .. *pyrrhocephalus*, **427**, 429\*.  
 .. *pyrrhocephalus*, 427.

- Pteropus rampyrus*, 343.  
 .. *rayneri*, 251, 252\*, 253, 254\*.  
 .. *rayneri* group, 250.  
 .. *robinsoni*, 815.  
 .. *rodericensis*, 273.  
 .. *rodricensis*, 273, 275\*.  
 .. *rostratus*, 759\*.  
 .. *ruber*, 165, 169\*.  
 .. *rubianus*, 255.  
 .. *rubicollis*, 165, 334.  
 .. *rubiginosus*, 241, 243\*.  
 .. *rubricollis*, 153, 159, 165, 166, 169\*, 208, 334.  
 .. *ruficollis*, 285.  
 .. *ruficollis*, 284, 285.  
 .. *rufus*, 202 (species), 204 (subsp.), 206\*, 215, 221\*, 387, 389\*.  
 .. *rufus* aut *niger* auriculis brevibus acutiusculis, 215, 219\*.  
 .. *rufus* group, 200.  
 .. *samoënsis*, 280, 284, 287\*.  
 .. *samoënsis* group, 280.  
 .. *satyrus*, 142.  
 .. *scapulatus*, 403, 406\*, 824.  
 .. *scapulatus* group, 402.  
 .. *schoënsis*, 529, 530, 531\*.  
 .. *seminudus*, 810.  
 .. *seychellensis*, 212, 213\*.  
 .. smaller species of, 288.  
 .. *solitarius*, 269.  
 .. *solomonis*, 148.  
 .. sp., 36, 121, 213, 229, 331, 347, 385, 428.  
 .. *speciosus*, 132.  
 .. *spectrum*, 127.  
 .. *stramineus*, 9, 10, 12\*.  
 .. *subniger*, 164, 168\*.  
 .. *taraiyensis*, 810.  
 .. *temminckii*, 138, 269, 316, 318\*, 822.  
 .. *temminckii* group, 315.  
 .. *titthæcheilus*, 605, 607\*, 611.  
 .. *tomesi*, 119, 120\*, 815, 816.  
 .. *tonganus*, 184, 186, 188\*, 189.  
 .. *torquatus*, 166, 169\*.  
 .. *tricolor*, 127, 266, 269\*.  
 .. *tuberculatus*, 309, 310\*.  
 .. *tytleri*, 227, 229\*, 820.  
 .. *ualanus*, 177, 178\*.  
 .. *ualeensis*, 177.  
 .. *ursinus*, 301, 305\*.  
 .. *vampirus*, 347.  
 .. *vampyrus*, 9, 165, 204, 215, 219\*, 343 (species), 347, 349 (subsp.), 358, 359.  
 .. *vampyrus* group, 321.  
*Pteropus vanicorensis*, 184.  
 .. *vanikorensis*, 184, 185\*, 309, 310\*.  
 .. *vanikoriensis*, 309.  
 .. *vetulus*, 153, 155, 156.  
 .. *vitiensis*, 280, 284\*.  
 .. *vociferus*, 119, 120\*.  
 .. *voeltzkowi*, 818.  
 .. *vulgaris*, 215, 221\*.  
 .. *wahlbergi*, 526.  
 .. *wallacei*, 445.  
 .. *whitei*, 530, 532, 539, 541\*.  
 .. *whitmeei*, 284, 287\*.  
 .. *woodfordi*, 407.  
 .. *yapensis*, 174.  
*pteropus* (*Pteropus*), 216, 223\*.  
*pumilus* (*Pteropus*), 816.  
*pusillus* (*Epomophorus*), 557, 558\*, 562.  
 .. (*Micropteropus*), 557, 558.  
 .. (*Pteropus*), 598, 602\*.  
*pygmaeus* (*Macroglossus*), 767.  
*pyrivorus* (*Pteropus*), 36, 37\*.  
*pyrrhocephalus* (*Pteropus*), 427, 429\*.  
*pyrrhocephalus* (*Pteropus*), 427.  
*rampyrus* (*Pteropus*), 343.  
*rayneri* (*Pteropus*), 251, 252\*, 253, 254\*.  
 .. (*Spectrum*), 251, 253.  
*rayneri* group (*Pteropus*), 250.  
*Rhynchoconyon*, 746.  
*robinsoni* (*Nyctimene*), 714.  
 .. (*Nyctimene*), 714.  
 .. (*Pteropus*), 815.  
*rodericensis* (*Pteropus*), 273.  
*rodricense* (*Spectrum*), 273.  
*rodricensis* (*Pteropus*), 273, 275\*.  
*rosenbergi* (*Callinycteris*), 737.  
 .. (*Eonycteris*), 737.  
*rostrata* (*Macroglossa*), 759.  
*rostratus* (*Macroglossus*), 759.  
 .. (*Pteropus*), 759\*.  
*Roulette*, 164, 165, 168\*.  
*Rousettus*, 16 (genus), 22 (subg.), 23\*, 576.  
*Rousettus aegyptiacus*, 29, 30, 49, 813.  
 .. *amplexicaudatus*, 33, 36, 40, 41, 43, 46, 812.  
 .. *angolensis*, 51.  
 .. *arabicus*, 33.  
 .. *bocagei*, 41.  
 .. *brachycephalus*, 582.  
 .. *brachyotis*, 44, 45, 46, 812.  
 .. *celebensis*, 46.  
 .. *collaris*, 26, 31, 51.  
 .. *dupreanus*, 8.  
 .. *gaillardi*, 22.  
 .. *kempi*, 813.  
 .. *lanosus*, 49, 813.

- Ronsettus leachi*, **25**, **26**, **810**.  
 „ *leschenaulti*, **35**, **810**.  
 „ *minor*, **43**, **811**.  
 „ *philippensis*, **41**.  
 „ *philippinensis*, **41**.  
 „ *seminudus*, **38**, **810**.  
 „ *shortridgei*, **811**.  
 „ *sjöstedti*, **26**, **810\***.  
 „ *smithi*, **814**.  
 „ *stramineus*, **10**, **15**.  
 „ *torquatus*, **581**.  
*Roussette*, **168**, **215**, **219\***, **349**.  
*Roussette à col rouge*, **164**, **168\***.  
*Roussette de Vanicoro*, **309**.  
*Roussette, Grande*, **206**.  
*Roussette jaune*, **9**.  
*Roussette kalou*, **350**.  
*Roussette Kéraudren*, **179**.  
*Roussette olive*, **598**.  
*Roussette, une autre espèce*, **165**.  
*Roussettes à ailes sur le dos*, **7**, **448**,  
     **458**.  
*Roussettes à queue*, **7**, **458**, **586**.  
*Roussettes sans queue*, **7**, **458**, **514**.  
*Roussettus*, **10**, **30**, **576**.  
*ruber* (*Pteropus*), **165**, **169\***.  
*rubianus* (*Pteropus*), **255**.  
*rubicollis* (*Pteropus*), **165**, **334**.  
*rubidum* (*Spectrum*), **165**, **169\***.  
*rubiginosus* (*Pteropus*), **241**, **243\***.  
*rubricolle* (*Spectrum*), **166**.  
*rubricollis* (*Pteropus*), **153**, **159**, **165**,  
     **166**, **169\***, **208**, **334**.  
 „ (*Sericonycteris*), **166**.  
*ruficollis* (*Pteropus*), **285**.  
*ruficollis* (*Pteropus*), **284**, **285**.  
*rufus* (*Pteropus*), **202** (species), **204**  
     (subsp.), **206\***, **215**, **221\***, **387**, **389\***.  
*rufus aut niger auriculis brevibus*  
*acutiusculus* (*Pteropus*), **215**, **219\***.  
*rufus group* (*Pteropus*), **200**.  
  
*sabæum* (*Eidolon*), **15**.  
*sabæus* (*Pterocyton*), **15**.  
*samoëense* (*Spectrum*), **281**, **284**.  
*samoënsis* (*Pteropus*), **280**, **284**, **287\***.  
*samoënsis group* (*Pteropus*), **280**.  
*satyrus* (*Pteropus*), **142**.  
*scapulatum* (*Spectrum*), **403**.  
*scapulatus* (*Pteropus*), **403**, **406\***, **824**.  
*scapulatus group* (*Pteropus*), **402**.  
*scherzeri* (*Cynopterus*), **606**, **627**, **628**,  
     **629**.  
 „ (*Pachysoma*), **627**.  
*schoëense* (*Pachysoma*), **529**.  
*schoënsis* (*Epomophorus*), **530**, **533**,  
     **557**.  
 „ (*Pteropus*), **529**, **530**, **531\***.  
*schovanus* (*Epomophorus*), **530**.  
*scitulus* (*Nyctimene*), **711**.  
  
*Scotonycteris*, **563**.  
*Scotonycteris bedfordi*, **567**, **568\***.  
 „ *zenkeri*, **567**.  
*seminuda* (*Senonycteris*), **[33]**.  
 „ (*Xantharpyia*), **39\***.  
*seminudus* (*Pteropus*), **810**.  
 „ (*Rousettus*), **38**, **810**.  
*Senonycteris*, **16**, **24\***.  
*Senonycteris seminuda*, **[38]**.  
*Sericonycteris*, **61**, **79\***.  
*Sericonycteris capistrata*, **319**.  
 „ *heudei*, **266**.  
 „ *molossina*, **275**.  
 „ *personata*, **321**.  
 „ *petersi*, **316**.  
 „ *rubricollis*, **166**.  
 „ *temmincki*, **138**.  
 „ *woodfordi*, **407**.  
*seychellensis* (*Pteropus*), **212**, **213\***.  
*shortridgei* (*Rousettus*), **811**.  
*sjöstedti* (*Rousettus*), **26**, **810\***.  
*Smaller species of Pteropus*, **288**.  
*smithi* (*Lissonycteris*), **814**.  
 „ (*Rousettus*), **814**.  
*sobrinus* (*Macroglossus*), **760**, **761**.  
*solitarius* (*Pteropus*), **269**.  
*solomonis* (*Pteropus*), **148**.  
*sp.* (*Carponycteris*), **761**.  
 „ (*Cynonycteris*), **22**, **31**, **51**.  
 „ (*Epomophorus*), **486**, **523**, **543**.  
 „ (*Pteropus*), **36**, **121**, **213**, **229**, **331**,  
     **247**, **385**, **428**.  
*spadiceus* (*Cynopterus*), **654**.  
 „ (*Dyacopterus*), **654**.  
 „ (*Thoopterus*), **654**.  
*speciosus* (*Pteropus*), **132**.  
*Spectrum*, **61**, **78\***.  
*Spectrum admiralitatum*, **144**.  
 „ *aneitanum*, **288**.  
 „ *anetianum*, **288**.  
 „ *assamense*, **339**.  
 „ *brunneum*, **149**.  
 „ *condorensis*, **110**.  
 „ *dasyllum*, **159**.  
 „ *epularium*, **392**.  
 „ *formosum*, **163**.  
 „ *fusum*, **192**.  
 „ *germaini*, **155**.  
 „ *griseum*, **138**.  
 „ *insulare*, **295**.  
 „ *hypomelanum*, **107**, **110**,  
     **113**, **116**, **121**, **124**, **127**,  
     **128**, **147**, **233**, **266**, **381**.  
 „ *leucopterus*, **311**.  
 „ *livingstonei*, **247**.  
 „ *lombocense*, **266**.  
 „ *lochoëense*, **181**.  
 „ *macassaricum*, **124**.  
 „ *macrota*, **396**.  
 „ *marianum*, **173**, **174**, **178**.  
 „ *mauritium*, **215**.



- Spectrum natale*, 233.  
 " *oculare*, 381.  
 " *pallidum*, 136.  
 " *poliocephalum*, 398.  
 " *pselaphon*, 301.  
 " *rayneri*, 251, **253**.  
 " *rodricense*, 273.  
 " *rubidum*, **165**, 169\*.  
 " *rubricolle*, 166.  
 " *samoëense*, 231, **284**.  
 " *scapulatum*, 403.  
 " *tonesi*, 119.  
 " *tuberculatum*, 309.  
 " *ualanum*, 177.  
 " *vampirus*, 215.  
 " *vampyrus*, 215.  
 " *vetulum*, 153, **155**, 156.  
 " *vociferum*, 119.  
 " *voeltzkowi*, 818.  
 " *vulgare*, **215**, 216.  
*spectrum* (Pteropus), 127.  
*spelæa* (Eonycteris), **734**, 736, 737.  
*spelæus* (Macroglossus), 734.  
*Sphærias*, 671.  
*Sphærias blanfordi*, 674.  
*splunx* (Cynopterus), **598**, 612, 617.  
 " (Vespertilio), **598**, 602\*.  
*Sphyrocephalus*, 501.  
*Sphyrocephalus labrosus*, 507.  
*Stenonycteris*, **23**, **813**.  
*Stenonycteris kempi*, 813.  
 " *lanosa*, **49**, 813.  
*straminea* (Cynonycteris), 7, 8, **9**, 10, 15.  
 " (Xantarpia), 9.  
 " (Xantharpya), 9.  
 " (Xantharpyia), **9**, 10, 15.  
*stramineum* (Pachysoma), 9.  
*stramineus* (Cynopterus), 10.  
 " (Pterocyon), 10.  
 " (Pteropus), **9**, 10, 12\*.  
 " (Roussettus), **10**, 15.  
 " (Roussettus), 10.  
*straminia* (Cynonycteris), 9.  
*streptans* (Epomops), 496.  
*stuhlinni* (Epomophorus), **526**, 527\*.  
*Styloctenium*, 442.  
*Styloctenium wallacei*, 445.  
*subniger* (Pteropus), **164**, 168\*.  
 " (Vespertilio), 165.  
*sunbana* (Dobsonia), 471.  
*Syconycteris*, **771**, 775\*.  
*Syconycteris australis*, 781.  
 " *crassa*, **775** (species), **780** (subsp.), 785.  
 " *finschi*, 779.  
 " *keyensis*, 779.  
 " *major*, 780.  
 " *naias*, 785.  
 " *papuana*, **777**, 780.  
*taraiyensis* (Pteropus), 810.  
*temmincki* (Pteropus), 138, 269, **316**, 318\*, **822**.  
 " (Sericonycteris), 138.  
*temmincki* group (Pteropus), 315.  
*Ternate Bat*, 204.  
*Ternate Bat*, Lesser, **8**, 12\*.  
*Ternate Bat*: The Rougette, 165.  
*Ternate Bat*: The Roussette, 349.  
*Thoopterus*, 651, 658, **662**, 664\*, 671.  
*Thoopterus blanfordi*, 674.  
 " *melanocephalus*, 661.  
 " *nigrescens*, 665.  
 " *spadiceus*, 654.  
*titthæcheilus* [Cynopterus], 605.  
*titthæcheilus* [Cynopterus], 605.  
*titthæcheilum* (Pachysoma), **605**, 616.  
*titthæcheilus* (Cynopterus), 600, **605**, 611, 616.  
 " (Pteropus), **605**, 607\*, 611.  
*titthæcheilus* [Cynopterus], 605.  
*titthochilus* [Cynopterus], 605.  
*titthoecheilus* [Cynopterus], 605.  
*tonesi* (Pteropus), **119**, 120\*, 815, 816.  
 " (Spectrum), 119.  
*tonganus* (Pteropus), 184, **186**, 188\*, 189.  
*torquata* (Cynonycteris), 580, **581**.  
 " (Myonycteris), 580, **581**.  
 " (Xantharpyia), 580, **581**.  
*torquatus* (Cynopterus), 581.  
 " (Pteropus), **166**, 169\*.  
 " (Roussettus), 581.  
 " (Roussettus), 580, **581**.  
*transiens* (Archæopteropus), xxxvii.  
*Tribonophorus*, **448**, 458\*.  
*Tribonophorus desmaresti*, **469**, 470\*.  
*tricolor* (Pteropus), **127**, **266**, 269\*.  
*Trygonycteris*, 738.  
*Trygonycteris woermanni*, 742.  
*tuberculatum* (Spectrum), 309.  
*tuberculatus* (Pteropus), **309**, 310\*.  
*tytleri* (Pteropus), **227**, 229\*, **820**.  
*ualanum* (Spectrum), 177.  
*ualanus* (Pteropus), **177**, 178\*.  
*ualensis* (Pteropus), 177.  
*umbrosa* (Dobsonia), 825.  
*unicolor* (Cynonycteris), 51.  
 " (Eleutherura), **30**, 32\*.  
 " (Epomophorus), **526**, 527\*.  
*Uronycteris*, **681**, 682, 695\*.  
*Uronycteris albiventer*, 700.  
 " *cephalotes*, 698, **704**, 708\*.  
 " *major*, 709.  
*ursinus* (Pselaphon), **301**, 305\*.  
 " (Pteropus), **301**, 305\*.

- vampirus (Pteropus), 347.  
 „ (Spectrum), 215.  
 Vampire Bat, 329.  
 vampyrus (Pteropus), 9, 165, 204, 215.  
 „ 219\*, **343** (species), 347,  
**349** (subsp.), 358, 359.  
 „ (Spectrum), 215.  
 „ (Vespertilio), 9, 165, 204,  
 215, 219\*, 347, **349**,  
 352\*.  
 vampyrus group (Pteropus), 324.  
 vanicorensis (Pteropus), 184.  
 vanikorensis (Acerodon), **184**, 309.  
 „ (Pteropus), **184**, 185\*,  
 309, 310\*.  
 vanikoriensis (Pteropus), 309.  
 varius (Nyctimene), 702.  
 veldkampii (Epomophorus), 562.  
 „ (Nanonycteris), 562.  
 Vespertilio, 586, 681.  
 Vespertilio celano, 349.  
 „ celano, 349.  
 „ caninus, 10, 165, 204, 215,  
 220\*, **349**.  
 „ cauda nulla, 349.  
 „ celano, **349**, 352\*.  
 „ cephalotes, **703**, 707\*.  
 „ cynocephalus Ternatanus,  
 349.  
 „ facie canina, 204.  
 „ fibulatus, **598**, 602\*.  
 „ giganteus, **329**, 332\*.  
 „ helvus, 9.  
 „ indicus, 329.  
 „ ingens, **215**, 219\*.  
 „ jubatus, 427.  
 „ mauritianus, **215**, 220\*.  
 „ melinus, **704**, 707\*.  
 „ niger, 215.  
 „ nudus, **350**, 352\*.  
 „ sphinx, **598**, 602\*.  
 „ subniger, **165**, 168\*.  
 „ vampyrus, 9, 165, 204,  
 215, 219\*, 347, **349**,  
 352\*.  
 Vespertiliones duo Indici, 329.  
 vetulum (Spectrum), 153, **155**, 156.  
 vetulus (Pteropus), 153, **155**, 156.  
 viridis (Cephalotes), **471**, 826.  
 „ (Dobsonia), **471**, 472, 825,  
**826**.  
 vitiensis (Pteropus), **280**, 284\*.  
 vociferum (Spectrum), 119.  
 vociferus (Pteropus), **119**, 120\*.  
 voeltzkowi (Pteropus), 818.  
 „ (Spectrum), 818.  
 vulgare (Spectrum), **215**, 216.  
 vulgaris (Pteropus), **215**, 221\*.  
 wahlbergi (Epomophorus), **521** (spe-  
 cies), **526** (subsp.).  
 „ (Pachysoma), 526.  
 „ (Pteropus), 526.  
 wallacei (Pteropus), 445.  
 „ (Styloctenium), 445.  
 whiteheadi (Harpyionycteris), 805.  
 whitei (Epomophorus), 523, 526, **539**.  
 „ (Pachysoma), 539.  
 „ (Pteropus), 530, 532, **539**,  
 541\*.  
 whitmeei (Pteropus), **284**, 287\*.  
 woermanni (Megaloglossus), 742.  
 „ (Trygonycteris), 742.  
 woodfordi (Nesonycteris), 792.  
 „ (Pteropus), 407.  
 „ (Sericonycteris), 407.  
 wroughtoni (Myonycteris), 580.  
 Xantarpia, 9.  
 Xantarpia, 9.  
 Xantharpyia, **16**, 23\*, 576.  
 Xantharpyia ægyptiaca, **30**, 33, 49,  
 813.  
 „ amplexicaudata, 33, 35,  
 39, **40**, 43, 45, 471.  
 „ angolensis, 51.  
 „ brachycephala, 582.  
 „ brachyotis, **45**, 46.  
 „ collaris, **26**, 31, 33, 51.  
 „ dupreana, 8.  
 „ hottentotta, 26.  
 „ leachi, 26.  
 „ leschenaulti, **35**, 33.  
 „ leucomelas, **10**, 13\*.  
 „ minor, 46.  
 „ palmarum, 10.  
 „ seminuda, 39\*.  
 „ straminea, **9**, 10, 15.  
 „ torquata, 580, **581**.  
 yapensis (Pteropus), 174.  
 zechi (Epomophorus), **539**, 541\*.  
 zenkeri (Epomophorus), 500, **523**,  
 524\*, 536.  
 „ (Scotonycteris), 567.  
 Zygenocephalus, 501.  
 Zygenocephalus labrosus, 507.







