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**THE BATS OF BIHAR—TAXONOMY AND
ECOLOGY**

by

Y. P. SINHA

**Issued by the Director
Zoological Survey of India, Calcutta**

**RECORDS
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By

YADUNATH PRASAD SINHA

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Zoological Survey of India, Patna-800020



सत्यमेव जयते

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CONTENTS

INTRODUCTION	1
ACKNOWLEDGEMENTS	3
KEY TO THE BATS OF BIHAR	3
TAXONOMY AND FIELD ECOLOGY	9
SUMMARY	50
REFERENCES	50

THE BATS OF BIHAR : TAXONOMY AND FIELD ECOLOGY

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INTRODUCTION

Bihar (Area : App. 1, 74,000 Sq km., Fig. 1) lies in the eastern part of India, bounded on the north by Nepal, on the east by West Bengal, on the south by Orissa, on the northwest by Uttar Pradesh and on the southwest by Madhya Pradesh. It may be divided into two natural regions viz., (1) plains to the north and south of the Ganga river and (2) Chota Nagpur Plateau. Climatically northern Bihar is temperate while the southern is hotter. Annual rainfall ranges between 100 and 150 cm.

Besides some sporadic information about bat fauna of Bihar by Blyth (1863), Anderson (1881), Blanford (1891), Wroughton (1915, 1918), Nath (1950), Ellerman and Morrison-Scott (1951), Sinha and Chakraborty (1971), Venkateshwarlu (1973) and Sinha (1980, 1981c), no consolidated taxonomical and ecological account is available. The present paper removes this lacuna in our knowledge. Collections were made by the author during 1977-82 from various parts of northern and southern Bihar covering all the 33 districts. Some material from Bihar as well as other states in India, and Burma, Nepal, Pakistan and Sri Lanka, available in the Zoological Survey of India, Calcutta, was also studied. Twenty seven known species and subspecies from Bihar have been thoroughly studied in this paper.

A key for the identification of bats of Bihar has been provided. Diagnosis, distribution and systematic notes for each species other than those reported by Sinha (1980) have been given. All measurements are in millimetres and the weight in grammes ; the figures in parentheses refer to mean values.

The following abbreviations have been used in the text :

App. : Approximate.

ch : Maximum height of brain case.

$c-m^1$ or $c-m^2$ or $c-m^3$: Length of upper tooth row.

$c-m_2$ or $c-m_3$: Length of lower tooth row.

CR : Length of cranial rostrum.

cw : Width of brain case.

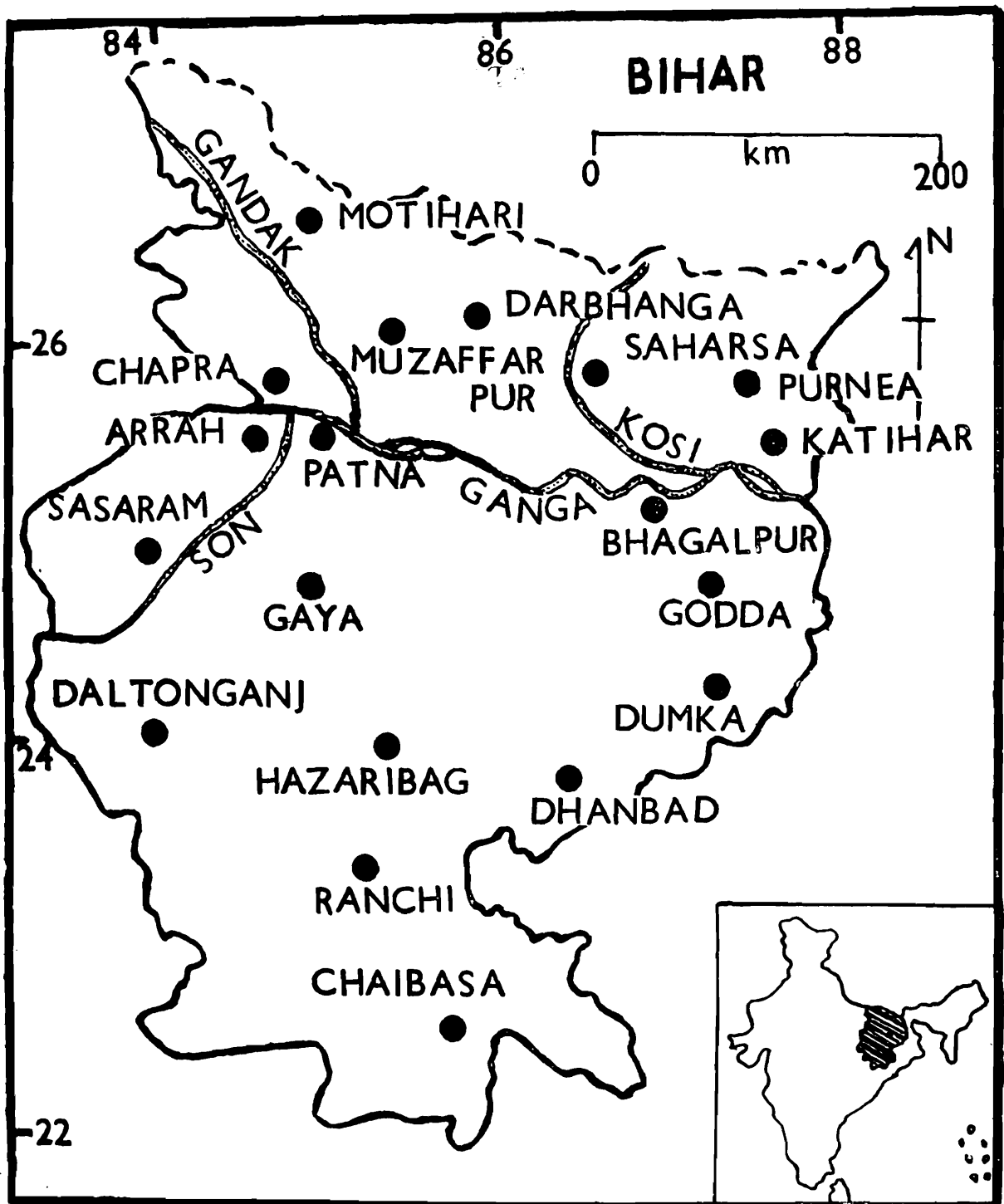


Fig. 1 : Map of Bihar (General).

E : Length of ear.

ex : Example.

f : Length of forearm.

- ft.* : Length of foot with claws.
 GPRS : Gangetic Plains Regional Station.
HB : Head and body length.
l. : Total length of skull.
ml. : Length of mandible.
m¹-m¹ or *m²-m³* : Maxillary width.
 Subad. : Subadult.
t. : Length of tibia.
Tl. : Length of tail.
Tr. : Length of tragus.
ws. : Wing spread.
Wt. : Body weight.
y. : Young.
 ZSI : Zoological Survey of India.
zw. : Zygomatic width.

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KEY TO THE BATS OF BIHAR

1. (8) Second finger with claw.
2. (3) Size large (*ws.* above 660, *f.* above 140) ;
tail invisible. *Pteropus. g. giganteus.*
3. (2) Size small (*ws.* below 560 ; *f.* below 90) ;
tail visible.

4. (5) Five teeth in upper molar series (premolars--molars), six in lower. *Rousettus leschenaulti.*
5. (4) Four teeth in upper molar series (premolars--molars), five in lower.
6. (7) Ear longer (size 19-24). *Cynopterus s. sphinx.*
7. (6) Ear shorter (size 16-18). *Cynopterus brachyotis.*
8. (1) Second finger without claw.
9. (10) Tail not visible. *Megaderma l. lyra.*
10. (9) Tail visible.
11. (24) Tail either partly free from interfemoral membrane or perforating it.
12. (15) Tail partly free from interfemoral membrane.
13. (14) Upper lip heavily wrinkled ; small antitragus present. *Tadarida aegyptiaca thomasi.*
14. (13) Upper lip not wrinkled ; antitragus absent.
15. (16) Tail shorter than forearm. *Rhinopoma microphyllum kinneari.*
16. (15) Tail longer than forearm. *Rhinopoma hardwickei hardwickei.*
17. (12) Tail perforating interfemoral membrane.
18. (23) Radio-metacarpal pouch present ; bullae complete.
19. (20) Black beard present in male ; gular sac absent in both sexes. *Taphozous m. melanopogon.*
20. (19) Black beard absent ; gular sac present in both sexes.
21. (22) Forearm short, length below 64 ; skull short, length below 22. *Taphozous l. longimanus.*
22. (21) Forearm long, length above 66 ; skull long, length above 25. *Taphozous k. kachhensis.*
23. (18) Radio-metacarpal pouch absent ; bullae imperfect. *Taphozous saccolaimus crassus.*
24. (11) Tail entirely covered by interfemoral membrane.
25. (32) Nose leaf present, tragus absent.
26. (29) Posterior nose leaf divided into transverse hollows ; first toe with three joints ; remaining toes with only two.
27. (28) Forearm long, length above 57. *Rhinolophus mitratus.*
28. (27) Forearm short, length below 43. *Rhinolophus l. lepidus.*
29. (26) Posterior nose leaf divided into longitudinal hollows ; all toes with two joints.
30. (31) Absence of supplementary leaflet on each side of anterior nose leaf. *Hipposideros fulvus pallidus.*
31. (30) Presence of two supplementary leaflet on each side of anterior nose leaf. *Hipposideros galeritus brachyotus.*
32. (25) Nose leaf absent ; tragus present.

33. (36) Upper cheek teeth (premolars-molars) six on each side. Wing membranes particoloured orange and black.
34. (35) Forearm short, length 44.2-47.4 ; skull short, length 17.7. *Myotis f. formosus.*
35. (34) Forearm long, length 50-53 ; skull long length 19.2. *M. f. andersoni.*
36. (33) Upper cheek teeth (premolars-molars) less than six on each side.
37. (48) Upper incisors 2-2.
38. (39) Outer upper incisor crowded inward between inner incisor and canine ; size large, forearm length 54-58 mm. *Hesperoptenus tickelli.*
39. (38) Outer upper incisor not crowded inward between inner incisor and canine ; size small, forearm length below 40 mm.
40. (45) Forearm short, length 26-32 ; skull short, length 10.5-13.
41. (44) Frontal depression between brain case and rostrum present.
42. (43) Skull long, length 12-13. *Pipistrellus c. coromondra.*
43. (42) Skull short, length 10.5-11.8. *Pipistrellus m. mimus.*
44. (41) Frontal depression between brain case and rostrum absent. *Pipistrellus paterculus.*
45. (40) Forearm long, length 32-38.3 ; skull long, length 13-15.1.
46. (47) Outer upper incisor long but slightly below the inner one. *Pipistrellus ceylonicus indicus*
47. (46) Outer upper incisor generally absent in adult but if present in some cases, it is very minute. *Pipistrellus dormeri,*
48. (37) Upper incisors 1-1.
49. (50) Size small, forearm length below 40 ; skull short, length below 16. *Scotoecus pallidus.*
50. (49) Size large, forearm length above 45 ; skull long, length above 18.
51. (52) Forearm length 47-53.3 mm ; skull length 18-19.5 mm. *Scotophilus k. kuhlii*
52. (51) Forearm length 56-65 mm ; skull length 21-23.1 mm. *Scotophilus h. heathi.*

TAXONOMY AND FIELD ECOLOGY
Suborder 1. MEGACHIROPTERA

Family I. PTEROPODIDAE*

Genus (1) **Pteropus** Brisson

1. **Pteropus giganteus** (Brünnich)
(Indian Flying Fox)

Vespertilio gigantea Brünnich, 1782, *Dyrenes Hist.* 1 : 45. Type-loc : Bengal

Pteropus giganteus giganteus (Brünnich)
(Plate 1b)

Vespertilio gigantea Brün. ; as above.

Pteropus. g. giganteus (Brün.), Ellerman and Morrison-Scott, 1951, p. 97.

Material examined : *Darbhanga Dist.* : Baghouni (27 Jul. 1922, ZSI, Cal.) and Ussri (7 Aug. 1922, ZSI, Cal.), 1 ♂, 1 ♀ ; *Giridih Dist.* : Chandaury village, c. 37 km. N. of Jamua (13 Jul. 1979, from banyan and peepal tree), 1 ♂, 1 ♀ ; *Patna Dist.* : Vikram (12 Aug. 1975, from sheesam tree), 1 ♂, 1 ♀ ; *Ranchi Dist.* : Barba Toli, c. 40 km. N. W. of Ranchi (17 Jul. 1979, from banyan tree), 1 ♂, 1 ♀ ; *Saharsa Dist.* : Bangaon (18 Oct. 1907, ZSI, Cal.), 4 ♀ ♀ ; *Santal Pargana Dist.* : Tick Villa colony, Dumka (5 & 6 Apr. 1979, from semal tree) and Borio village (7 Apr. 1979, from banyan and peepal trees), 4 ♂ ♂, 2 ♀ ♀ and 1 ♀ (y) ; *Singhbhum Dist.* : Luia (7 Mar. 1914 & 21 Jul. 1914, ZSI, Cal.), 2 ♀ ♀

Other observation localities : *Begusarai Dist.* : Hiratola, c. 3 km. E. of Kurha (8 Oct. 1980) on peepal tree and Simaria village (8 Oct. 1980), on semal tree ; *Bhagalpur Dist.* : Bakarpur, c. 5 km. N. of Mirjapur chauk (9 Apr. 1979) on peepal tree ; *East Champaran Dist.* : Bhaluahia village, Dhaka block, c. 24 km. N. E. of Motihari (23 Oct. 1981) on sheesam, peepal and mango trees ; *Giridih Dist.* : Laria Tar near Jamua (14 Jul. 1979) on peepal tree ; *Hazaribag Dist.* : Chattar Mandu, c. 6 km. E. of Ramgarh (22 Jul. 1979) and Rudh, c. 40 km. N. W. of Hazaribag (24 Jul. 1978) on peepal trees ; *Katihar Dist.* : Bourni Gorgama c. 8 km. N. E. of Katihar (17 May 1981) on peepal tree ; *Madhubani Dist.* : Kakana, c. 2 km. S. of Madhubani (25 May 1981) on bamboo and peepal trees and Lokhi Bazar, c. 15 km. from N. E. of Khutauna (26 May 1981) on banyan tree ; *Muzaffarpur Dist.* : Badur Chapra, c. 10 km. S. E. of Muzaffarpur (14 Oct. 1980) on peepal and banyan trees ; *Palamau Dist.* : Rajparsi, c. 12 km. N. E. of Hariharganj (15 Dec. 1979) on tamarind and peepal trees and Barka Gaon, Panki

* I follow Walker *et. al.* (1968)

Road, c. 8 km. S. E. of Daltonganj (19 Dec. 1979) on mango trees ; *Purnea Dist.* : Purnea (18 May 1981) on tamarind tree in front of Jail gate ; *Samastipur Dist.* : Dadpur Dudhpura, c. 10 km. N. E. of Pusa Road station (11 Oct. 1980) on peepal tree ; *Santal Pargana Dist.* : Barikodar Channa, near Karamtala Station (9 Apr. 1979) and Deoghar (6 Aug. 1979) on banyan tree , *Singhbhum Dist.* : Surya Basa, c. 10 km. S. E. of Chaibasa (20 Jul. 1979) on semal tree ; *Sitamarhi Dist.* : Punaura, c. 6 km. W of Sitamarhi station (24 Oct. 1981) on tamarind tree ; *Siwan Dist.* : Hashua (27 Oct. 1981) on peepal tree ; *Vaishali Dist.* : Sarsai, c. 11 km. N. E. of Hajipur (8 Sep. 1982) on peepal tree ; *W Champaran Dist.* : Rajpur c. 6 km. E. of Narkatiaganj (19 Oct. 1981) on semal tree.

Measurements : External : 8 ♂♂ : *HB.* 235-265 (256) ; *E.* 37-40 (38.4) ; *f.* 150-170 (164) ; *t.* 75-85 (80) ; *ft.* 47-55 (51) ; *ws.* 1040-1160 (1120). 6 ♀♀ : *HB.* 235-255 (245) ; *l.* 35-38 (36.5) ; *f.* 155-180 (166) ; *t.* 75-82 (78.6) ; *ft.* 47-60 (53.8) ; *ws.* 1020-1200 (1110).

Skull : 5 ♂♂ : *l.* 69.5-73 (71.5) ; *zw.* 36.5-40.7 (38.7) ; *cw.* 25-26 (25.4) ; *ch.* 22.3-24.8 (23.9) ; *m¹-m¹* 19-20 (19.7) ; *c-m²* 26.1-28.6 (27.5) ; *c-m₃* 28.5-31 (30.4), *ml.* 54-57 (55.4). 2 ♀♀ : *l.* 69,69.5 ; *zw.* 36.3, 36.5 ; *cw.* 25,25 ; *ch.* 24,24.5 ; *m¹-m¹* 19.4, 19.7 ; *c-m²* 26,28 ; *c-m₃* 28.5, 31.1 ; *ml.* 52,56.

Weight : *Wt.* of individuals excluding pregnant females before feeding : 700-820 (775).

Remarks : Out of seven skulls, three (2 ♂♂, 1 ♂♀) have no first upper premolar.

Distribution in Bihar (Fig. 2) : Districts of West Champaran, Siwan, East Champaran, Muzaffarpur, Sitamarhi, Madhubani, Darbhanga, Samastipur, Begusarai, Saharsa, Purnea, Katihar, Palamau, Patna, Hazaribag, Ranchi, Singhbhum, Giridih, Bhagalpur, and Santal Pargana. Besides old records from Darbhanga, Saharsa, Bhagalpur, Hazaribag and Singhbhum dists. all other records are new.

Field ecology : In Bihar, like other places in India, this bat was seen in hundred to about a thousand numbers permanently roosting on semal (*Bombax malabaricus*), Sheesam (*Dalbergia sisso*), peepal (*Ficus bengalensis*) mango (*Mangifera indica*) and tamarind (*Tamarindus indica*) trees in forests as well as in orchards in plains near tank, pond and river.

Besides roosting place, this bat was seen visiting teak (*Tectona grandis*), custard apple (*Anona squata*), palm (*Borassus flabelifer*), date (*Phoenix silvestris*), mahua (*Bassia latifolia*) and wood apple (*Feronia* sp.) trees in fruiting season. In non-fruiting season this bat was observed to

chew soft leaf and twigs of semal and tamarind trees in Dumka and Sitamarhi respectively and flower of mahua in Boreo. The foliage of the semal trees in Dumka appeared flat as if trimmed by gardener. The

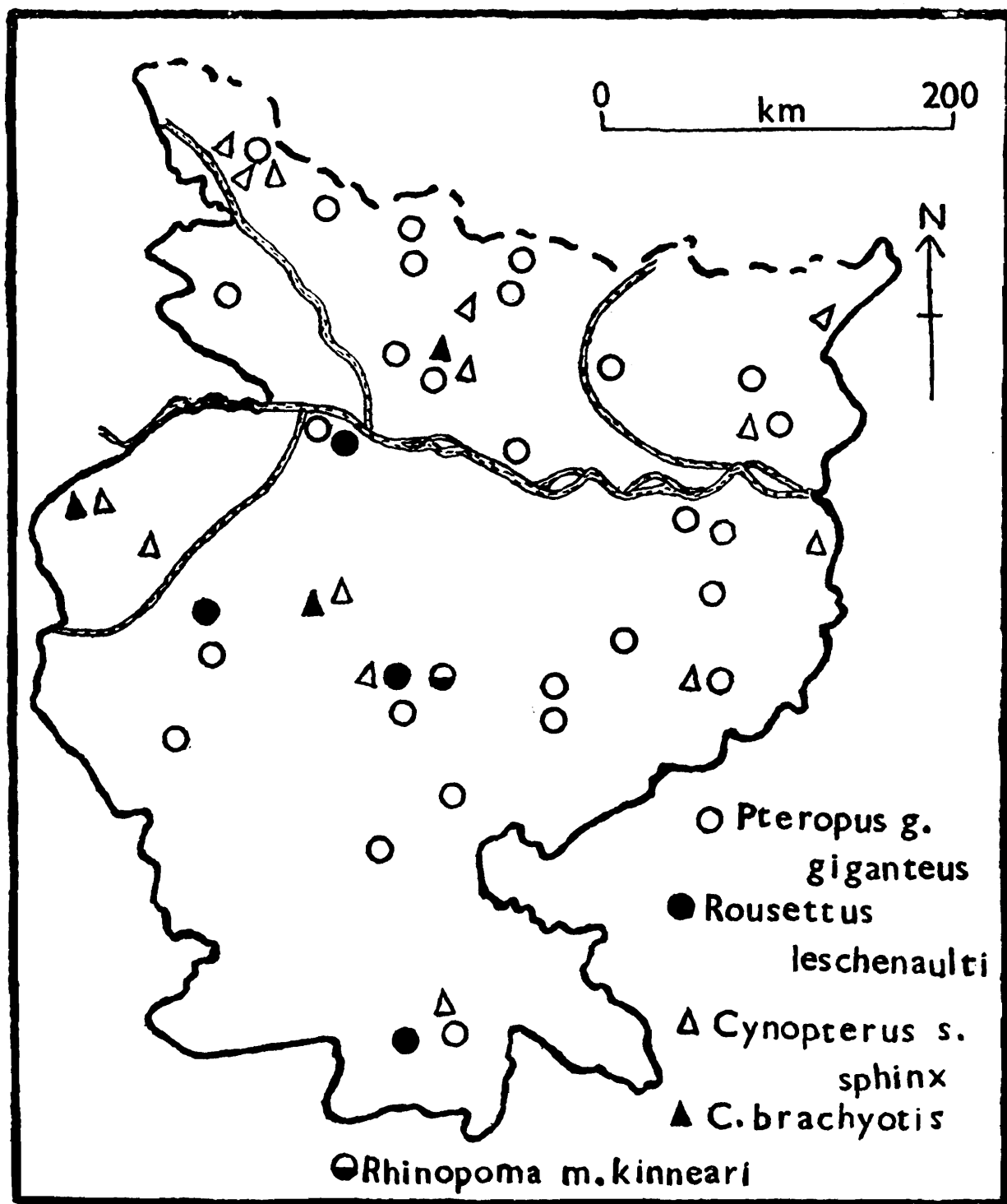


Fig. 2 : Distribution of bats in Bihar.

“refuse” of the tamarind leaf and twigs were seen in Punaura (Sitamarhi) in various places under the tree where bat was roosting. Females collected during April were mostly pregnant having single foetus of different sizes in the right cornu of the uterus and in one case

there was a suckling young (size : *HB.* 105 ; *E.* 24 ; *f.* 81 ; *t.* 35 ; *ft.* 38) in her left arm. All the females had two well developed thoracic teats.

Genus (2) **Rousettus** Gray

2. **Rousettus leschenaulti** (Desmarest)

(Indian Fulvus Fruit Bat)

(Plate 1a)

Pteropus leschenaulti Desmarest, 1980, *Encycl. Meth. Mammalia 1* : 110. Type-loc. : Pondicherry, India.

Rousettus leschenaulti (Desm.) Ellerman and Morrison-Scott, 1951, p. 93 ; Sinha, 1969, p. 764. (*Syn. Xantharpia seminuda* Gray).

Material examined : *Aurangabad Dist.* : Deb, c. 20 km. S. E. of Aurangabad (14 Dec. 1979), 1 ♂ ; *Hazaribag Dist.* : Padma, c. 28 km. N.W. of Hazaribag (23 Jul. 1979), 16 ♂ ♂, 14 ♀ ♀, 1 ♀ (y.) ; *Patna Dist.* : Hiranand Sah Lane, Patna City, (26 Feb. 1980), 4 ♂ ♂, 4 ♀ ♀ ; *Singhbhum Dist.* : (Shinghbhum as mention in old label, 1870, Coll.-V Ball, ZSI, Cal.), 1 ♀

Measurements : External : 12 ♂ ♂ : *HB.* 120-145 (129.2) ; *E.* 19-24 (20.7) ; *Tl.* 14-18 (15.5) ; *f.* 73-87 (83.7) ; *t.* 32-43 (39.5) ; *ft.* 20-23 (21.7) ; *ws.* 500-550 (525). 12 ♀ ♀ : *HB.* 100-125 (115.8) ; *E.* 18-22 (20.3) ; *Tl.* 11-16 (14.4) ; *f.* 72-85 (78.4) ; *t.* 29-42 (38.5) ; *ft.* 19-22 (20.3) ; *ws.* 480-530 (500).

Skull : 6 ♂ ♂ : *l.* 34-39.4 (37.5) ; *zw.* 19.6-23.2 (21.7) ; *cw.* 15-16.6 (15.9) ; *ch.* 12.6-14 (13.5) ; *m¹-m¹* 11-12.2 (11.5) ; *c-m²* 14-16 (14.8) ; *c-m₃* 15.5-17.7 (16.4) ; *ml.* 27-32 (29.1). 1 ♀ : *l.* 36.3 ; *zw.* 23.2 ; *cw.* 16.1 ; *ch.* 13.1 ; *m¹-m¹* 11.6 ; *c-m²* 14.2 ; *c-m₃* 15.5 ; *ml.* 29.6.

Weight : *Wt.* of individuals excluding pregnant females before feeding : 70-110 (90).

Remarks : The females are smaller than males as reported by Khajuria (1979) and Sinha (1980).

Distribution in Bihar (Fig. 2) : Previously this bat was recorded by Sinha (1980) from Chaibassa (Singhbhum Dist.). Present material are from Hazaribag, Aurangabad and Patna districts of southern Bihar. I could not find this bat from northern Bihar.

Field ecology : This bat was found in semidark and discarded building surrounded by thick groves in Padmagarh (Hazaribag Dist.), Deb (Aurangabad Dist.) and Patna City as mentioned by Sinha (1981b) for Rajasthan population. The size of colony was about 500 ex. in Padmagarh, 10 ex. in Deb and 10 ex. in Patna city. Like other places it was also not seen here on the tree.

Specimens of *Scotophilus h. heathi* were collected from permanent colony of *Rousettus leschenaultii* in Padmagarh and of *Megaderma lyra lyra* in Deb. In Patna City specimens of *R. leschenaultii* were collected from the permanent colony of *Taphozous m. melanopogon*. It was seen here only in February-March when fruits and tender leaves of peepal tree broke out from buds.

On a rainy day when the clouds were dark it was found flicking among Asoka trees laden with unripe fruits. Plenty of seeds were observed on the ground below Asoka trees. On dissection these bats had only liquid gut contents.

Mixed colonies of males, females and youngs were found in every locality. The number of males are generally more than females. This bat was seen in underground rooms of building in winter at Deb.

Among females collected from Padmagarh in July one had a suckling young (size : *HB.* 65 ; *f.* 42 ; *Wt.* 20) and another was in an advanced stage of pregnancy (size of embryo : *HB.* 50 ; *f.* 32 ; *Wt.* 15). One female received from Dr. H. S. Randhwa, Delhi University collected in March (4 Mar. 1982) from a monument in New Delhi was pregnant and had an advanced stage of embryo. Sinha (1980) found suckling young in September in Gujarat. Suckling young in March, April, May and August was reported by Brosset (1962a) in Central and Western India. It shows that this bat breeds in all seasons excepting winter. Nonparous females collected in July had only spot in place of mammae as reported by Gopalakrishna *et al.* (1977) in *Rhinolophus rouxi*.

Genus (3) *Cynopterus* Cuvier

3. *Cynopterus sphinx* (Vahl)

(Short-nosed Fruit Bat)

Vespertilio sphinx Vahl, 1797, *Skr. nat, selsk. Copenhagne*, 4 (1) : 123, Type-loc. : Tranquebar, S. India.

Cynopterus sphinx sphinx (Vahl)

(Plate 1c)

Vespertilio sphinx Vahl, 1797, as above.

Cynopterus sphinx sphinx (Vahl), Ellerman and Morrison-Scott 1951, p. 98 ; Agrawal, 1972, p. 265 (Syn. *Cynopterus sphinx gangeticus* Andersen.).

Material examined : *Darbhanga Dist.* : Baghounie (29 Jul. 1922, N. A. Baptista, ZSI, Cal.), 1 ♀ ; *Gaya Dist.* : Singar (28 May 1914, C. A. Crump, ZSI, Cal.), Bodh Gaya (22 Jul. 1978), 1 ♂, 1 ♀ ; *Hazaribag Dist.* : Padma Garh (23 Jul. 1979), 1 ♂ and 1 ♀ (y.) ; *Katihar Dist.* : Raj Bhawan compound in Binodpur mahalla, Katihar (16 May 1981), 1 ♂, 1 ♀ ; *Munger Dist.* : Abhayapur (19 Oct. 1974, K. P. Singh, GPRS),

1 ♂ ; *Patna Dist.* : Khagaul (3 Nov. 1983), 3 ♀ ♀ ; *Rohtas Dist.* : Sasaram (18 Feb. 1982) and Mohania (20 Feb. 1982), 1 ♂, 1 ♂ ; *Samastipur Dist.* : Kubouli, c. 6 km. S. W of Pusa Road Station (11 Oct. 1980), 1 ♂ ; *Santal Pargana Dist.* : Dumka (no date, donated by Zoology Department, S. P. College, Dumka), and Rajmahal (8 Apr. 1979), 3 ♂ ♂, 9 ♀ ♀, 3 ♂ ♂ and 7 ♀ ♀ (y.) ; *Singhbhum Dist.* : Chaibasa (19 Jul. 1979), 1 ♂ ; *West Champaran Dist.* : Narkatiaganj (20 Oct. 1981), Betia (20 Oct. 1981) and Majhowlia (20 Oct. 81), 1 ♂, 3 ♀ ♀

Other observation localities : *Purnea Dist.* Lahara Village, c. 4 km. N. W of Kishanganj (20 Jan. 1982) : two examples were seen hanging from ventral surface of palm leaves.

Measurements : External : 9 ♂ ♂ : *E.* 20-23 (21. 2) ; *f.* 63-80 (71.8) ; *t.* 21-23 (26.6) ; *ft.* 16-20 (17.5). 13 ♀ ♀ : *E.* 19-24 (22.1) ; *f.* 70-76 (72.3) ; *t.* 23-31 (28.1) ; *ft.* 15-18 (16.9).

Skull : 8 ♂ ♂ : *l.* 31.5-36.5 (33.7) ; *zw.* 19-22 (20.8) ; *cw.* 13.5-15 (14.3) ; *ch.* 11.2-13.1 (12.3) ; *CR* 8-10 (8.6) ; *m¹-m¹* 10-11.2 (10.6) ; *c-m¹* 11-12 (11.8) ; *c-m₂* 12-13.8 (12.9) ; *ml.* 23-28 (25.5). 3 ♀ ♀ : *l.* 33-34.5 (33.8) ; *zw.* 21 (in all) ; *cw.* 14-15 (14.4) ; *ch.* 12.5 (in all) ; *CR* 8.7-9 (8.8) ; *m¹-m¹* 9.9-10.7 (10.3) ; *c-m¹* 11.2-12 (11.6) ; *c-m₂* 12.5-13 (12.8) ; *ml.* 25.4-27 (16.1).

Weight : *Wt.* of individuals excluding pregnant females before feeding : 45-60 (55).

Remarks : Example from Abhayapur (Munger Dist.) has invisible tail. Specimen from Chaibasa has smaller forearm (length : 63) and skull (length 31.5) while from Mohania (Rohtas Dist.) has longer forearm (length : 80) and skull (length : 36.5). Measurements of male specimen of Mohania is very close to *C. sphinx tithaecheilus* Andersen of Java, Lombok and Timor.

Distribution in Bihar (Fig. 2) : Both sides of Ganga river ; recorded from Darbhanga, Gaya, Hazaribag, Katihar, Munger, Patna, Purnea, Rohtas, Samastipur, Santal Pargana, Singhbhum and West Champaran districts.

Field ecology : This short-nosed Fruit Bat was collected from under surface of the hanging green or dry leaves in semi-forested area and plains on both sides of the Ganga river except in Padma (Hazaribag Dist.) and Katihar (Katihar Dist.) where it was collected when it was hanging head downward from ceiling of a hall of an old building. In Rajmahal (S. P. Dist.) and Kubouli (Samastipur Dist.) unlike other bats *C. sphinx* was found in hot sun in shaded tent like structures made by scoring palm leaves causing the sides to fold over as mentioned by Goodwin (1962) for *Artibeus watsoni* and *Uroderma* in tropical America.

It was not found in association with *Rousettus leschenaulti* but in separate corners of the same ceiling of a discarded house in Padma where *R. leschenaulti* was roosting in abundance.

In mist net this bat was obtained from guava (*Psidium guava*), ber (*Zizyphus jujuba*), asoka (*Polyanthia longifolia*) and plantain (*Musa sp.*) gardens in fruiting season and from Mohwa (*Bassia latifolia*) garden in non fruiting season. This observation gives some stress on its favourite food.

Different sizes of suckling youngs (f. 60-80% of mother) attached to the teats of lactating mother were obtained in April, May and July. This bat is known to breed throughout the year.

An example of male participating in parental care of young was seen for the first time in this species at katihar where a male was found involved in carrying a young attached ventro-ventrally. This case may be accidental.

4. *Cynopterus* (?) *brachyotis* (Müller)

(Borneo short-nosed Fruit Bat)

Pachysoma brachyotis Müller, 1838, *Tijdschr. Natuur. Gesch.* 5 (1): 146. Type-loc.: Borneo.

Material examined: Bihar: Gaya Dist.: Bodh Gaya (23 Jul. 1978), 1 ♀; Nawadah Dist.: Nawadah (9 Nov. 1982), 1 ♀; Rohtas Dist.: Mohania (21 Feb. 1982), 1 ♂; Samastipur Dist.: Pusa (T. B. Fietcher, 19 May 1931, ZSI, Cal.); 1 (unsexed). Other than Bihar: INDIA: Assam: Cachar (1868, ZSI, Cal.), 1 ♀; Kerala: Trivandrum (Kalli and Vellany, 13 Jun. 1915, ZSI, Cal.), 1 ♂, 1 ♀ and 1 ♂ (young); Meghalaya: Garo Hills (Above Tura, S. W. Kemp, Jul-Aug. 1917, ZSI, Cal.), 1 (unsexed); Tamil Nadu: Madurai (High wavy Mountain, ZSI, Cal.), 1 ♀; W. Bengal: Calcutta (Indian Mus. compound, F. H. Gravely, 26 Nov. 1912, ZSI, Cal.), 1 (unsexed); Andamans: (R. W. Lewis, ZSI, Cal.), 1 ♂, 1 ♀ NEPAL: (J. Scully, 13 & 27 Feb. 1877), 1 ♂, 1 ♀ PAKISTAN: Karachi (exchange from Karachi Museum, now in ZSI, Cal.), 1 ♀ SRI LANKA: (Dr. Kelaart, ZSI, Cal.), 1 ♂ 1 ♀ BURMA: Toungoo (January-April, 1927; ZSI, Cal.) 1 ♂, 5 ♀ ♀

Measurements: External: 1 (unsexed), 2 ♀ ♀ (from Bihar): *E.* 16-18 (16.8); *f.* 71-73 (72); *t.* 27-30 (29); *ft.* 16-18.5 (17.3). 1 ♂, 1 ♀ (from Kerala): *E.* 16.5, 17.9; *f.* 64.5, 68; *t.* 22.5, 26.2; *ft.* 15, 16.8. 1 ♀ (from Assam): *E.* 18; *f.* 63; *t.* 24; *ft.* 13. 1 (unsexed, from Meghalaya): *E.* 17.5; *f.* 67.5; *t.* 26; *ft.* 14.5. 1 ♀ (from Tamil Nadu): *E.* 17; *f.* 65.1; *t.* 23.2; *ft.* 14.1 (unsexed, W Bengal): *E.* 16; *f.* 67.5; *t.* 24.2; *ft.* 16.3. 1 ♂, 1 ♀ (from Andamans): *E.* 17, 17.5; *f.* 64.5, 65; *t.* 23, 25; *ft.* 14.5,

15.2. 1 ♂, 1 ♀ (from NEPAL) : *E.* 17, 18 ; *f.* 62, 64 ; *t.* 21, 23 ; *ft.* 14.5, 15. 1 ♀ (from PAKISTAN) : *E.* 17.8 ; *f.* 67 ; *t.* 28 ; *ft.* 15. 1 ♂, 5 ♀ ♀ (from BURMA) : *E.* 16.5-18.5 (17.5) ; *f.* 60-71 (64.9) ; *t.* 22-27 (24) ; *ft.* 11-15 (12.7). 1 ♂, 1 ♀ (from SRI LANKA) : *E.* 16.5, 16.8 ; *f.* 60, 62 ; *t.* 19.5, 22 ; *ft.* 14.8, 15.

Skull : 1 ♂, 1 ♀ (from Bihar) : *l.* 33.4, 32.5 ; *zw* 20.5, 20 ; *cw* 14, 14 ; *CR.* 8.3, 8.2 ; *ch.* 12.5, 11.8 ; *m¹-m¹* 12, 12 ; *c-m¹* 11.2, 11 ; *c-m₂* 12.8, 12.3 ; *ml.* 25.7, 25. 1 ♂ (from Kerala) : *l.* 32 ; *zw.* 21.2 ; *cw.* 14 ; *CR.* 9.6 ; *ch.* 12 ; *m¹-m¹* 10 ; *c-m¹* 11.2 ; *c-m₂* 12.5 ; *ml.* 24. 1 (unsexed, from Meghalaya) : *l.* 31.2 ; *zw.* 19.5 ; *cw.* 13.9 ; *CR.* 8.5 ; *ch.* 11.2 ; *m¹-m¹* 9 ; *c-m¹* 10.4 ; *c-m₂* 11.6 ; *ml.* 23.7. 1 (unsexed, from West Bengal) : *l.* 32 ; *zw.* 19 ; *cw.* 13.3 ; *CR.* 9.3 ; *ch.* 10.4 ; *m¹-m¹* 9.6 ; *c-m¹* 11 ; *c-m₂* 12.1 ; *ml.* 25. 1 ♂, 1 ♀ (from Andamans) ; *l.* 30, 31.8 ; *zw.* 18, 18.7 ; *cw.* 13.1, 14 ; *CR.* 9, 10.4 ; *ch.* 9.8, 10.1 ; *m¹-m¹* 9, 9.8 ; *c-m¹* 10.5, 10.8 ; *c-m₂* 11.3, 12.2 ; *ml.* 23, 24.5. 1 ♂, 1 ♀ (from SRI LANKA) : *l.* 28, 30 ; *zw.* 17, 20 ; *cw.* 12, 13 ; *CR.* 6.7, 7.5 ; *m¹-m¹* 8.1, 9.5 ; *c-m¹* 9, 10 ; *c-m₂* 10.1, 10.5 ; *ml.* 19.7, 23. 1 ♂ 3 ♀ ♀ (from BURMA) : *l.* 29.5-31 (30.4) ; *zw.* 18.5-21 (19.2) ; *cw.* 12.7-14 (13.2) ; *CR.* 6.5-7.4 (7) ; *m¹-m¹* 9-10 (9.4) ; *c-m¹* 10-11 (10.4) ; *c-m₂* 10.2-12.5 (11.2) ; *ml.* 22-24.6 (23).

Weight : *Wt.* of a specimen was 50.

Diagnosis : This species can be separated from *Cynopterus sphinx* by smaller ear (below 19 vs. 19 and above 19 mm.) and average smaller skull : 31.2-33.4 (32.3) vs. 31.5-36.5 (33.9). Other external and skull characters are almost same.

Distribution in Bihar (Fig. 2) : No previous record of this species has been known from Bihar. The present records from Gaya, Rohtas and Samastipur districts are new for Bihar. *Elsewhere* : INDIA : Meghalaya, Assam, West Bengal, Tamil Nadu, Kerala, Andaman and Nicobar Islands. EXTRA-INDIA : PAKISTAN, NEPAL, BURMA, SOUTHERN CHINA, SRI LANKA, THAILAND (=SIAM). CAMBODIA, VIETNAM, MALAYASIA, ANDALAS (=SUMATRA), JAVA, KALIMANTAN (=BORNEO), SULAWES (=CELEBES) and PHILIPPINE ISLANDS.

Systematic note : Ellerman and Morrison-Scott (1951) while recognising six subspecies of *C. brachyotis* have maintained *C. b. angulatus*. Hill and Thonglongya (1972) have transferred *C. angulatus* to *C. sphinx* as *C. sphinx angulatus*. I feel *C. angulatus* is an intermediate form between *C. brachyotis* and *C. sphinx* and in that case, probably it should be treated as a distinct species.

Above specimens from Bihar and other parts of India and Pakistan, Nepal, Burma and Sri Lanka has been identified by me as *Cynopterus*

brachyotis, the measurements especially the length of forearm, ear, skull and rostrum overlap those given for Bihar and other place (Fig. 7 & 8).

Field ecology: I could not find roost of this bat. It has been collected in the mist net set in the small groves of guava near arhar pulse field in February (flowering season) in Mohania and in a large guava garden in November in Nawadah. Females collected in the last week of July and in the second week of November are non-pregnant. A female collected in Nawadah had crushed particles of guava in her mouth and on wing membrane.

Suborder 2. MICROCHIROPTERA

Family II. RHINOPOMATIDAE

Genus (4) *Rhinopoma* Geoffroy

5. *Rhinopoma microphyllum* (Brünnich) (Large Rat-tailed Bat)

Vespertilio microphyllum Brünnich, 1782, *Dyrenes Hist.*, 1: 50, pl. 6, figs. 1-4
Type-loc.: Arabia and Egypt.

Rhinopoma microphyllum kinneari Wroughton

Rhinopoma kinneari Wroughton, 1912, *J. Bombay nat. Hist. Soc.*, 21 (4): 165.
Type-loc.: Bhuj, Kutch, Gujarat India.

I could not collect this species in Bihar. Wroughton (1915) collected it at Gojhunda, Hazaribag District of Bihar (Fig. 2).

6. *Rhinopoma hardwickei* Gray (Lesser Rat-tailed Bat)

Rhinopoma hardwickei Gray, 1831, *Zool. Misc.*, p. 37. Type loc.: India.

Rhinopoma hardwickei hardwickei Gray (Plate 1d)

Rhinopoma hardwickei Gray, 1831, as above.

Material examined: *Bhojpur Dist.*: Arrah (Tari Mehalla, 23 Oct. 1978), 12 ♀♀, 14 ♂♂; *Gaya Dist.*: Singar (22 & 27 May 1914, C. A. Crump, ZSI, Cal.) and Bojh Gaya (21 July 1978), 5 ♂♂ 16 ♀♀; *Giridih Dist.*: Kabutari Pahar c. 35 km. N. W of Jamua (13 Jul. 1979), 1 ♀; *Munger Dist.*: Munger (Tilpahari, 11 Apr. 1979 and 6 Sep. 1982), 14 ♂♂, 24 ♀♀; *Rohtas Dist.*: Sasaram (Hasan sur Sah Suri Tomb, 25 Oct, 1978), 10 ♂♂, 11 ♀♀

Measurements: External: 41 ♂♂: *Tl.* 62-82 (72); *f.* 57-65 (61); *t.* 27-33 (30.1); *ft.* 14-17 (15.6). 52 ♀♀: *Tl.* 64-81 (71.7); *f.* 56-63 (58.6); *t.* 27-31.5 (29.3); *ft.* 13-17 (15.5).

Skull: 5 ♂♂: *l.* 17-19.1 (18.7); *zw.* 11-11.7 (11.4); *cw.* 8.1-9.0 (8.7); *ch.* 8.5-8.8 (8.6); *m³-m³* 8.1-9.0 (8.6); *c-m³* 6.1-7.1 (6.8); *c-m₃* 7.0-7.6 (7.3); *ml.* 12.2-13.6 (13.1); 5 ♀♀: *l.* 17.8-18.4 (18.2);

zw. 11-11.5 (11.3); cw. 8.2-8.5 (8.3); ch. 8-8.2 (8.1); m^3 - m^3 8.1-8.7 (8.5); c - m^3 6.4-7 (6.8); c - m , 7.1-7.8 (7.5); ml. 13-13.2 (13.04).

Weight : Wt. of individuals excluding pregnant females before feeding 15-25 (22.5).

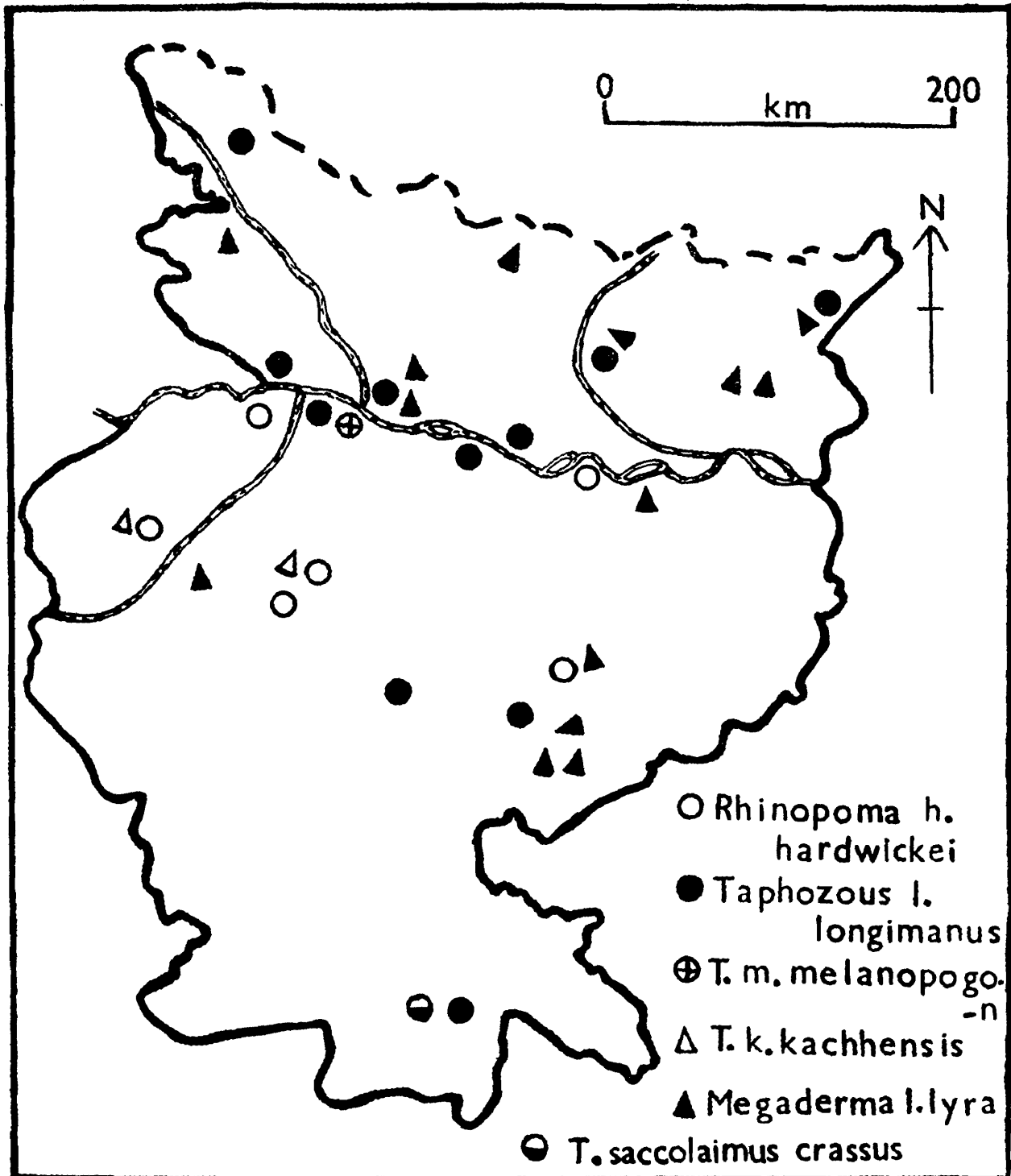


Fig. 3 : Distribution of bats in Bihar.

Distribution in Bihar (Fig. 3) : Bhojpur, Gaya, Giridih, Munger and Rohtas districts of southern Bihar. It was not found in the plains north of the Ganga river.

Field ecology : In hilly area this bat was obtained from inner side

of dome of monuments (Sasaram and Gaya), discarded houses on hill top (Munger), cave (near Giridih) and old houses in city (Arrah). Size of colony : 50 to 500 ex.

This bat flies out of the roost late in the night. According to my observation in Bodh Gaya it did not fly out of the temple upto 8.30 P. M. on 27 July 1978. Khajuria (1972) also mentioned that this bat had not been observed to leave the haunt upto 8 P. M. in mating season (23 Feb. 71 to 27 Feb. 71).

Only in the cave of Kabutari Pahar near Tisari (Giridih Dist.) this bat was found in Association with *Megaderma lyra lyra* and *Hipposideros fulvus pallidus*.

Most of the females collected on 11 April 1979 were in early stage of pregnancy (size of embryo : 7-9) either in left or right horn of uterus. Those collected on 21 July 1978 had a suckling young (size : f. 50-54.5), clinging to them.

According to Khajuria (1972) the act of copulation in this species occurs in the last week of February in Madhya Pradesh which is adjacent to Bihar. It indicates the pregnancy season of this bat begins in the last week of February and ends in June. A single young is born either in the end of June or in the beginning of July.

Individuals collected just before winter (on 23rd and 25th Oct.. 1978) have heavy fat deposition in thigh, lower portion of abdomen and upper portion of interfemoral membrane as reported by Sinha (1976) for Rajasthan population.

Family III. EMBALLONURIDAE

Genus (5) *Taphozous* E. Geoffroy

7. *Taphozous longimanus* Hardwicke

(Indian pouch-bearing bat)

Taphozous longimanus Hardwicke, 1825 *Trans. Linn. Soc. London* 14 : 525. Type-loc. : Calcutta, W. Bengal, India.

Taphozous longimanus longimanus Hardwicke

Taphozous longimanus longimanus Hardwicke

Taphozous longimanus Hardwicke, 1825, as above.

Material examined : *Begusarai Dist.* : Ayodhya Bari, Begusarai (8 Oct. 1980), 1 ♂, 1 ♀ and 1 ♂ (y.) ; *Bhojpur Dist.* : Bin Toli, Arrah (22 Sept. 1984), 1 ♀ ; *Patna Dist.* : Seonar, c. 3 km. from Mokamah (15 Feb. 1978 and 13 Apr. 1979), and Maner (13 & 14 Apr. 1978) and Khagaul (12 Oct. 1982), 4 ♂♂, 9 ♀♀ ; *Purnea Dist.* : Kishanganj (16 Jan. 1982), 2 ♂♂ ; *Saharsa Dist.* : Hatia Gachi c. 4 Km. S. E.

of Saharsa (22 May 1981), 1 ♂, 2 ♀ ♀ ; *Saran Dist.* : Siripur near Chapra (no date, ZSI, Cal.), 1 ♀ ; *Singhbhum Dist.* : Chaibasa (19 & 20 Jul. 1979), 4 ♂ ♂, 9 ♀ ♀ ; *Vaishali Dist.* : Dhanauti village, c. 5 km. S. of Gandak Project Dak Bunglow, Hajipur (7 Nov. 1977), 1 ♂ ; *West Champaran Dist.* : Chaubey Tola, Narkatiaganj (19 Oct. 1981), 1 ♂, 4 ♂ ♂.

Other observation localities : *Giridih Dist.* : Madhuban (15 Jul. 1979) ; *Hazaribag Dist.* : Ichak (24 Jul. 1979).

Measurements : External : 13 ♂ ♂ : *HB.* 71-77 (74.3) ; *TI.* 22.5-25 (23.5) ; *f.* 58-63 (60) ; *t.* 24-26 (25.3) ; *ft.* 12-14.3 (12.9) ; *ws.* 380-420 (403), 23 ♀ ♀ : *HB.* 75-80 (78.2) ; *TI.* 24-32 (27.3) ; *f.* 57-63 (60.6) ; *t.* 24-27 (25.7) ; *ft.* 12-14 (13.5) ; *ws.* 380-420 (405).

Skull : 6 ♂ ♂ : *l.* 20-21 (20.4) ; *zw.* 12.7-13.7 (13.2) ; *cw.* 10.3-11.1 (10.7) ; *ch.* 10.2-10.6 (10.4) ; *m³-m³* 8.8-9.5 (9.1) ; *c-m³* 9.9-9.6 (9.1) ; *c-m₃* 9.4-10.6 (10) ; *ml.* 16.1-16.5 (16.4). 6 ♀ ♀ : *l.* 19.3-20.7 (20.3) ; *zw.* 12.7-13.2 (13) ; *cw.* 10.2-11 (10.6) ; *ch.* 10-10.6 (10.2) ; *m³-m³* 8.8-9.6 (9.1) ; *c-m³* 8.9-9.5 (9.2) ; *c-m₃* 10-10.2 (10.1) ; *ml.* 15.7-16.5 (16.1).

Weight : *Wt.* of individuals excluding pregnant females before feeding : 20-32 (25).

Colour : of fur in males is generally light brown but darker in females.

Distribution in Bihar (Fig. 3) : Both sides of Ganga river ; recorded from Begusarai, Bhojpur, Giridih (Wroughton 1915), Hazaribag, Patna, Purnea, Saharsa, Saran, Singhbhum, Vaishali and West Champaran districts. previously it was only known from Nimiaghat, Giridih Dist. by Wroughton (1915).

Field ecology : This bat was collected from hollows in the trunks of banyan (in Begusarai) and peepal (in Saharsa, Seonar near Mokama, Narkatiaganj and Kishanganj) trees ; from crown of palm trees (Chaibasa, Hajipur and Khagaul) ; and from inner portion of dome of the church in Chaibasa. The size of colony was 2 to 25 ex. in hollows and in crown of trees while about 100 ex. inside the dome of Church. Other bats was not found in association with this bat. It was found in less darker places than others.

Females collected in April (13 & 14 Apr. 1978, 13 Apr. 1979), May (22 May 1981), July (20 Jul. 1981) and October (12 Oct. 1982, 19 Oct. 1981) were pregnant and each had an embryo of different size either in left or right horn of uterus. A female (*f.* 60 ; *Wt.* 30) collected on 8th October 1980 had a suckling young (with coagulated milk in the gut) of about its equal size (*f.* 60 ; *Wt.* 18) attached to the breast. Foetus obtained from uterus of females collected in April had *HB.* 19-32 and

f. 11-22, in May had 25 and 10 and in July had 4-21 and 0-10. Females collected in October had bulbous left horn of uterus showing early stage of pregnancy. For detail on its breeding season see Gopalakrishna (1954).

Adult males collected in January, February, April, July and October had well developed gular sac and pectoral gland woozing yellowish creamy secretion with peculiar bitter smell. Adult and young males collected in November had prominent gular sac and pectoral gland but without yellow secretion. The bitter smell of the secretion perhaps helps in attracting females during copulation period.

Gut contents had mandible, wings and antennae of dictyopteran and coleopteran insects and many parasitic nematodes.

Ticks and mites were collected from body of this bat.

8. *Taphozous melanopogon* Temminck (Black-bearded Tomp Bat)

Taphozous melanopogon Temminck, 1841. *Mon. Mamm.* ; 2, p. 287. Type-loc. : Bantam, Western Java.

Systematic note : According to Medway (1965) the diagnostic characters of *T. M. fretensis* from Borneo consist of back fur buff or brownish grey, base of hair always conspicuously paler, forearm 60-65. I find, however, that *T. m. melanopogon* in India has the same characters. I do not, therefore, accept Medway's *fretensis* as a valid subspecies.

Taphozous melanopogon melanopogon Temminck (Plate 2 c, d, e)

Taphozous melanopogon Temminck, 1841, as above.

Material examined : Bihar : Patna Dist. : Govind Bag Mandir, Rajaghat and Hiranand Sah lane in Patna City (18 Jul. 1977, 15 Aug. 1977, 26 Mar. 1979, 28 Apr. 1979, 24 May. 1979, 25 Jun. 1979, 21 Aug. 1979, 24 Sep. 1979, 15 Oct. 1979, 26 Nov. 1979, 26 Feb. 1980, 24 Mar. 1980, 25 Apr. 1980, 25 Jul. 1980, 24 Sep. 1980, 12 Dec. 1980, 3 Jan. 1981, 21 Jan. 1981, 4 Feb. 1981 and 24 Feb. 1981), 129 ♂♂, 98 ♀♀

Besides above specimens 1 also studied 3 ♀♀ from Jashpur; west of Chota Nagpur (Now in Raipur district of *Madhya Pradesh*); 1 ♀ from Nagarcoil, Kanyakumari district of *Tamil Nadu* (ZSI, Cal., Reg. No. 17457); 1—from Balapalli Range, Cuddapah district of *Andhra Pradesh* (ZSI, cal. ; Reg. No. 17476) and 2 (unsexed) from Bhubaneshwar, *Orissa* (4-6. Nov. 1912, ZSI, Cal. ; Reg. No. 9196 and 9197).

Measurements : External : 129 ♂♂ : *f.* 62-68 (64.7) ; *t.* 22-26 (24.7) ; *ft.* 12-15 (13.8) ; *ws.* 390-430 (408). 98 ♀♀ : *m* : *f.* 62-68 (65) ; *t.* 23-26 (24.8) ; *ft.* 12-15 (13.7) ; *ws.* 400-430 (415).

Skull : 12 ♂♂ : *l.* 20.5-25.4 (20.96) ; *zw.* 12.7-13.8 (13.1) ; *cw.* 10.2-10.6 (10.4) ; *ch.* 10-10.7 (10.5) ; *m*³-*m*³ 8.7-9.6 (9.3) ; *c-m*³ 9-9.6 (9.3) ; *c-m*₃ 9.7-10.4 (10.2) ; *ml.* 16-17.1 (16.4), 7 ♀♀ : *l.* 21-21.5 (21.2) ; *zw.* 12.2-13.1 (12.9) ; *cw.* 10.2-10.6 (10.4) ; *ch.* 10-10.6 (10.3) ; *m*³-*m*³ 8.6-9.6 (9.2) ; *c-m*³ 9-9.3 (9.1) ; *c-m*₃ 9.5-10.1 (9.9) ; *ml.* 15.5-16.6 (16.1).

Weight : *Wt.* of individuals excluding pregnant females before feeding : 24-30 (27).

Diagnosis : This species differs from others in the presence of black beard in male, absence of gular sac and pectoral gland in both sexes ; upper incisor weak and minute, (not found in other Indian species) :

Remarks : Upper incisors are generally found absent in the adult specimens of Indian *Taphozous*. Dobson (1876), Miller (1907), Phillips (1935) and Winge (1941) have given dental formula of the genus *Taphozous* as $i \ 1/2, c \ 1/1 \ pm \ 2/2 \ m \ 3/3 = 30$. Dobson (loc. cit.) also mentioned that upper incisors are often absent in adult animals. On carefully cleaning the skulls I have found a pair of weak and minute upper incisors attached to the tip of cartilaginous premaxillaries (plate 2, fig. c.).

Among 129 ♂♂ collected from Patna City I found 17 ♂♂ without black beard but absence of black beard is not related with its breeding period, age etc. as it is found in adult males in almost every months or even in young. Is this absence a genetic phenomenon ? Males are generally bright brown colour while females are darker.

Distribution in Bihar (Fig. 3) : No previous record from Bihar.

I find it only in Patna City (Sinha, 1981 c), **Elsewhere** : INDIA : Kerala, Karnataka Maharashtra, Tamil Nadu. Andhra Pradesh, Gujarat (Shina, 1981 a), Madhya Pradesh, Orissa (Khaparde, 1976), Rajasthan (Sinha, 1981 d), and Andaman Islands (Khajuria, 1953 ; Hill, 1967). EXTRA-INDIA : SRI LANKA (Phillips, 1922), BURMA, MALAYA, YUNNAN, LAOS, JAVA.

Field ecology : Ecological observations on this bat were made at Govind Bag Mandir, Rajaghat and Hiranand Sah Lane in Patna City. At these places colonies (size : 25-500 ex.) were found in discarded semidark rooms and varandahs of old temples and houses. Bats were either hanging from ceilings or on the wall in head down position. As observed on 10th March 1981, its emergence time was 20 minutes after sunset. The time of sunset was 6 P. M., and of emergence 6. 20 P. M.,

Other general habits are almost same as mentioned by Khajuria (1979) except that it was found only in temporary association with *Rousettus leschenaulti* in February-March when peepal tree near the colony started fruiting. Association with other bats in rest of the months of the year was not seen as found by Khajuria (Loc. cit.).

Pairs in copula have been seen in the last week of December and first week of January. Male was found on the back of female for some time and then the female slipped below. Pregnancy was always found in the right cornu of the uterus. Khaparde (1976) mentioned that physiologically right cornu is dominant over the left in bearing pregnancy.

Pregnant females have been found in January (on 21 Jan. 1981, dia. of *Rt.* horn : 2 to 2.5 mm. ; dia. of *Rt.* horn on or before 3. Jan. 1980 : 1.5 mm.), February (on 4 Feb. 1981 : dia. of *Rt.* horn 2-2.5 mm ; on 24 Feb. 1981 : dia of *Rt.* horn 6.7 mm.' length of embryo, 6-11 mm.), March (on 26 Mar. 1979 : size of foetus-*HB* 6-20 mm. ; *f.* 0-10 mm.), April (on 28 Apr. 1979 : size of foetus-*HB*. 17-22 ; *f.* 5-11.), May (on 24 May 1979 : size of foetus-*HB*. 45 ; *f.* 32 *wt.* 10 gm.).

Most of the females collected in May and June had a young attached to the breast (on 24 May 1979 : size of young-*HB*. 51-52 ; *f.* 38-41 ; on 25 Jun. 1979 : *HB*. 58 ; *f.* 45.5). No pregnant females were found from July to December.

From above observation it appears that copulation in this species takes place either in the last week of December or in the first week of January. Birth of single young starts in the last week of May and ends in the last week of June.

Gestation period is around 5 months in Bihar and unlike *T. longimanus*, it has restricted breeding period in June. My observation on breeding slightly differs from those of Khaparde (1980) and Khajuria (1979). They could not find pregnant females after 5th. June.

Youngs grow rapidly. I could not see any young attached with the mother on or after 25th July in Patna City. Khajuria (*loc cit*) found lactation continues for about four months after delivery in Jabalpur while Khaparde (*loc. cit*) could not obtain lactating mother in any month except May and June in Orissa.

Weight of individuals (excluding pregnant females) were taken in every month of the year as follows :—

Beginning of January (3 Jan. 1980) : average *Wt.* of 8 ex. : 28.6 ; late January (21 Jan. 1981) : average *Wt.* of 14 ex. : 26.4 ; February (4 Feb. 1981) : average *Wt.* of 22 ex. : 26.5 ; March (24 Mar. 1980) : average *Wt.* of 5 ex. : 25 ; April (25 Apr. 1980) : average *Wt.* of 10 ex.

29.4 ; May (24 May 1979) : average *Wt.* of 5 ex. : 27.2 ; June (25 Jun. 1979) : average *Wt.* of 10 ex. : 26 ; July (25 Jul. 1980) : average *Wt.* of 6 ex. : 24.6 ; August (21 Aug. 1979) : average *Wt.* of 8 ex. : 25.5 ; September (24 Sept. 1980) : average *Wt.* of 14 ex. : 25.5 ; October (15 & 25. Oct. 1979) : average *Wt.* of 13 ex. : 24.9 ; November (26 Nov. 1979) : average *Wt.* of 10 ex. : 28 ; December (12 Dec. 1980) : average *Wt.* of 14 ex. : 30.

Weight taken in different months indicates that maximum fat deposition in this species taken place in extreme cold (December : *Wt.* 30) and hot (end of April : 29.4) which perhaps helps in escaping from severe cold and heat. It was always found on the wall and hanging from ceiling but not in crevices etc. even in extreme cold and heat.

No ecto-parasites were found on the body. A snake (*Naja naja*) was observed attacking *T melanopogon* hanging from the ceiling. A *T melanopogon* was also seen in the mouth of a black cat. Wall lizzards, snails, cockroaches and centipades were also seen in its roosting place.

In laboratory this bat was kept in a cage covered with moist towels. They were provided with cockroaches, small frogs, moths and some coleopteran insects but it did not even touch them. Forcibly they were given biscuits and milk which was taken in small quantities. They licked water from moist towel and from petridishes. Within a week they all died. Before death pregnant females gave birth to an immature dead young.

9. *Taphozous kachhensis* Dobson

(The Kutch Sheath-tailed Bat)

Taphozous kachhensis Dobson, 1972, *J. Asiat. Soc. Beng.*, Calcutta. 41 (2) : 221.
Type—loc. : Kutch, India.

Taphozous kachhensis kachhensis Dobson

(Plate 2 a, b)

Taphozous kachhensis Dobson, 1872, as above.

Material examined : *Gaya Dist.* : Jagannath Temple. Bodh Gaya. (22 Jul. 1978 and 3 Apr. 1981), 1 ♂, 1 ♀ ; *Rohtas Dist.* : Shersah Suri Tomb, Sasaram (28 Oct 1978), 1 ♀

Measurements : External : 1 ♂ : *HB.* 90 ; *TI.* 28 ; *E.* 20 ; *Tr.* 4. 5 ; *f.* 69. 2 ; *t.* 28 ; *ft.* 18. 2 ♀ ♀ : *HB.* 93, 95 ; *TI.* 30, 32 ; *E.* 21, 21. 5 ; *f.* 71, 74 ; *t.* 31, 32 ; *ft.* 17. 5, 18.

Skull : 1 ♂ : *l.* 25. 5 ; *zw.* 15 ; *cw.* 11. 8 ; *ch.* 10. 1 ; *m^s-m^s* 10. 6 ; *c-m^s* 11.3 ; *c-m₃* 13 ; *ml.* 20. 4. 1 ♀ : *l.* 26. 5 ; *zw.* 16. 5 ; *cw.* 12 ; *ch.* 10. 2 ; *m^s-m^s* 12 ; *c-m^s* 11.2 ; *o-m^s* 13. 5 ; *ml.* 20. 3.

Distribution in Bihar (Fig. 3) : Gaya and Rohtas districts.

Field ecology : Like other places, this bat was obtained from crevices, cracks etc. in the ceiling of old temples (Bojh Gaya) and monument (Sasaram) in the hottest part of Bihar. Colony size : 10-15 ex. (in one place but in different crevices or cracks). Emergence time as observed on 22nd July 1978 is 6. 50 P. M., 15 minutes after sunset.

Specimen obtained in the last week of October (27 Oct. 1978) had heavy fat deposition in its thigh, upper portion of interfemoral membrane and lower portion of abdomen.

Gut contents show legs, wings and antennae of Hemiptera, Coleoptera and Hymenoptera.

It was not found in association with other bats but in the same building in which there was a colony of *Pipistrellus coromandra*, *Rhinopoma hardwickei* and *Scotophilus heathi*.

Female collected in April from Bojh Gaya was pregnant, having single embryo of early stage in the right cornu of the uterus (size : length 15 mm.).

10. *Taphozous saccolaimus* Temminck

(Pouch-bearing Bat)

Taphozous saccolaimus Temminck, 1838, *Tijdschr. Naturg. Gesch.*, 5 : 14. Type-loc. : Java.

Diagnosis : It can be easily separated from other species of *Taphozous* by the absence of radio-metacarpal pouch, complete bullae, much broader mesopterygoid fossae and proportionately larger anterior upper premolar. Other species of *Taphozous* have the radio-metacarpal pouch either small or large, bullae imperfect antero-internally, mesopterygoid fossae small and anterior upper premolar smaller.

The gular sac is well developed in both sexes of *T. saccolaimus* while it is well developed only in male of *T. longimanus* and *T. kachhensis*.

Distribution : Sri Lanka, Peninsula of India, Burma ; Malay States (= Malayasia), Sumatra (= Andalas), Java.

Systematic note : Only one subspecies *T. saccolaimus crassus* is found in India. I could not find it in Bihar. It has been mentioned here on the basis of old record from Koria, Singhbhum district of Bihar and Orissa by Wroughton (1915).

Taphozous saccolaimus crassus Bloth

Taphozous crassus Blyth, 1844, *J. Asiat. Soc. Beng.*, 13 : 491. Type-loc. : Mirzapore, Uttar Pradesh, India.

I could not collect specimens of *T. s. crassus* although Wroughton

(1915) recorded it from Korias, Singhbhum district of Bihar and Orissa (Fig. 3). The characters given above are on the basis of previous literatures and on the specimens of *T. saccolaimus* examined by me in the collection of ZSI, Calcutta from other places.

Family IV MEGADERMATIDAE
Genus (6) **Megaderma** E. Geoffroy

11. **Megaderma lyra** E. Geoffroy
(Indian False Vampire)

Megaderma lyra E. Geoffroy, 1810, *Ann. Mus. Hist. Nat.*, Paris, 15 : 190. Type-loc. : East coast of Madras.

Megaderma lyra lyra Geoffroy
(Plate 5 a)

Megaderm lyra Geoffroy, 1110, as above.

Megaderma lyra lyra Geoff., Sinha, 1971, p. 86. (Syn. : *Euchiera lyra caurina* And. & Wr.)

Material examined : *Aurangabad Dist.* : Deb, c. 20 km. S. E. of Aurangabad (14 Apr. 1979), 1 ♂, 4 ♀ ♀; *Bhagalpur Dist.* : Sultanganj (10 Apr. 1979), 8 ♀ ♀; *Bhojpur Dist.* : Dumaron (27 Aug. 1983), 6 ♂ ♂; *Dhanbad Dist.* : Dhaia, c. 5 km. N. of Dhanbad (19 Aug. 1982), Katras Raja Ka Garh, c. 20 km. W of Dhanbad (20 Aug 1982) and Chungi village in Rajganj Police Station, c. 20 km. N. W of Dhanbad (21 Aug. 1982), 6 ♀ ♀, 11 ♀ ♀; *Giridih Dist.* : Kabutari Pahar, c. 35 km. N. W. of Jamua (13 Jul. 1979), 1 ♂; *Gopalganj Dist.* : Hathua (28 Oct. 1981), 1 ♂, 4 ♀ ♀; *Madhubani Dist.* : Mahant Jee Ka Math, Adalpur, c. 3 km. N. of Jhanjharpur Rly. Station (24 May 1981), 2 ♀ ♀ and 1 ♀ (y); *Purnea Dist.* : Indigo factory near Purnea (1872), J. Anderson, ZSI, Cal.), Purnea old city (18 May 1911), Garh Banaili, c. 17 km. S. E. of Purnea town (19 May 1981), Khagra Nawab Sahab Ki Kothi, c. 2 km. N. of Kishanganj (18 Jan. 1982), 5 ♂ ♂, 18 ♀ ♀ and 2 ♂ ♂, 5 ♀ ♀ (y); *Saharsa Dist.* : Bangaon (in label "Bhagaon" old Purnea Dist., 17 Oct. 1907, C. A. Pavia, ZSI, Cal.) 4 ♀ ♀; *Vaishali Dist.* : Harpur Osti, c. 3 km. S. of Mahuwa (24 Apr. 1967) and 12 Oct. 1975, Y P. Sinha, ZSI, Cal.), Barai Tola in Jadhuan village, c. 4 km. E. of Hajipur (8 Nov. 1977), 5 ♂ ♂, 8 ♀ ♀

Measurements : External : 19 ♂ ♂ : *HB.* 76-84 (80) ; *E.* 34-39 (37) ; *Tr.* 19-23 (21) ; *f.* 65, 67 (66) ; *t.* 32-34 (33. 2) ; *ft.* 17.1-19.3 (18.4) ; *ws.* 420-440 (430). 51 ♀ ♀ : *HB.* 77-85 (80) ; *E.* 37-39 (38) ; *Tr.* 16-23 (19) ; *f.* 62.5-71 (67.2) ; *t.* 31.5-37 (34) ; *ft.* 17-22 (19) ; *ws.* 420-480 (433).

Skull : 5 ♂♂ : 1. 26.2-28.6 (27.7) ; zw. 16.4-16.7 (16.5) ; cw. 12-12.4 (12.2) ; ch. 12.1-12.8 (12.2) ; m^s - m^s 9.5-10.2 (9.8) ; c - m^s 10.7-11.3 (10.9) ; c - m_3 11.8-12.7 (12.1) ; ml. 19.3-19.9 (19.6) ; 5 ♀♀ : 1. 27.8-28.1 (28) ; zw. 16.2-17.6 (16.9) ; cw. 12.2-12.9 (12.4) ; ch. 11.2-12.8 (12) ; m^s - m^s 10-10.5 (10.1) ; c - m^s 11.2-11.5 (11.4) ; c - m_3 12.2-12.8 (12.4) ; ml. 20.1-20.6 (20.3).

Weight : *Wt.* of individuals excluding pregnant females before feeding : 33-43 (40) in winter and 40-50 (44) in summer.

Distribution in Bihar (Fig.3) : Both sides of the Ganga river in Aurangabad, Bhagalpur, Dhanbad, Giridih, Gopalganj, Madhubani, Purnea, Saharsa and Vaishali districts.

Field ecology : In Bihar, this bat was collected from semidark and discarded rooms of brick and mud houses and godowns in plains and from caves in forested hill. Size of colony : 25-200 ex.

"Refuse" obtained from the ground below the colony contains skull and some vertebrae of the house Shrew (*Suncus musinus*) ; humerus bones of some bats (*Hipposideros* and *Rhinopoma* spp.) and bird ; and complete but mutilated skeleton including skull and lower jaw and bunch of hairs of rats. This indicates its some favourite food and carnivorous habit as mentioned in previous literatures by various authors.

This bat was found in association with *Hipposideros fulvus pallidus* and *Rhinopoma h. hardwickei* in the cave of "Kabutari Pahar" in deep forest near Tisari (Giridih Dist.) and with *Rousettus leschenaulti* in Deb (Aurangabad Dist.).

It starts flying slightly late in the evening (about half an hour after sunset). The time of emergence of this bat and sunset as noted in Purnea on 18th May, 1981 was 7 P. M. and 6.29 P. M. respectively.

Females obtained on 19, 20 and 21 August 1982, 28 October 1980 and 8 November 1977 were non-pregnant and had normal uterus, on 14 December 1979 had slightly enlarged left horn and on 18 January 1982 small bulbous left horn, All females collected on 10 Apr. 1981 were pregnant and had single mid-stage foetus (*HB.* 27-34 ; *f.* 15-21) in left horn. Among 11 females collected on 18, 19 and 24 May 1981, nine had a suckling young (*HB.* 52-71 ; *f.* 44-62) and two were pregnant (size of foetus : *HB.* 42 ; *f.* 30).

From the above data on breeding it appears that fertilization in this bat takes place around mid December and birth of a young in May. Gopalakrishna (1969) mentioned pregnancy season of this bat from November to May (gestation period : 155-160 days) for Nagpur and Aurangabad population.

Young was found clinging to the mother ventrum to ventrum with hind feet around her neck and inguinal teats in its mouth. Pectoral teats are used only for suckling milk.

Individuals in summer are found fatter than in the winter. It may be due to availability of plenty of food in summer.

Family V RHINOLOPHIDAE
Genus (7) **Rhinolophus** Lacepede

12. **Rhinolophus lepidus** Blyth
(Little Indian Horseshoe Bat)

Rhinolophus lepidus Blyth, 1844, *J. Asiatic Soc. Beng.*, Calcutta, 13 : 486. Type-loc. : Calcutta, India.

Rhinolophus lepidus lepidus Blyth
(Plate 3 b, d, e)

Rhinolophus lepidus lepidus Blyth, 1844, as above.

Material examined : *Gaya Dist.* : Singar (May, 1915, C. A. Crump, ZSI, Cal.), 7 ♂♂ ; *Giridih Dist.* : Madhuban near Parashnath Hill (21 Feb. 1972, B. Nath & Party, ZSI, GPRS, Patna), 1 ♂ ; *Munger Dist.* : Basudeopur Mahalla, Munger (5 Sep. 1982), 1 ♂ ; *Singhbhum Dist.* : Manoharpur (from tunnel in an haematite mine, no date, S. W. Kemp, ZSI, Cal.) and Luia near Chaibasa (21 Jul. 1914, C. A. Crump, ZSI, Cal.), 4 ♂♂, 3 ♀♀

Measurements : External : 13 ♂♂ : *f.* 39-40 (39.6) ; *t.* 15.6-17.2 (16.5) ; *ft.* 6-8 (7.1) ; *ws.* 230-250. 3 ♀♀ : *f.* 39.3-41.2 (40.2) ; *t.* 14.6-15.5 (15.1) ; *ft.* 7.4-7.8 (7.6).

Skull : 5 ♂♂ : *l.* 16.6-17 (16.7) ; *zw.* 7.8-8.4 (8.1) ; *cw.* 6.8-8 (7.2) ; *m³-m³* 5.9-6.5 (6.1) ; *c-m³* 5.9-6.5 (6.3) ; *c-m₃* 6.5-7 (6.7) ; *ml.* 11-11.2 (11.1). 2 ♀♀ : *l.* 16.1, 16.7 ; *zw.* 7.9, 8 ; *cw.* 6.7, 7.1 ; *m³-m³* 6, 6.1 ; *c-m³* 6, 6.2 ; *c-m₃* 7, 7 ; *ml.-*, 11.1.

Weight : *Wt.* taken of a male individual before feeding : 10.

Distribution in Bihar (Fig. 4) : Recorded only from hilly areas south of the Ganga river including Gaya, Giridih, Munger and Singhbhum districts.

Field ecology : It was collected from an underground room of an old house near grove in Basudeopur, Munger.

Gut content of the specimen collected in February had complete head of a dipteran fly and wings attached with thorax and abdomen of a hymenopteran insect.

13. *Rhinolophus mitratus* Blyth

Rhinolophus mitratus Blyth, 1844, *J. Asiat. Soc. Beng.*, Calcutta, 13 : 482. Type-loc, ; Chaibasa (Bihar).

Material examined : Singhbhum Dist. : Chaibasa (no date, ZSI, Cal.), 2 (unsexed, among which one holotype specimen not in good condition).

Diagnosis and measurements : See Sinha (1973).

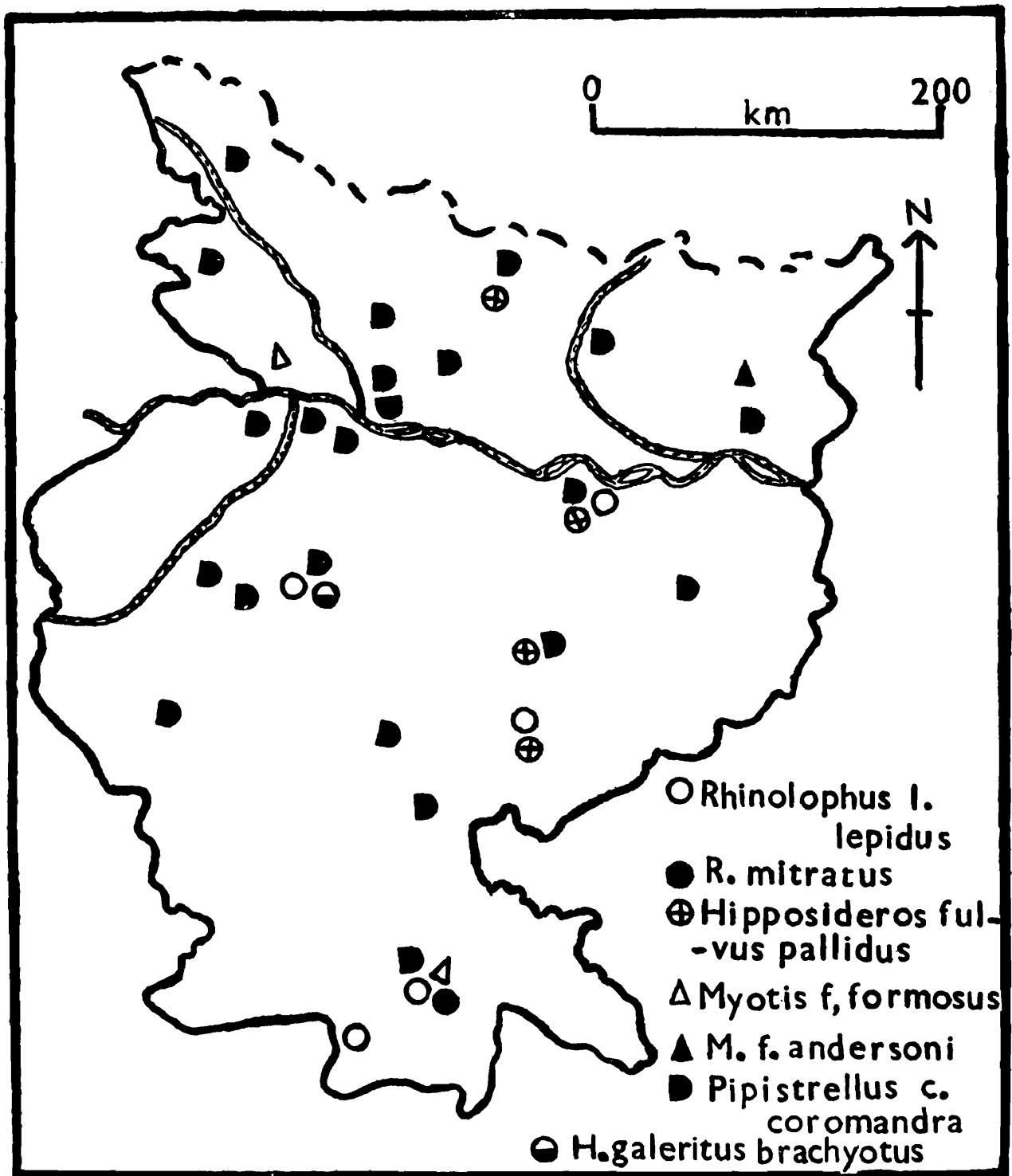


Fig. 4. Distribution of bats in Bihar

Distribution in Bihar (Fig. 4) : Only recorded from type-locality "Chaibasa", Singhbhum district.

Genus (8) **Hipposideros** Gray14. **Hipposideros fulvus** Gray
(Fulvus Leaf nosed Bat)

Hipposideros fulvus Gray, 1838, *Mag Zool. Bot.*, 2 : 492. Type-loc. : Dharwar, S. India.

Hipposideros fulvus pallidus Andersen
(Plate 3 a, c)

Hipposideros fulvus pallidus Andersen, 1918, *Ann. Mag. nat. Hist.*, London, (9) 2 : 381. Type-loc. : Junagadh, Gujarat, India.

Material examined ; *Darbhanga Dist.* : (Banhar as on label, 5 Oct. 1922, N. A. Baptista, ZSI, Cal.), 1 ♂ ; *Gaya Dist.* : Maniama, Ca. 15 km. from Jahanabad (4 Jan., 1985), 1 ♂, 3 ♀ ♀ ; *Giridih Dist.* : Nimiaghat (19 June 1914, C. A. Crump, ZSI, Cal.) and Kabutari Pahar near Tisari c. 35 km. N. W. of Jamua (13 Jul. 1979), 19 ♂ ♂, 9 ♀ ♀ ; *Hazaribag Dist.* : Hazaribag (ZSI, Cal.), 1 ♂ ; *Munger Dist.* : Basudeopur, Munger (5 Sep. 1982), 1 ♂, 1 ♀

Measurements : External : 17 ♂ ♂ : *HB.* 40-48 (43.8) ; *E.* 19-23.5 (20.7) ; *f.* 37.5-40.5 (39.2) ; *t.* 16-19.5 (18.3) ; *ft.* 8-8.5 (8.2) ; *ws.* 250-260 (258). 7 ♀ ♀ : *HB.* 42-47 (45) ; *E.* 20-21 (20.6) ; *f.* 39.2-41 (39.9) ; *t.* 18-19 (18.4) ; *ft.* 8-8.5 (8.4), *ws.* 250-260 (251). 3 ♂ ♂ (Subad.) : *HB.* 37-43 (40) ; *E.* 14-15 (14.6) ; *f.* 35-36 (35.5) ; *t.* 16.5-17.5 (17) ; *ft.* 8 (in all) ; *ws.* 250-260 (253). 2 ♀ ♀ (subad.) : *HB.* 40, 40 ; *E.* 15, 15 ; *f.* 35.5, 36.5 ; *t.* 16.2, 17 ; *ft.* 7, 8 ; *ws.* 250, 260.

Skull : 6 ♂ ♂ : *l.* 16.4-17.1 (16.9) ; *zw.* 8.7-9.1 (9) ; *cw.* 7.9-8.4 (8.1) ; *ch.* 7.1-7.8 (7.5) ; *m¹-m³* 6.1-6.7 (6.3) ; *c-m¹* 6.1-6.4 (6.2) ; *c-m₃* 6.6-6.8 (6.7) ; *ml.* 10.7-11.2 (11). 4 ♀ ♀ : *l.* 16.6-17 (16.9) ; *zw.* 8.8-9 (8.9) ; *cw.* 8-8.3 (8.1) ; *ch.* 7.2-7.8 (7.6) ; *m³-m³* 6.1-6.6 (6.4) ; *c-m³* 6.2-6.5 (6.4) ; *c-m₃* 6.8-7.1 (7) ; *mi.* 10.6-11 (10.9).

Weight : *Wt.* of individuals excluding pregnant females before feeding : 5.5-7 (6).

Remarks : As already reported (Sinha, 1980) adult males and females have prominent frontal sac which is not found in subadult.

Distribution in Bihar (Fig. 4) : Recorded from Darbhanga, Giridih, Hazaribag and Munger districts of Bihar.

Field ecology : This bat was collected by me from a cave in "Kabutari Pahar" (hillock) in deep forest near Tisari, c. 35 km. N. W. of Jamua in Giridih district and from an underground room of an old house near grove in Munger. In Kabutari Pahar, it was found in association with *Megaderma l. lyra* and *Rhinopomaeh. hardwickel* but in

Munger there was only two individuals (1 ♂, 1 ♀) in an underground room.

Females obtained in July and September were non-pregnant and some of them subadults indicating that parturition takes place most probably either in May or June.

15. *Hipposideros galeritus* Cantor

Hipposideros galeritus Cantor, 1846, *J. Asiat. Soc. Beng.*, 15 : 183. Type-loc. : Penang, Malay States (=Malayasia).

Diagnosis : It can be easily distinguished from *H. fulvus* by the presence of two supplementary leaflets on each side of anterior nose-leaf, width of cochleas subequal to their distance apart (wider in *H. fulvus*) and larger size of forearm length 44 compared to 37.5-40.5 in *H. fulvus*. Dental formula same as in other species of *Hipposideros*.

Distribution : India and Sri Lanka to Borneo and Java.

Systematic note : Recently Jenkins and Hill (1981) recognized four subspecies in which *Hipposideros galeritus brachyotus* Dobson (= *Phyllorhina brachyota* Dobson, 1874) is found in the present Bihar (Text-fig. 4). I could not collect it from Bihar but mentioned here on the basis of Wroughton (1915).

Family VI. MOLOSSIDAE

Genus (9) *Tadaride* Rafinesque

16* [*Tadarida aegyptiaca* (E. Geoffroy)] (Asiatic Free-tailed Bat)

Nyctinomus aegyptiacus Geoffroy, 1818, *Description de l' Egypte*, 2 : 128, pl. 2. Type-loc. : Egypt.

Tadarida aegyptiaca Geoff., Chaturvedi, 1964, p. 432, (syn. *Tadarida tragatus* Dobson.)

Tadarida aegyptiaca thomasi Wroughton (Plate 4 a)

Tadarida thomasi Wroughton, 1919, *J. Bombay nat. Hist. Soc.*, Bombay, 26 (4) : 732. Type-loc. Bhuj, Kutch, India.

Tadarida aegyptiaca thomasi Wr., Ellerman and Morrison-Scott, 1951, P. 135 ; Sinha, 1970, p. 87 (Syn. : *Tadarida gossei* Wr.).

* Mentioned here on the basis of old record from "Jashpur" which is now in Madhya Pradesh,

Material examined : Chota Nagpur : Jashpur*, 1 ♂ (in ZSI, Calcutta).

Measurements : External : *f.* 47 ; *t.* 14.5 ; *fi.* 8.4.

Skull : *I* 19.5 ; *zw.* 12 ; *cw.* 9.5 ; *m*³-*m*³ 8.4. ; *c-m*³ 7.5 ; *c-m*₃ 8 ; *ml.* 14.

Remarks : The above specimen was previously identified by Dobson (1976) as *Tadarida tragata* Dobson. Chaturvedi (1964) synonymised *Tadarida tragata* with *Tadarida aegyptiaca* and treated this specimen as *Tadarida aegyptiaca* without assigning it to any subspecies. I have carefully examined it and found it belonging to *Tadarida aegyptiaca thomasi* Wroughton.

Family VII. VESPERTILIONIDAE

Genus (10) *Myotis* Kaup

17. *Myotis formosus* (Hodgson) (Hodgson's Bat)

Vespertilio formosa Hodgson, 1835, *J. Asiat. Soc. Beng.*, Calcutta, 4 : 700. Type-loc. : Nepal.

(*Syn. Kerivoula pallida* Blyth, *Cat. Mamm. Mus. Asiat. Soc.*, p. 34. Type-loc, Chaibasa, Bihar, India ; Ellerman and Morrison-Scott., 1951, p. 156.

Diagnosis : This species can easily be separated from other species of *Myotis* by its colour of membranes which are orange with the exception of black triangular areas between the third and fourth, and fourth and fifth and inside the fifth. The colour pattern of membrane is not found in any other bats except *Kerivoula picta*. The black triangular is some times dotted and streaked with orange. Wings originate from the base of outer toe. Except size, skull (Fig. 9) characters are very much similar as mentioned by Sinha (1980) for *M. blythi*.

Distribution of species : Fukien and adjacent states in southern China ; Nepal, Northern part of India including Punjab (Hoshiarpur), Himachal Pradesh (Dharamsala), Uttar Pradesh (Kumaun and Mussoorie), Bihar (Chapra, Chaibasa, Purnea) W Bengal, (Darjeeling), Sikkim, Assam (Goalpara), Meghalaya (Cherrapunji) ; Korea ; Formosa ; Southern Japan.

Systematic note : Ellerman and Morrison-Scott (1951) divided *Myotis formosus* Hodgson into six subspecies as follows :

* *Distribution in Bihar* (Fig. 4) : I could not find this species in present Bihar. It was previously known from "Jashpur" in Chota Nagpur area but now "Jashpur" is in Raigarh District of Madhya Pradesh very near to border.

(1) *M. f. formosus* (Hodgson) 1855.—Nepal and northern India as above excluding Purnea (in Bihar) and Darjeeling (W. Bengal).

(2) *M. f. rufoniger* Tomes, 1858.—Fukien and adjacent states in southern China.

(3) *M. (?) formosus andersoni* Trouessart, 1897.—Purnea (now in Bihar).

(4) *M. f. tsuensis* Kuroda, 1922—Southern Japan.

(5) *M. f. watasei* Kishida, 1924—Formosa.

(6) *M. f. chofusukei* Mori, 1928—Korea.

Among above six subspecies only two are from Indian Union viz. *M. f. formosus* Hodgson and *M. formosus andersoni*. Ellerman and Morrison—Scott (*loc. cit.*) expressed their doubt treating *andersoni* as a subspecies of *formosus*. Blanford (1891) mentioned that *V. dobsoni* Anderson (= *M. f. andersoni* Trouessart) appeared to be founded on a very large individual of *Vespertilio formosus* (= *Myotis formosus*) with forearm 2.15 inches (= 54.6 mm.). He has given forearm length of *M. formosus* 1.9 inches (= 48.3 mm.). In my opinion if *Myotis formosus* is unique species for its colour of wing membrane “partly coloured orange and black” and this character is the same in *V. dobsoni* Anderson (= *M. f. andersoni* Trouessart), I agree with Blanford (*loc. cit.*) that *V. dobsoni* (= *M. f. andersoni*) is nothing but the *Myotis formosus*.

Ellerman and Morrison—Scott (*loc. cit.*) assigned Darjeeling specimen to *M. f. formosus*. Measurements taken by me show that Darjeeling (W Bengal) and Purnea (Bihar) specimens have longer forearm, foot (including claws) and skull [*f.* (2 ex). 50, 53 ; *ft.* 13, 14.6 ; *l.* (1 ex) ; 19.2] than in *M. f. formosus* from other part of North India [*f.* (8 exs.) : 44.2-48 (46.5) ; *ft.* (8 ex.) : 10.8-12.2 (11.5) ; *l.* (6 exs.) : 16.8-17.9 (17.5)]. Thus, at present, I treat, Purnea and Darjeeling specimens as *M. f. andersoni* Trouessart distinct from *M. f. formosus* (Hodgson).

17 a. *Myotis formosus formosus* Hodgson

Vespertilio formosa Hodgson, 1835, as above.

Kerivoula pallida Blyth, 1863, as above.

Material examined : Bihar : Saran Dist. : Serpur (Siripur) near Chapra (no date, J. M. D. Mackenzie, ZSI, Cal.), 1 (unsexed) ; Singhbhum Dist. : Chaibasa (1842, S. R. Tickell, ZSI, Cal. ; Syntypes-Reg. no. 15654, 15655, 15657), 3 (unsexed). *Other than Bihar* : Meghalaya : Khasia-Hills Dist. : Cherrapunji (Lt. Col. H. H. Godwin-Austen, ZSI, Cal.), 1 ♀ ; Assam : Goalpara Dist. : Goalpara (H. L. Haughton, 1870, ZSI, Cal.), 1 ♀ ; Punjab : Hoshiarpur Dist. (ZSI, Cal.), 1 ♂.

Measurements : External : 8 ex. : *f.* 44.2-48 (46.5) ; *t.* 21-24.2 (22.4) ; *ft.* 10.8-12.2 (11.5).

Skull : 6 ex. : *I.* 16.8-17.9 (17.5) ; *zw.* 11.5-12.1 (11.8) ; *cw.* 8.4-8.7 (8.5) ; *ch.* 7.3-7.9 (7.6) ; *m³-m³* 7.1-7.8 (7.5) ; *c-m³* 6.6-7.5 (7.1) ; *c-m₃* 7.2-7.9 (7.5) ; *ml.* 13.3-13.6 (13.5).

Diagnosis : Same as species and differs from *M. f. andersoni* in having smaller forearm, foot (including claws) and skull.

Distribution in Bihar (Fig. 4) : Saran and Singhbhum districts.

Elsewhere : As above.

17 b. *Myotis formosus andersoni* Trouessart

Vespertilio dobsoni Anderson, 1881, *Cat. Mamm. Indian Mus.*, Calcutta, p. 143. Type-loc. : Purnea, Bihar.

Vespertilio andersoni Trouessart, 1891, *Cat. Mamm.*, p. 129. New name for *Vespertilio dobsoni* Anderson, preoccupied.

Material examined : Bihar : Purnea Dist. : Purnea (20 May 1875 ; S. J. Shillingford, ZSI, Cal. Reg. Nos. 15582, 15583-syntypes), 1 ♀ (ad.) and 1 ♀ (y.). Other than Bihar : W Bengal : Darjeeling (Dr. F. Stoliczka, 1871, ZSI, Cal.), 1 (unsexed).

Measurements : External : 2 ex. (ad.) : *f.* 50, 53 ; *t.* 23, 25 ; *ft.* 13, 14.6. 1 ♀ (y.) : *f.* 46 ; *t.* 20 ; *ft.* 12.7.

Skull : 1 ♀ (ad.) : *I.* 19.2 ; *m³-m³* 8.8 ; *c-m³* 7.6 ; *c-m₃* 8.6 ; *ml.* 14.7.

Diagnosis : This subspecies differs from *M. f. formosus* in having longer forearm, foot (including claws) and skull.

Distribution in Bihar (Fig. 4) : Purnea in Purnea Dist. **Elsewhere** : Darjeeling (W. Bengal).

Genus (11) *Pipistrellus* Kaup

18. *Pipistrellus coromandra* (Gray)

(Indian Pipistrelle)

Scotophilus coromandra Gray 1838, *Mag. Zool. Bot.*, 2 : 498. Type-loc. : Pondicherry, Coromandel coast, India.

Diagnosis : Externally *P. coromandra* can be differentiated from its nearest and sympatric species *P. mimus* from broader muzzle and white margin of wing membrane (in freshly collected specimen). Specimens are average larger in external measurements but this is an overlapping character. Skull (Fig. 11) longer (*I.* 12-13 vs. 10.5-11.8) and average broader (*zw.* 7.5-8.4 vs. 6.6-8) ; mandible longer (*ml.* 8.5-9.6 vs. 7.2-8.3). Rostrum longer and broader than that of *P. mimus* ; rostral

pit deeper and constriction between brain-case and rostrum narrower. Dental formula same as described by Sinha (1980) for *P. mimus*.

Distribution of species : Southern part of China ; almost whole India including Gujarat, Maharashtra, Karnataka, Madhya Pradesh, Uttar Pradesh, Pondicherry, Orissa, Bihar, W Bengal, Sikkim and Car Nicobar ; Sri Lank ; Burma ; Vietnam ; Hainan ; and ? Persia (= Iran) (Ellerman and Morrison-Scott, 1951).

Systematic note : Ellerman and Morrison-Scott (1951) provisionally recognised four subspecies as-*P. c. coromandra*, *P. (?) c. aladdin*, *P. c. portensis* and *P. c. tramatus* but Corbet (1978) listed *aladdin* as a subspecies of *Pipistrellus pipistrellus*. Thus, only three subspecies are now valid as follows in which *P. c. coromandra* is found in Bihar.

P. c. coromandra Gray.-Indian localities as mentioned above and Sri Lanka.

P. (?) c. portensis J. Allen.-Hainan.

P. c. tramatus Thomas.-Southern part of China ; Burma and ; Vietnam.

***Pipistrellus coromandra coromandra* Gray**

(Plate 4 b ; 5 b, c)

Scotophilus coromandra Gray, 1838, as above.

Material examined : *Aurangabad Dist.* : Biratpur (14 Feb. 1980), 2 ♂ ♂, 1 ♀ ; *Bhagalpur Dist.* : Sultanganj (10 Apr. 1979), 4 ♀ ♀ ; *Bhojpur Dist.* : Arrah (Town School, 25 Oct. 1978), 1 ♂, 1 ♀ ; *Gaya Dist.* : Singar (30 May 1914, C. A. Crump, ZSI, Cal.), Bodh Gaya (22 July 1978), 1 ♂, 2 ♀ ♀ ; *Giridih Dist.* : Tisari, c. 32 km. N. W. of Jamua (13 Jul. 1979), 2 ♂ ♂, 1 ♂ (y.), 1 ♀ (y.) ; *Gopalganj Dist.* : Mirganj (26 Oct. 1981), 3 ♂ ♂, 4 ♀ ♀ ; *Hazaribag Dist.* : Hazaribag (W. T. Blanford, 1872, ZSI, Cal.) Chattar Mandu and Ramgarh (22 Jul. 1979), 2 ♂ ♂, 3 ♀ ♀ ; *Katihar Dist.* : Mania Ghat village c. 5 km. S. of Katihar (17 May 1981), 5 ♀ ♀, 5 ♀ ♀ (y.) ; *Madhubani Dist.* : Kanti c. 2 km. E. of Madhubani and Jamunia village (25 May 1981), 1 ♂, 1 ♀ ; *Munger Dist.* : Dharhara (5 Sep. 1968) and Chandi Asthan Munger (11 Apr. 1979), 2 ♂ ♂, 1 ♀ ; *Muzaffarpur Dist.* : Bhikanpur village in Mushari Block near Muzaffarpur (4 Dec. 1981), 1 ♂ ; *Palamau Dist.* : Kechaki (18 Dec. 1979) and Betala (21 Dec. 1979), 9 ♂ ♂, 10 ♀ ♀ ; *Patna Dist.* : Rajendra Nagar in Patna (6 Dec. 1977) and Maner (13 Apr. 1978), 1 ♂, 2 ♀ ♀ ; *Purnea Dist.* : Purnea old city (18 May 1981), 2 ♂ ♂, 1 ♀ ; *Saharsa Dist.* : Bangaon, c. 8 km. N. W. of Saharsa (21 May 1981), 5 ♀ ♀, 3 ♂ (y.) and 8 ♀ ♀ (y.) ; *Samastipur Dist.* : Kubouli, Madhopur and Khairy village near Pusa Rd. Station (10 and 11 Oct. 1980), 9 ♂ ♂.

9 ♀ ♀ ; *Santal Pargana Dist.* : Borio (7 Apr. 1979) and Rajmahal (8 Apr. 1979), 1 ♂, 2 ♀ ♀ ; *Singhbhum Dist.* : Chaibasa (8-11 Aug. 1914 and 15 Jul. 1915, C. A. Crump, ZSI, Cal. ; 19 Jul. 1979, self), Tambo c. 2 km. S, E. of Chaibasa (19 Jul. 1978) and Surya Basa c. 10 km. S. E. of Chaibasa (20 Jul. 1979), 9 ♂ ♂, 14 ♀ ♀ ; *Vaishali Dist.* : Harpur Osti (9 and 24 Apr. 1967 and 8 Oct. 1977 and Mokarri Tola Mirzanagar (8 Oct. 1977) in Mahuwa Block, Brahabatta (14 Jun. 1979) in Jhandaha Block and Choti Marai c. 5 km. S. E. of Hajipur (7 Nov. 1977), 5 ♂ ♂, 15 ♀ ♀ ; *W Champaran Dist.* ; Barba and Jamunia villages near Narkatiaganj Rly. Station (18 Oct. 1981), 3 ♂ ♂, 2 ♀ ♀

Measurements : External : 50 ♂ ♂ : *f.* 27*-32 (29.4) ; *t.* 11-13 (11.8) ; *ft.* 6-7 (6.4) ; *ws.* 190-210 (199). 71 ♀ ♀ : *f.* 28-32 (30.2) ; *t.* 10-14 (11.9) ; *ft.* 6-7.5 (6.5) ; *ws.* 180-230 (204).

Skull : 13 ♂ ♂ : *l.* 12-12.8 (12.3) ; *zw.* 7.5-8.2. (7.9) ; *cw.* 6.2-7 (6.5) ; *ch.* 5.5-6 (5.9) ; *m^s-m^s* 5.1-6 (5.8) ; *c-m^s* 4.5-5 (4.7) ; *c-m₃* 4.7-5.2 (5) ; *ml.* 8.5-9.3 (8.9). 28 ♀ ♀ : *l.* 12-13 (12.3) ; *zw.* 7.5-8.4 (8) ; *cw.* 6-7 (6.6) ; *ch.* 5.1-6.2 (5.9) ; *m^s-m^s* 5.1-6.1 (5.6) ; *c-m^s* 4.2-5.5 (4.6) ; *c-m₃* 4.7-5.2 (4.9) ; *ml.* 8.5-9.6 (9).

Weight : Average Wt. of individuals excluding pregnant females before feeding : 4-5 (4.6). No seasonal variations has been observed.

Remarks : Average external measurements indicate that it is larger than *P. mimus*. Skull is always bigger than in *P. mimus*. There is no marked difference in measurements of two sexes.

Distribution in Bihar (Fig. 4) : Both sides of the Ganga river in Aurangabad, Bhagalpur, Bhojpur, Gaya, Giridih, Gopalganj, Hazaribag, Madhubani, Munger, Muzaffarpur, Palamau, Patna, Purnea, Saharsa, Samstipur, Santal Pargana, Singhbhum, Vaishali and W. Champaran districts. *Elsewhere* : As above.

Field ecology : This bat was generally collected from hole in bamboo of thatched house and crevices between logs, ceiling and wall of houses. In Madhopur c. 3 km. from Pusa Road Railway Station, Samstipur district, it was collected from folds of a quilt hanging from rope in the room of a house in October 1980. The size of colony varies from one to 25.

The colony of this bat was found sometime near the colony of *P. mimus* and *P. dormeri* but not in association with these species. Other animals e.g. wasps (order Hymenoptera) and cockroaches (order Dictyoptera) are found in association with this bat (in the same hole, crevices, etc.).

In feeding ground, along with *P. mimus* and *P. dormeri* this bat

was found flying here and there. It was also observed skipping on the surface of water.

Emergence time of this bat was recorded by Sinha (1984) a few minutes before to 16 minutes after sunset. It is dependent on a number of factors like length of the day, timing of sunset and light intensity.

I have no experience about reaction of this bat to storms as mentioned by Chakraborty (1976). In Bihar, storms were seen either before of its emergence or in the night when we can not see the bat. In light rains this bat was observed flying but in heavy rains it was found hiding in safe places. In the morning it was seen flying towards roosting place 5-10 minutes before sun-rise but in cloudy weather it was seen even after sun rise.

Parts of small ants and mouth parts of dipteran fly were found in the gut contents.

Among females collected in April (on 8 Apr. 1979 and 10 Apr. 1979) one had two suckling youngs (size : *HB* 23-26 ; *f.* 13.5-20) and the rest (collected on 9 Apr. 1967, 13 Apr. 1978 and 24 Apr. 1967) were carrying two foetuses one in each cornu of uterus except two which had single foetus in the left cornu. The suckling youngs free from mother collected from hole in bamboos in May (17 May 1981) had coagulated milk in the gut. All females collected in July (19-22 Jul. 1979) were carrying early to advance stages (*HB.* 17 ; *f.* 11) of foetuses except one which had two suckling youngs (*HB.* 20 ; *f.* 11). Females collected in August had also two suckling youngs attached to their breast.

My above observations on breeding biology indicate that there is no restricted breeding period in this bat and that the mother gives birth generally to two youngs and one in rare cases, at least three times in a year, one in April, next in July-August and third may be in October-November.

19. *Pipistrellus mimus* Wroughton (Indian Pygmy Pipistrelle)

Pipistrellus mimus Wroughton, 1899, *J. Bombay nat. Hist. Soc.*, 12 (4) : 722. Type-loc. : Maheshkatri, The Dangs District, Gujarat.

Pipistrellus mimus mimus Wroughton (Plate 4d)

Pipistrellus mimus Wroughton, 1899, as above.

Pipistrellus mimus mimus Wroughton, Sinha, 1980, P. 40. (syn. : *Pipistrellus mimus glaucillus* Wroughton).

Material examined : *Begusarai Dist.* : Bishnupur near Begusarai (7 Oct. 1981), 1 ♀ ; *Bhagalpur Dist.* : Sultanganj (9. Apr. 1979), 2 ♀ ♀ ; *Bhojpur Dist.* : Arrah town (23 Oct. 1978) and Pirotta village c. 10 km. N. W. of Arrah (24 Oct. 1978), 6 ♂ ♂, 5 ♀ ♀ ; *Darbhanga Dist.* : Kameshwar Nagar, Darbhanga (27 May 1981), 4 ♂ ♂, 7 ♀ ♀ and 1 ♂ (y.), 1 ♀ (y.) ; *Dhanbad Dist.* : Naya Bazar, Dhanbad (22 Aug. 1982), 1 ♀ ; *E. Champaran Dist.* : Bariarpur village c. 4 km. S. E. of Motihari (23 Oct. 1981), 5 ♂ ♂, 5 ♀ ♀ ; *Gaya Dist.* : Singar (May, 1914 ; C. A. Crump ; ZSI, Cal.), 5 ♂ ♂, 10 ♀ ♀ ; *Hazaribag Dist.* : Hazaribag (July-August, 1914 ; C. A. Crump ; ZSI, Cal.) ; 5 ♂ ♂, 7 ♀ ♀ ; *Madhubani Dist.* : Khutauna c. 35 km. N. of Jhanjharpur Rly. Station (26 May 1981) and Ranti c. 2 km. E. of Madhubani (25 May 1981), 7 ♂ ♂, 15 ♀ ♀ ; *Muzaffarpur Dist.* : Muzaffarpur Kachheri (14 Oct. 1980), 4 ♂ ♂, 4 ♀ ♀ ; *Patna Dist.* : Patna (6 May 1967 ; Y Paswan), 1 ♂ ; *Rohtas Dist.* : Sasaram (Sersah Suri Tomb, 26 Oct. 1978), 2 ♂ ♂, 6 ♀ ♀ ; *Saharsa Dist.* : Bagahi, 6 km. N. W. of Saharsa (21 May 1981), 2 ♀ ♀ ; *Santal Pargana Dist.* : Borio (7 Apr. 1979) and Kanhaiya Asthan, Rajmahal (8 Apr. 1979), 8 ♂ ♂, 15 ♀ ♀ and 1 ♂ (y.), 3 ♀ ♀ (y.) ; *Singhbhum Dist.* : Chaibasa (July-August, 1914 ; C. A. Crump, ZSI, Cal.), 5 ♂ ♂, 8 ♀ ♀ ; *Sitamarhi Dist.* : Punaura c. 6 km. W of Sitamarhi (24 Oct. 1981), 2 ♂ ♂ ; *Vaishali Dist.* : Kanhauli c. 9 km. S. E. of Bhagwanpur (9 Sep. 1982), 1 ♀ ; *W. Champaran Dist.* : Narkatiaganj (18 Oct. 1981) and Betia (20 Oct. 1981), 1 ♂, 1 ♀

Measurements : External : 55 ♂ ♂ : *f.* 26-29.6 (27.2) ; *t.* 10-12.4 (11.4) ; *ft.* 4.5-7 (5.9) ; *ws.* 140-180 (168) 80 ♀ ♀ : *f.* 27-31 (28.6) ; *t.* 11-12.2 (11.5) ; *ft.* 5-7.2 (6.2) ; *ws.* 170-190 (180).

Skull : 14 ♂ ♂ : *l.* 10.5-11.2 (10.9) ; *zw.* 6.6-7.6 (7.2) ; *cw.* 6-6.5 (6.2) ; *ch.* 5.1-5.8 (5.5) ; *m³-m³* 4.3-5.2 (5) ; *c-m³* 3.9-4.4 (4) ; *c-m₃* 4-5 (4.2) ; *ml.* 7.2-8 (7.6). 27 ♀ ♀ : *l.* 10.8-11.8 (11.3) ; *zw.* 7-8 (7.4) ; *cw.* 6-7 (6.3) ; *ch.* 5.1-6.3 (5.6) ; *m³-m³* 4.9-5.4 (5.1) ; *c-m³* 3.8-4.4 (4) ; *c-m₃* 4-4.4 (4.2) ; *ml.* 7.5-8.3 (7.8).

Weight : Average *Wt.* of individuals excluding pregnant females before feeding : 4-5 (4.3). No seasonal variation has been observed.

Remarks : Measurements show that females are on average larger than the males.

Distribution in Bihar (-Fig. 5) : Most common bat in Bihar recorded from Begusarai, Bhojpur, Dhrbhanga, E. Champaran, Gaya, Giridih, Hazaribag, Madhubani Muzaffarpur, Patna, Rohtas, Saharsa, Santal Paragana, Singhbhum, Sitamarhi and W Champaran Districts.

Field ecology : Like *P. coromandra*, this bat was also collected from holes, crevices and from very narrow spaces in houses and trees. In

Muzaffarpur court building it was also collected from the back of a notice board. This species is the first which starts flying just after sunset and end its flight just before sunrise.

This was not found in association with other bats in Bihar. The colony size was found solitary to 25 individuals. Pregnant females obtained in April and May had generally two foetuses (size : *HB* 8-16.4 ; *f.* 4-9) and one in rare cases. Suckling young (slightly smaller than

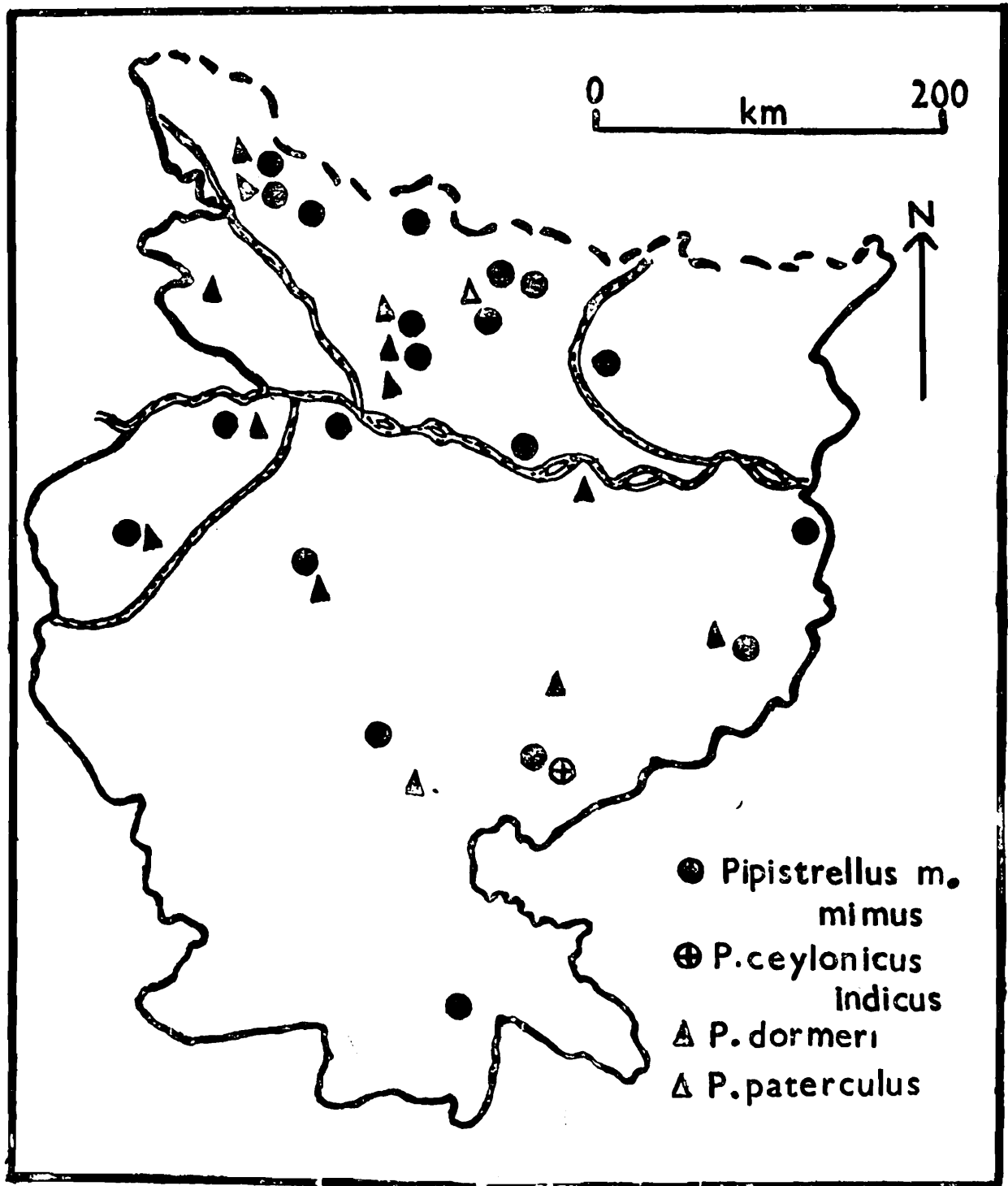


Fig 5. Distribution of bats in Bihar

mother ; *f.* 26-26.8) sometime attached to the nipples and sometimes in holes, etc, free from mother (coagulated milk was found in the gut)

were also obtained in April and May. Females obtained in October were non-pregnant.

From above observations it appears that possibly it has extensive breeding seasons from January-February-July-August as mentioned by Gopalkrishna *et al.* (1977).

20. *Pipistrellus ceylonicus* Kelaart (Kelaart's Pipistrelle)

Scotophilus ceylonicus Kelaart, *Prodr. Faun. Zeylan.*, 22. Type-loc. : Trincomalee, Sri Lanka.

Diagnosis : This is the largest Pipistrelle bat in Bihar and can easily be separated from other's by larger size of body, skull and wing spread. Although measurements of some individuals come in the range of *P. dormeri*, it can be easily differentiated from the latter by its upper outer incisor (Text-fig. 11) which is longer and slightly below the inner one. In *P. dormeri*, outer upper incisor is generally absent in adult and if present it is very minute. Dental formula same as in other species.

Distribution of species : Sri Lanka ; widely distributed in western and central India (Brosset, 1962b) including Maharashtra, Karnataka, Gujarat, Madhya Pradesh (Khajuria, 1980), Bihar and W. Bengal ; Pakistan ; Burma ; Vietnam (old Indo-China) ; Kalimantan (= Borneo ; Hill, 1963).

Systematic note : Ellerman and Morrison-Scott (1951) recognised provisionally six subspecies of *P. ceylonicus* from Palaearctic and Indian regions *vis.* (1) *P. c. ceylonicus* Kelaart, from Sri Lanka ; (2) *P. c. indicus* Dobson from Southern Peninsular India ; (3) *P. (?) c. raptor* Thomas from Tonkin, Vietnam ; (4) *P. (?) c. shanorum* Thomas from Burma ; (5) *P. c. chrysothrix* Wroughton ; and (6) *P. c. subcanus* Thomas from Pakistan and Gujarat (India).

Siddiqi (1961) synonymised *P. chrysothrix* (= *P. c. chrysothrix* Wroughton with *P. c. indicus* Dobson. I could not find major differences in external and cranial measurements of *P. c. subcanus* Thomas (f. 34-37 ; l. 14.5-14.9), *P. c. chrysothrix* Wroughton (f. 34.5-38.8 ; l. 14.2-14.9) and *P. c. indicus* Dobson (f. 35.5-39.1 ; l. 14.8-15.3) present in Zoological Survey of India, Calcutta, but without detailed study conclusion cannot be drawn.

Hill (1963) described a new subspecies of *P. ceylonicus* from North Borneo as *P. c. borneanus* Hill.

Khajuria (1980) also agreed with Siddiqi (1961) regarding the inclusion of *P. chrysothrix* Wroughton (= *P. c. chrysothrix*) in *P. c.*

indicus Dobson. I identified specimens from Bihar as *P. c. indicus* Dobson.

Pipistrellus ceylonicus indicus Dobson

(Plate 6 c)

Vesperugo indicus Dobson, 1878, *Cat. Chiroptera Br. Mus.*, p. 22. Type-loc.: Mangalore, Malabar coast, India.

Pipistrellus ceylonicus indicus Dobson, Khajuria, 1980, p. 25.; Siddiqi, 1961 (syn. *Pipistrellus chrysothrix* Wroughton).

Material examined : Chota Nagpur : 1 ♂, 1 ♀ (exact locality not known, presented by W. T. Blanford in 1876; ZSI, Cal.); Dhanbad Dist. : Dhanbad (19 Aug. 1982), 7 ♀ ♀.

Measurements : External : 1 ♂ : *f.* 34.5; *t.* 13; *ft.* 7.3. 18 ♀ ♀ : *HB.* (7 exs.), 49-54 (51.7); *TL.* (7 exs.), 34-40 (37.6); *f.* 35.4-38.3 (37.3); *t.* 13.5-15 (14.3); *ft.* 8.9-2 (8.7) *ws.* (7 ex.) 260-270 (264).

Skull : 1— : *l.* 14.2; *zw.* 9.4; *cw.* 7.15; *ch.* 6.5; *m*³-*m*³ 6.6; *c-m*³ 5.2; *c-m*₃ 5.6; *ml.* 10.5-4 ♀ ♀ : *l.* 14.4-15.1 (14.7); *zw.* 10 (in all); *ew.* 7.1-7.9 (7.6); *ch.* 6.2-6.7 (6.5); *m*³-*m*³ 6.6-7 (6.8); *c-m*³ 5.6-5.7 (6.67); *c-m*₃ 6.6-1 (6.05); *ml.* 10.6-11.2 (10.9).

Diagnosis : Same as in species.

Distribution in Bihar (Fig. 5) : Dhanbad and Singhbhum districts. **Elsewhere** : All the Indian localities as mentioned above except western portion of Gujarat including Bhuj (Kutch), Kathiawar and Palanpur.

Field ecology : This bat was collected by me in Dhanbad from long narrow gap in the wall of road bridge. It was detected early in the morning while entering in this gap after completing night activity.

All the seven females collected on 19th August, 1982 had two embryos (size : *l.* 13-18; *f.* 6-9) one in each cornu of the uterus except two which had only one embryo in Rt. cornu. Mid stage of pregnancy in August in Bihar very much tally with the observation of Madhavan (1971) and Gopalkrishna *et. al.* (1971) in Maharashtra.

21. Pipistrellus dormeri (Dobson)

(Dormer's Bat)

(Plate 6 a, b, c, d)

Scotozous dormeri Dobson, 1875, *Proc. zool. Soc. London*, 1875, p. 373. Type-loc.: Bellari Hills, India.

Pipistrellus dormeri dormeri Dobs., Ellerman and Morrison-Scott, 1951, p. 102; Agrawal, 1972, p. 266. Syn. : *Scotozous dormeri caurinus* Thomas).

Material examined : Bhojpur Dist. : Arrah (24 and 25 Oct. 1978), 1 ♂, 4 ♀ ♀; Gaya Dist. : Bodh Gaya (21 and 22 Jul. 1978), Singar (20 May 1914; C. A. Crump; ZSI, Cal.), 3 ♂ ♂, 4 ♀ ♀; Giridih Dist. :

Tisri, c. 32 km. N. of Jamua (13 Jul. 1979), 1 ♂, 2 ♀ ♀ ; *Hazaribag Dist.* : Chattarmandu, c. 6 km. E. of Ramgarh (22 Jul. 1979), 1 ♂ ; *Muzaffarpur Dist.* : Sahu Pokhar and Sastri Nagar in Muzaffarpur (13 Oct. 1980), 4 ♂ ♂, 6 ♀ ♀ ; *Patna Dist.* : Barh (near Gulab Bag, 25 Jan. 1985), 1 ♀ ; *Rohtas Dist.* : Sasaram (near Sersah Suri Tomb, 18 Feb. 1982), 1 ♂ ; *Samastipur Dist.* : Kubouli and Khairi villages near Pusa Rd. Stn. (10 and 11 Oct. 1980), 6 ♂ ♂, 6 ♀ ♀ ; *Santal Parganas Dist.* : Borio (7 Apr. 1979); 8 ♂ ♂, 7 ♀ ♀ ; *Singhbhum Dist.* : Kaira near Chaibasa (10 Aug. 1914; C. A. Crump, ZSI, Cal.) 1 ♂ ; *Siwan Dist.* : Dakshin Tola, Siwan (26 Oct. 1981), 1 ♂, 2 ♀ ♀ ; *Vaishali Dist.* : Brahabatta (10 Mar. 1969), Mokarri-Mirxanagar (8 Oct. 1977 and 15 Jnn. 1979) and Harpur Osti (8 Sep. 1982) near Mahuwa, 5 ♂ ♂, 9 ♀ ♀ ; *W Champaran Dist.* : Barba and Jamunia villages near Narkatiaganj Rly. Station and District Board Dak Bunglow compound Narkatiaganj (18 and 19 Oct. 1981) and Nurse's Hostel compound Betia (20 Oct. 1981), 11 ♂ ♀, 1 ♀.

Measurements : External : 38 ♂ ♂ : *f.* 32-38 (34.1) ; *t.* 11.3-13.5 (12.6) ; *ft.* 7-9 (7.8) ; *ws.* 230-250 (740), 35 ♀ ♀ : *f.* 33-38 (35.1) ; *t.* 12-14 (12.9) ; *ft.* 7.2-9 (8.2) ; *ws.* 230-250 (240).

Skull : 20 ♂ ♂ : *l.* 13-14.4 (13.8) ; *zw.* 9.2-11 (10) ; *cw.* 7.3-8.1 (7.5) ; *ch.* 6-7 (6.4) ; *m^s-m^s* 6.3-7.1 (6.8) ; *c-m^s* 5.2-6 (5.8) ; *c-m₃* 5.6-6.5 (6.1) ; *ml.* 10-11.4 (10.6), 22 ♀ ♀ : *l.* 13-14.2 (13.6) ; *zw.* 9.2-10.5 (9.9) ; *cw.* 7.1-8 (7.5) ; *ch.* 6-6.8 (6.4) ; *m^s-m^s* 6.4-7.2 (6.8) ; *c-m^s* 5.5-6 (5.8) ; *c-m₃* 5.9-6.3 (6.1) ; *ml.* 10.1-11.2 (10.6).

Weight : Average weight of individuals excluding pregnant females before feeding : 5-8 (6).

Remarks : Its external and skull measurements are very close to *P. ceylonicus*. It differs from the latter in dental characters : Outer upper incisors generally absent but if present it is very minute.

Colour of fur vary individually from rufous yellow to dark brown above and pale to white below.

Distribution in Bihar (Fig. 5) : It is very common in Bihar both sides of Ganga river and recorded from Bhojpur, Gaya, Giridih, Hazaribag, Muzaffarpur, Rohtas, Samastipur, Santal Pargana, Singhbhum, Siwan, Vaishali and West Champaran districts.

Field ecology : Roosting habit of this species in Bihar is very similar to that in Rajasthan and Gujarai as mentioned by Sinha (1981a, 1981b). It is not found in association with *P. mimus* and *P. coromandra* but near by of them. Size of colony : Solitary to 25 ex. It starts flying in the evening within 5 to 10 minutes after sunset. Emergence period varies according to season and conditions of the sky.

Females which had first pregnancy were found without teats

otherwise mature pregnant and nursing mothers had well developed mammae, non-pregnant female had reduced teats.

Pregnant females with one or two foetuses were found in April (size 6-10) and July (size : 10-17) and subadults in October. In Rajastan, Sinha (1981) found pregnant females in July and September. Madhavan (1978) gave details about its breeding biology for Maharashtra population who mentioned that it breeds throughout the year.

22. *Pipistrellus paterculus* Thomas (Burmese Pipistrelle)

Pipistrellus paterculus Thomas, 1915. *J. Bombay nat. Hist. Soc.*, 24 : 32. Type-loc. : Mt. Popa, Upper Burma.

Material examined : Bihar : *Darbhanga Dist.* : Buhnar (15 Aug. 1922, N. A. Baptista, ZSI; Cal.) 1 ♂, 1 ♀ *Other than Bihar* : BURMA : Upper Chindwin (ZSI, Cal.), 1 ♂, 2 ♀ ♀

Measurements : External : 1 ♂ : *HB.* 39 ; *Tl.* 29 ; *E.* 11 ; *f.* 26.6 ; *t.* 9.7 ; *ft.* 6. 2 3 ♀ ♀ : *HB.* 41-45 (43) ; *Tl.* 31-34.5 (32.5) ; *E.* 11-11.5 (11.2) ; *f.* 28.7-30.4 (29.8) ; *t.* 10.4-11.4 (10.9) ; *ft.* 6.5-6.8. (6.6).

Skull : 1 ♂ : *l.* 11.4 ; *zw.* 6.9 ; *cw.* 6 ; *ch.* 5.45 ; m^3-m^3 5.15 ; $c-m^3$ 4.15 ; $c-m_3$ 4.5 ; *ml.* 8.3. 2 ♀ ♀ : *l.* 11.7, 12 ; *zw.* 7, 7.8 ; *cw.* 5.9, 5.9 ; *ch.* 5.4, 5.6 ; m^3-m^3 5, 5.1 ; $c-m^3$ 4.3, 4.4 ; $c-m_3$ 4.5 ; $m^3-ml.$ 9-.

Diagnosis : External and skull measurements resembles with *P. mimus*. It differs from the latter in presence of profile sloping uniformly from brain-case to rostrum ; broader, flatter and smooth rostrum and absence of pit at the junction of brain case and rostrum. Also see Sinha (1983).

Distribution in Bihar (Fig. 5) : Only recorded from Darbhanga district of Bihar in India. *Elsewhere* : Burma and Pakistan (Walton, 1974).

Genus (12) *Scotoecus* Thomas

23. *Scotoecus pallidus* (Dobson) (Yellow Desert Bat) (Plate 7 b)

Scotophilus pallidus Dobson, 1876, *Monogr. Asiat. Chiroptera, Appendix D*, p. 136. Type-loc. : Mina Mir, near Lahore, Punjab, North-Western India.

Material examined : *Bhagalpur Dist.* : Sultanganj (10 Apr. 1979), 1 ♂, 2 ♀ ♀ : *Darbhanga Dist.* : Baghownie (26 Jul. and 30 Aug. 1922, N. A. Baptista, ZSI, Cal.), 1 ♂, 1 ♀ ; *Muzaffarpur Dist.* : Bikanpur in

Mushari Block (28 Jul. 1981 and 4 Dec. 1981, donated by P. Rajendran), 3 ♂♂, 2 ♀♀ ; *Santal Pargana Dist.* : Tinpahar (no date, ZSI, Cal.) 1 ♀

Measurements : External : 5 ♂♂ : *f.* 37-38.5 (37.9) ; *t.* 13.8-14.5 (14.1) ; *ft.* 8-9.1 (8-9.1 (8.6)). 6 ♀♀ ; *f.* 35.6-38.5 (37) ; *t.* 12.2-14.5 (13.1) ; *ft.* 8.2-10 (9.3).

Skull : 2 ♂♂ : *l.* 14.7, 15.1 ; *zw.*-, 11.5 ; *cw.* 8.8 ; *ch.* 6.2, 7 ; *m³-m³* 7, 7.1 ; *c-m³* 5.8, 6 ; *c-m₃* 6.1, 6.1 ; *ml.* 11.2, 11.2. 4 ♀♀ ; *l.* 14.5-15.1 (14.9) ; *zw.* 10.5-11.2 (10.9) ; *cw.* 7.6-8 (7.9) ; *ch.* 6.2-7 (6.5) ; *m³-m³* 6.9-7.3 (7.) ; *c-m³* 5.3-6 (5.8) ; *c-m₃* 6-6.6 (6.2) ; *ml.* 11-11.3 (11.2).

Diagnosis : External features resemble with *P. dormeri*. It differs from the genus *Pipistrellus* in some skull characters and dentition. Skull (Fig. 12) is larger and its occipital crest more prominent. Inner upper incisors and first upper premolars are absent *as against* present in *Pipistrellus*.

Dental formula : $i\ 1/3; c\ 1/1, pm\ 1/2, m\ 3/3 = 30$.

Remarks : Recently Hill (1974) has allocated the Indian *pallidus* to *Scotoecus*. I have not examined other species of *Scotoecus* but follow Hill.

Distribution in Bihar (Fig. 6) ; Darbhanga (Sinha and Chakraborty, 1971), Muzaffarpur, Santal Pargana (Sinha and Chakraborty, 1971), and Bhagalpur districts. *Elsewhere* : PAKISTAN ; Punjab and Uttar Pradesh in INDIA.

Field ecology : It is not as common as *Pipistrelle* in Bihar. But its habitats are quite similar. It is collected from holes and crevices in the building.

Females collected in July and December were non-pregnant and in April (10 Apr. 1974) had two foetuses (size : *HB* 13-17 ; *f.* 6-12) one in each cornu of the uterus. This is the sole information on its breeding biology in India.

Genus (13) *Hesperoptenus* Peters

24. *Hesperoptenus tickelli* (Blyth)

(Tickell's Bat)

Nycticejus tickelli Blyth, 1851, *J. Asiat. Soc. Beng.*, Calcutta, 20 : 157. Type-loc. : Chaibasa, Bihar, India.

Material examined : Singhbhum Dist. : Kaira near Chaibasa (8 Aug. 1914, ZSI, Cal.), 1 ♂ and 3 (unsexed-Syntypes).

Measurements : External : 1 ♂ : *HB.* 70 ; *TL.* 53 ; *E.* 16 ; *f.* 52.6 ; *ft.* 10. 3 (unsexed) ; *f.* 51-55 (54) ; *t.* 20.5-21.7 (21).

Skull : 1 ♂ (partly broken) : *l.* 18.9 ; *zw.* 14.8 ; *cw.* 11.5 ; *ml.* 15.9.

Distribution in Bihar (Fig. 6) : Recorded only from Singhbhum district. I could not collect this bat even after vigorous attempt.

Field ecology : I am unknown about its field ecology. Walker *et. al.* (1968) mentioned that *Hesperoptenus* roosts singly or in small group often in the foliage of tree and begin to fly early in the evening soon after the pipistrelles. Youngs are born in June.

Genus (14) *Scotophilus* Leach

25. *Scotophilus kuhlii* Leach (Lesser Yellow Bat)

Scotophilus kuhlii Leach, 1821, *Trans. Linn. Soc. Lond.*, 13 : 69, 71. Type-loc. : India.

Vespertilio temmincki Horsfield, 1838, *Zool. Res. Java* Type-loc. : Western Java.

Scotophilus kuhlii kuhlii Leach

(Plate 7 a)

Scotophilus kuhlii Leach 1821, as above.

Scotophilus wroughtoni Thomas, 1897, *J. Bombay nat. Hist. Soc.*, 11 : 275. Type-loc. : Kim, Surat District, Gujarat.

Material examined : *Bhojpur Dist.* : Bin Toli, Arrah (22 Sep. 1984), 5 ♂ ♂, 6 ♀ ♀ ; *Hazaribag Dist.* : Haranganj Mahalla in Hazaribag (24 Jul. 1979) and Lohra (28 and 29 Dec. 1914, ZSI, Cal.), 5 ♂ ♂, 9 ♀ ♀ ; *Katihar Dist.* : Mania Ghat village, c. 5 km. S. of Katihar (17 May 1981), 4 ♀ ♀ ; *Munger Dist.* : Kalayanpur, Jamui (20 Jun. 1980), 4 ♂ ♂ ; *Muzaffarpur Dist.* : Mithanpura, c. 12 km. S. E. of Muzaffarpur (14 Oct. 1980), 2 ♂ ♂, 7 ♀ ♀ ; *Palamau Dist.* : Daltonganj (20 Mar. 1914, ZSI, Cal.), 1 ♀ ; *Patna Dist.* : Dihara (13 Nov. 1966, Y Paswan), 1 ♀ ; *Purnea Dist.* : Paschim Palli near Kishangang Rly. Stn. (20 Jan. 1982), 1 ♂ ; *Samastipur Dist.* : Milky, c. 4 km. S. W. of Pusa Road Rly. Station (11 Oct. 1980), 4 ♂ ♂, 11 ♀ ♀ ; *Santal Pargana Dist.* : Borio (7 and 8 Apr. 1979), 1 ♂, 2 ♀ ♀ ; *Singhbhum Dist.* : Garikhana Mahalla in Chaibasa (18 Jul. 1979), 4 ♂ ♂ ; *Vaishali Dist.* : Harpur Osti.. c. 4 km. S. of Mahuwa (14 Oct. 1980), 1 ♂.

Measurements : External : 23 ♂ ♂ : *HB.* 61-70 (65) ; *Tl.* 43-51 (47) ; *f.* 47-52 (48.7), *t.* 16.5-21 (19.2) ; *ft.* 8.5-12 (10.4) ; *ws.* 270-340 (310). 34 ♀ ♀ : *HB.* 58-72 (66) ; *Tl.* 47-54 (50.5) ; *f.* 49.5-53.3 (50.3) ; *t.* 18.7-22 (20.2) ; *ft.* 9-12 (10.5) ; *ws.* 300-350 (330).

Skull : 9 ♂ ♂ : *I.* 18-19.1 (18.5) *zw.* 13.1-13.9 (13.3) ; *cw.* 9-10 (9.6) ; *ch.* 9-10 (9.2) ; *m*³-*m*³ 8.2-9 (8.7) ; *c-m*³ 6.7-7.1 (6.9) ; *c-m*₃

7.3-8.0 (7.7); *ml.* 12.9-13.5 (13.2); 11 ♀ ♀ : *l.* 18-19.5 (18.5); *zw.* 13-13.8 (13.2); *cw.* 9-10.2 (9.5); *ch.* 8.6-9 (8.9); *m³-m³* 8.1-9.2 (8.7); *c-m³* 6.7-7 (6.8); *c-m₃* 7.5-7.8 (7.7); *ml.* 13-14.6 (13.4).

Weight : Average *Wt.* of individuals excluding pregnant females before feeding : 24-25 (24.7).

Remarks : Females are average larger than males. Colour varies from grey brown to dark brown above and dirty white to chestnut

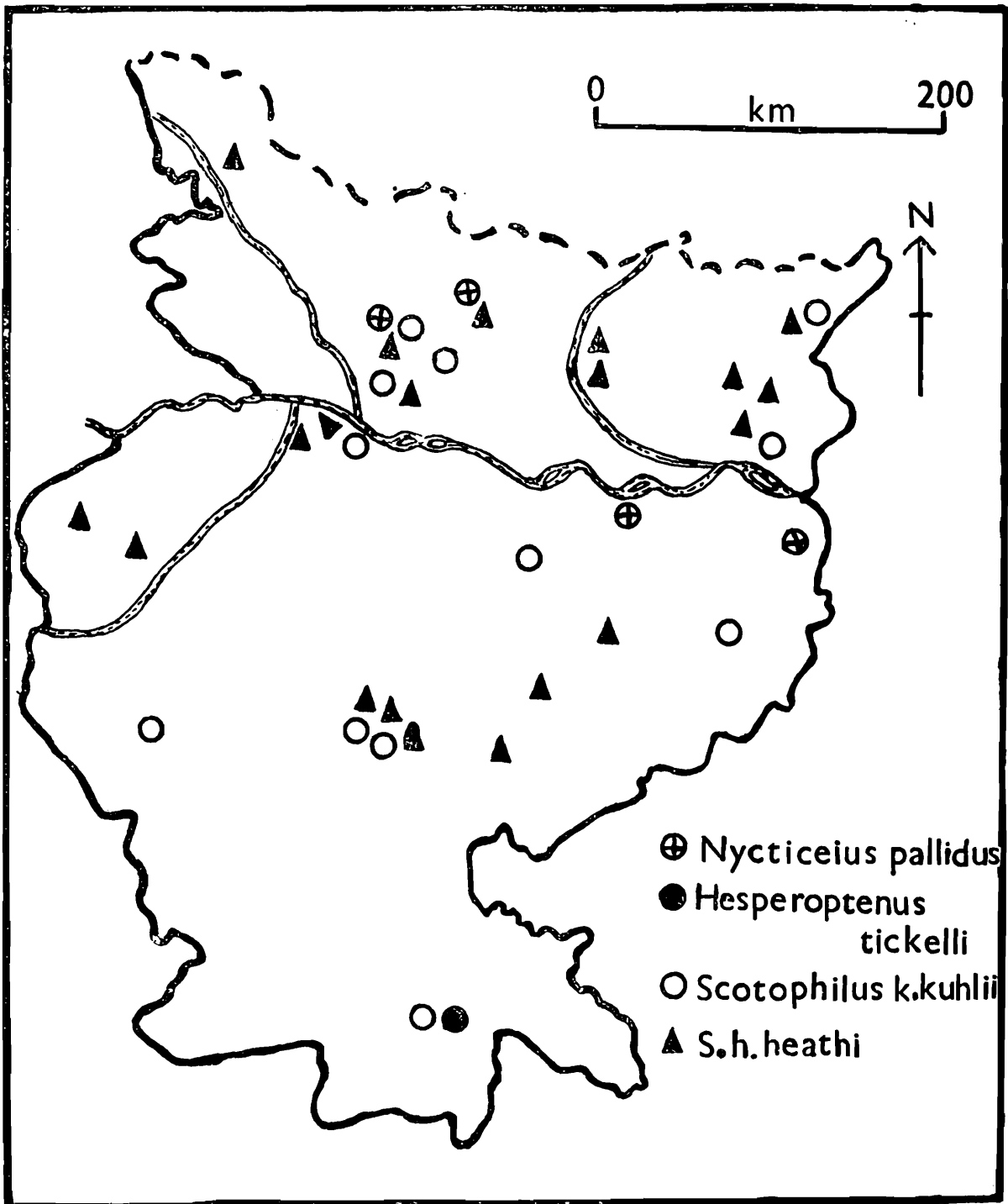


Fig 6. Distribution of bats in Bihar

brown below. Specimens collected from south of the Ganga river have

bright white undersurface in comparison with the specimens from north of the river.

Distribution in Bihar (Fig. 6): Both side of the Ganga river recorded from Bhojpur, Gaya, Hazaribag, Katihar, Munger, Muzaffarpur, Palamau, Patna, Purnea, Samastipur, Santal Pargana, Singhbhum and Vaishali districts.

Field ecology: Most of the specimens were collected from hanging and folded dry leaves of Plam trees. In Harpur Osti (Vaishali Dist.) it was collected from a crevices in a house and in Kishanganj from a small hollow in the trunk of a peepal tree. Similar type of habitat has been mentioned by Wroughton (1912), Gopalakrishna (1947) and Brosset (1962 b) in Western India. Size of colony: solitary to 30 exs.

Pregnant females were found in April (7-8 Apr. 1979, early pregnancy) and May (17 May 1981, advanced stage, size of foetus: *HB.*: 23-31; *f.* 10-19) and mothers with two suckling youngs (size: *HB.* 46-54; *f.* 38-48) in July (24 Jul. 1979). Females collected in October were nonpregnant. My observation is very much tally with Gopalakrishna (1947) who has mentioned pregnancy season for Bangalore population from March to July and gestation period from 105 to 115 days.

26. *Scotophilus heathi* (Horsfield) (Greater yellow Bat)

Nycticejus heathi Horsfield, *Proc. Zool. Soc. Lond.* 1831, p. 113. Type-loc.: Madras, India.

Scotophilus heathi heathi (Horsfield) (Plate 7 c, d)

Nycticejus heathi Horsfield, 1831, as above.

Scotophilus heathi heathi (Horsf.), Siddiqi, 1961, p. 450. (Syn.: *Vespertilio belangeri* Geoffroy); *S. kuhlii*, Wroughton (1955) identified *H. heathi* as *H. kuhlii* from Bihar.

Material examined: *Darbhanga Dist.*: Baghownie (26 Jul. 1922, N. A. Baptista, ZSI, Cal.) and Mithla University campus, Kameshwar Nagar, Darbhanga (27 May 1981), 1 ♂, 1 ♀; *Giridih Dist.*: Tisri, c. 32 km. N. of Jamua (13 Jul. 1979) and Nimiaghat (6 Jun. 1914, C. A. Crump, ZSI, Cal.) 2 ♂♂, 4 ♀♀; *Hazaribag Dist.*: Near Hazaribag Lake (28 Feb. 1970, R. K. Varshney). Padma (23 Jul. 1979) and Ichak (24 Jul. 1979), 2 ♂♂, 1 ♀; *Katihar Dist.*: Raj Bhawan Hata, Katihar (16 May 1981), 2 ♂♂; *Muzaffarpur Dist.*: Sanskrit college, Muzaffarpur (13 Oct. 1980) and Bhikanpur in Musahari block (4 Dec. 1981, P. Rajendran), 1 ♂, 1 ♀; *Patna Dist.*: Jaihind Gali, Patna city (17 Jul.

1980, R. B. Sharma), Barh (25 Jan. 1985) and Maner (13 Apr. 1978), Fatwa (27 May 1983); 2 ♂♂, 3 ♀♀; *Purnea Dist.* : Purnea old city 18 May 1981), Kasawa, 14 km. S. E. of Purnea town (19 May 1981), Kishanganj Gulari Bazar (19 Jan. 1982) and Dharamganj near Kishanganj (20 Jan. 1982), 15 ♂♂, 5 ♀♀; *Rohtas Dist.* : Sasaram (from Sersah Suri Tomb, 26 Oct. 1978) and Mohania (20 Feb. 1982), 1 ♂, 1 ♀; *Saharsa Dist.* : Saharsa church (23 May 1981) and Bangaon (no date, C. A. Pavia, ZSI, Cal.), 9 ♂♂; *Santal Pargana Dist.* : Kiajori near Punasi Dam Site, c. 35 km. W of Deoghar (17 Jun. 1980), 1 ♂, 2 ♀♀; *Vaishali Dist.* : Harpur Osti, c. 12 km. S. E. of Bhagwanpur Rly. Station (8 Sep. 1982), 1 ♂; *W;* *Champaran Dist.* : Narkatiaganj (19 Oct. 1981), 2 ♂♂, 2 ♀♀

Measurements : External : 34 ♂♂; *HB.* 68-76 (73); *TL.* 55-64 (62); *f.* 56-63.5 (60.6); *t.* 24-27 (25.5); *ft.* 11-15 (13); *ws.* 370-420 (400). 19 ♀♀; *HB.* 72-90 (80); *TL.* 64-66 (64.5); *ft.* 57-65 (62); *t.* 21.4-26.5 (24.7); *ft.* 11-15 (13.3); *ws.* 380-430 (410).

Skull : 9 ♂♂ : *l.* 21-23.1 (22.4); *zw.* 15.3-16.5 (16); *cw.* 10.2-12.1 (11); *ch.* 9.1-11 (10.8); *m³-m³* 9.8-11 (10.5); *c-m³* 7.4-8.4 (8.1); *c-m₃* 8.5-9.6 (9.2); *ml.* 15.1-16.8 (16.2). 8 ♀♀ : *l.* 21.5-22.6 (22); *zw.* 15.7-16.8 (16.2); *cw.* 11-13.2 (11.8); *ch.* 9.3-11.5 (10.6); *m³-m³* 10-11 (10.5), *c-m³* 7.3-8.2 (7.9); *c-m₃* 8.5-9.2 (8.7); *ml.* 15.6-17 (16.2).

Weight : Average *Wt.* of individuals excluding Pregnant females before feeding 34-36.5 (35).

Remarks : External measurements show that females are on average larger than the males.

Distribution in Bihar (Fig. 6) : Recorded from Darbhanga, Giridih, Hazaribag, Katihar, Muzaffarpnr, Patna, Purnea, Rohtas, Saharsa, Santal Pargana, Singhbhum, Vaishali and Champaran districts.

Field ecology : This bat was found in hollow, crevice, crack, narrow space in old building, tomb and fort and in hollows of banyan and peepal trees. In some places *viz.* Tisari, Kishanganj, Maner and Narkatiaganj, this bat was collected in the mist-net during different hours in night. Size of colony : Solitary to 50 ex. This bat starts flying in evening 8-10 minutes after sun-set as observed in Purnea on 18 and 19 May, 1981 (Time of sunset : 6.29 and 6.30 P.M. ; time of emergence : 6.37 and 6.40 P.M. respectively).

Only in Padma (Hazaribag Dist.) it was collected from the colony of *Rousettus leschenaulti*.

I could not find opportunity to collect pregnant females. Females with one or two suckling young (size : *HB.* 41-57 ; *f.* 20-48) of various sizes were collected in May and June. Females collected in July and

October were neither pregnant nor mother. Madhavan (1980) mentioned for Trichur (Kerala) population that birth of a young takes place in following April and May.

Gut contents had parts of legs and wings of various insects in which those of beetles and hymenopteran insects were recognised.

GENERAL DISCUSSIONS AND CONCLUSIONS

Of the 27 species and subspecies till now recorded from Bihar, four belong to the family Pteropodidae, two to Rhinopomatidae, four to Emballonuridae, one to Megadermatidae, four to Rhinolophidae, one to Molossidae (collection made from "Jashpur" which was previously in Bihar but now in Raigarh district of Madhya Pradesh) and eleven to Vespertilionidae.

It is quite apparent from the foregoing account that the distribution of bats in different parts of Bihar, like any other part of India, depends upon the availability of suitable shelters and on the climatic condition of the area. All bats of the family Pteropodidae except *Rousettus leschenaulti* are found on both sides of the Ganga river. They are generally dwellers of big trees which are abundant on both sides of the river and depend mainly on big fruits with soft pulp and fly long distances in search of them. *Rousettus leschenaulti* as reported by Sinha (1981 b) in Rajasthan, is a hill-dwelling bat, found in caves and deserted houses among groves. In Bihar, it has been found in a deserted house in forested area of Hazaribag and Deb (Aurangabad dist.) and occasionally in a deserted temple in Patna City on the southern bank of the Ganga river. It was never found on trees and was absent in Plains north of that river.

Of the two species of the family Rhinopomatidae *Rhinopoma h. hardwickei* is found in abundance south of the Ganga river, mostly in hilly areas but is absent in the plains north of the river; the other *Rhinopoma microphyllum kinneari* also has been reported by Wroughton (1915) from the hilly areas of southern Bihar, but I have not been able to find it.

Of the four species of the family Emballonuridae, only *Taphozous I. longimanus* is found on both sides of the Ganga river and was collected mostly from hollows of either banyan or peepal trees or from the crowns of the palm trees. In Bihar, it is mostly a tree-dweller. *Taphozous m. melanopogon* and *T. K. kachhensis* are found only south of the Ganga river in deserted houses and temples. *Taphozous k. kachhensis* has

been observed only in Gaya and Rohtas districts, which are the hottest parts of Bihar. *Taphozous saccolaimus crassus* has been reported by Wroughton (1915) from Koira, Singbhum district of old Bihar and Orissa has not be found by me in present Bihar.

Megaderma lyra lyra of the family Megadermatidae is widely distributed on both sides of the Ganga river in semidark or dark godowns, abandoned rooms, caves, etc. It is a fast flier even in day time and hides quickly under the bed, behind trunks etc., and even in other room, when disturbed. The climate does not appear to effect its distribution.

Of the four species of the family Rhinolophidae recorded from Bihar *Rhinolophus mitratus* appears to be rare. There is no subsequent report of its occurrence in Bihar since it was described on the basis of only one specimen by Blyth in 1844. The holotype material in ZSI, Calcutta collection is in damaged condition. I did not find any specimen of this species. *Rhinolophus I. lepidus* and *Hipposideros fulvus pallidus* are found only in hilly areas of southern Bihar, in Munger, Giridih and Hazaribag districts. I did not find them north of the Ganga. However, one specimen of *H. f. pallidus* collected by N. A. Baptista in 1922 from old Darbhanga Dist. (north of the Ganga river) present in ZSI, Calcutta, was studied by me. *Hipposideros galeritus brachyotus* has also been reported by Wroughton (1915) from the hilly area of southern Bihar but not found by me.

Tadarida aegyptiaca thomasi of the family Molossidae was recorded from Jashpur, under "Chutia Nagpur" (= Chota Nagpur) which, at present is under Madhya Pradesh. This is most likely to occur in Bihar but it has not been found by me.

Of the 11 species and subspecies of the family Vespertilionidae, *Hesperoptenus tickelli* and *Pipistrellus paterculus* are rare and I did not find them. *Pipistrellus m. mimus*, *P. c. coromandra* and *P. dormeri* are very common on both sides of the Ganga river. *Scotoecus pallidus*, *Scotophilus k. kuhlii* and *Scotophilus h. heathi* are not so common, but are found on both sides of the Ganga river. *Pipistrellus ceylonicus indicus* is found only in hilly areas south of the Ganga river. *Myotis f. formosus* and *M. f. andersoni* are very rare and I was not able to collect them in Bihar but however recorded them on the basis of old collection.

Unlike birds, sexual dimorphism among bats is found only in a few cases. Measurements of both sexes show that the males are on an average larger than the females among *Rousettus leschenaulti* but smaller

in *Pipistrellus mimus mimus*, *Scotophilus k. kuhlii* and *S. h. heathi*. In other bats this type of differentiation was not observed.

The males of the family Emballonuridae can be easily separated from the females on the basis of the prominent gular pouch, pectoral gland, black beard, etc., besides sex organs. The males of *Taphozous l. longimanus* and *T. k. kachhensis* have prominent gular pouch and pectoral gland and those of *T. m. melanopogon* have black beard. The females of the former two species have gular pouch in a very reduced condition and have no pectoral gland, and those of the latter have no black beard.

Sinha (1980) found the presence of frontal sac only in the males of *Hipposideros fulvus* in the Rajasthan population but in Bihar this sac has been observed in both the sexes except in subadults and young ones. It shows that this organ develops in this bat only after attaining certain age.

Weights of all specimens of both sexes of 15 species of Bihar bats were taken through out the year excluding pregnant females before feeding. These bats can be identified provisionally on the basis of weight. They are arranged below according to their mean weights in descending order :

- (1) *Pteropus g. giganteus* (775)
- (2) *Rousettus leschenaulti* (90)
- (3) *Cynopterus s. sphinx* (55)
- (4) *Cynopterus brachyotis* (50)
- (5) *Megaderma l. lyra*. (40)
- (6) *Scotophilus h. heathi*. (35)
- (7) *Taphozous m. melanopogon* (27)
- (8) *Taphozous l. longimanus* (25)
- (9) *Scotophilus k. kuhlii* (24.7)
- (10) *Rhinopoma h. hardwickei* (22.5)
- (11) *Rhinolophus l. lepidus* (10)
- (12) *Hipposideros fulvus pallidus* (6)
- (13) *Pipistrellus dormeri* (6)
- (14) *Pipistrellus c. coromandra* (4.6)
- (15) *Pipistrellus m. mimus* (4.3)

Monthly weights taken for the whole year of *Taphozous m. melanopogon* show that its maximum weight is reached either in extreme cold or in extreme hot seasons. It may be due to maximum fat deposition to save it from cold or heat.

The colour of fur has no taxonomic importance as it varies due to sex, age, season, etc. as mentioned by Brosset (1963).

Interspecific association has been observed as given here : (1) *Rousettus leschenaulti* with *Taphozous m. melanopogon* (2) *Scotophilus h. heathi* with *R. leschenaulti* (3) *Megaderma l. lyra* and *Rhinopoma h. hardwickei* with *Hipposideros fulvus pallidus* (4) *Rousettus leschenaulti* with *Megaderma l. lyra*. *Pipistrellus c. coromandra*, *P. m. mimus* and *Scotophilus h. heathi* were found in the same building but in separate colonies. The cause of these associations is unknown to me. Brosset (1962 b) mentioned that it is due to ecological convergence.

Sexual association is most common among bats. Males, females and youngs were captured from the same colony in breeding season and males, females and subadults in non-breeding season.

Emergence period of various species has been observed in the field. It is found that the emergence of bats is mostly related to the time of sunset. Among Microchiroptera generally small bats emerge earlier than the large ones.

Breeding data of different bats taken in Bihar is more or less similar as observed by others in other parts of the country. Climatic conditions appear to play very little on the breeding of bats. Breeding period starts with copulation in most bats in February-March and the birth of one or two youngs occurs in May-June. *Pteropus g. giganteus*, *Rousettus leschenaulti*, *Cynopterus s. sphinx*, *Taphozous l. longimanus*, *Pipistrellus c. coromandra*, *P. m. mimus* and *P. dormeri* appear to have extensive breeding periods. They breed at least twice in a year.

Sex-ratio : Altogether 1185 examples of 24 species and subspecies from Bihar have been studied of which 1134 examples of 18 species and subspecies were collected by me. The present data is not sufficient to draw any conclusion regarding sex ratio in case of *Cynopterus brachyotis*, *Taphozous k. kachhensis*, *Rhinolophus lepidus* and *Pipistrellus ceylonicus indicus*. In other species, there are more males than females in *Taphozous m. melanopogon*, *Hipposideros fulvus pallidus* and *Scotophilus h. heathi* but less in *Pteropus g. giganteus*, *Cynopterus s. sphinx*, *Rhinopoma h. hardwickei*, *Taphozous l. longimanus*, *Megaderma l. lyra*, *Pipistrellus c. coromandra*, *P. m. mimus* and *Scotophilus k. kuhlii*. Males and females are about equal in number in *Rousettus leschenaulti*, *Pipistrellus dormeri* and *Scotoceus pallidus*.

Similar trend of sex ratio was reported for Rajasthan population by Sinha (1978). Compared to Rajasthan, more males were found in case of *Hipposideros fulvus pallidus* and *Scotophilus h. heathi*.

SUMMARY

1. This paper deals with the taxonomic characters as exhibited by body parts and skull of 27 species and subspecies of Bihar bats belonging to the families Pteropodidae, Rhinopomatidae, Emballonuridae, Megadermatidae, Rhinolophidae, Molossidae and Vespertilionidae.

2. The taxonomic importance of characters, variation of colour of fur, dentition and measurements of external body parts and skull are discussed.

3. A synoptic key to the bats of Bihar is given.

4. Venkateswarlu (1973) listed only 13 species of bats from Bihar. Here, 14 more species and subspecies are added.

5. Three species viz. *Taphozous m. melanopogon*, *Taphozous k. kachhensis* and *Pipistrellus paterculus* have been recorded for the first time from Bihar, and the range of 16 other species and subspecies in Bihar has been considerably extended.

6. Field ecology of 18 species and subspecies has been discussed in detail and compared with the findings of previous workers on these species from other parts of India.

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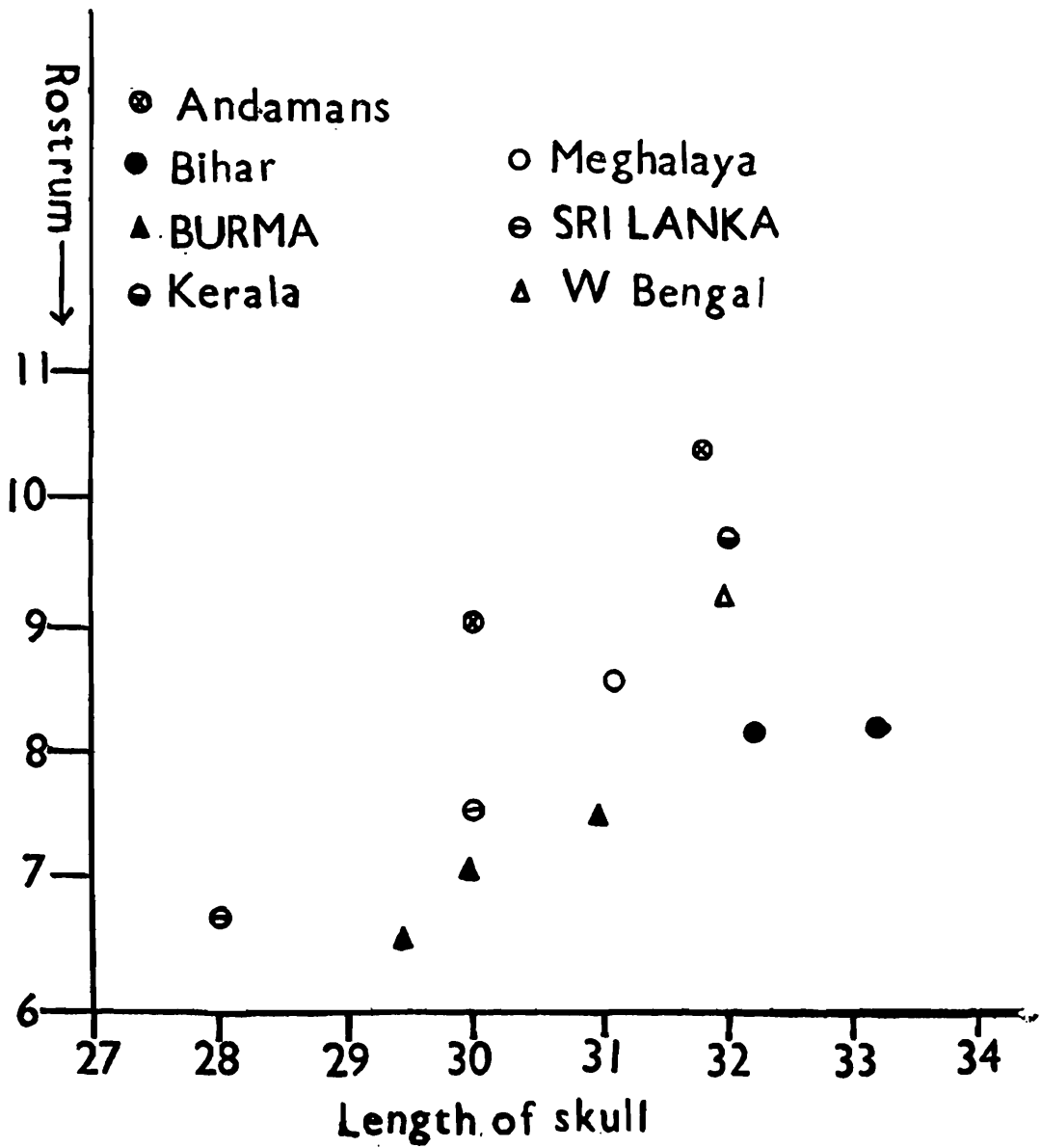


Fig. 7.—Length of skull and rostrum (front of orbit to nare) in *Cynopterus(?) brachyotis*.

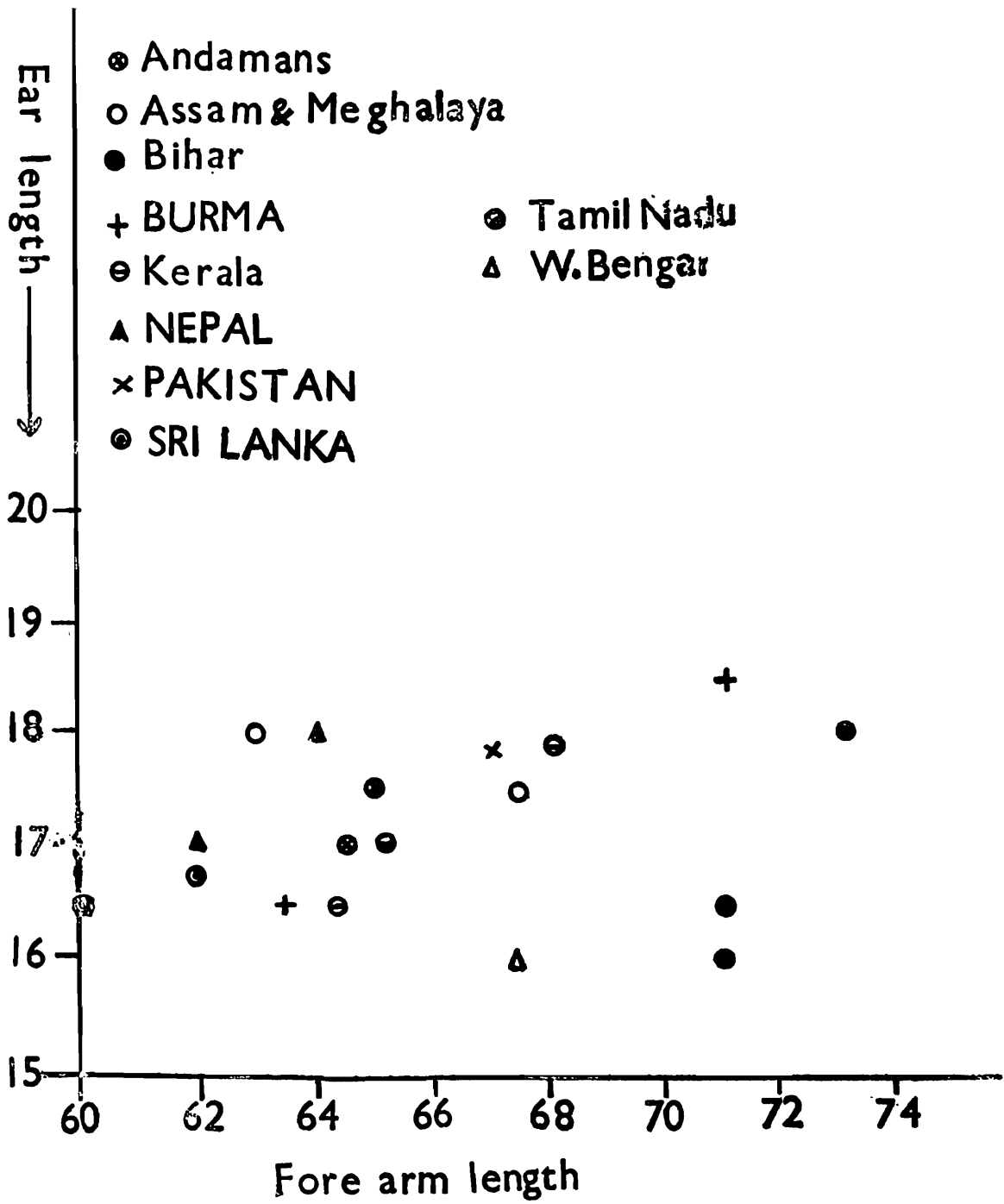


Fig. 8.—Length of forearm and ear in *Cynopterus (?) brachyotis*.

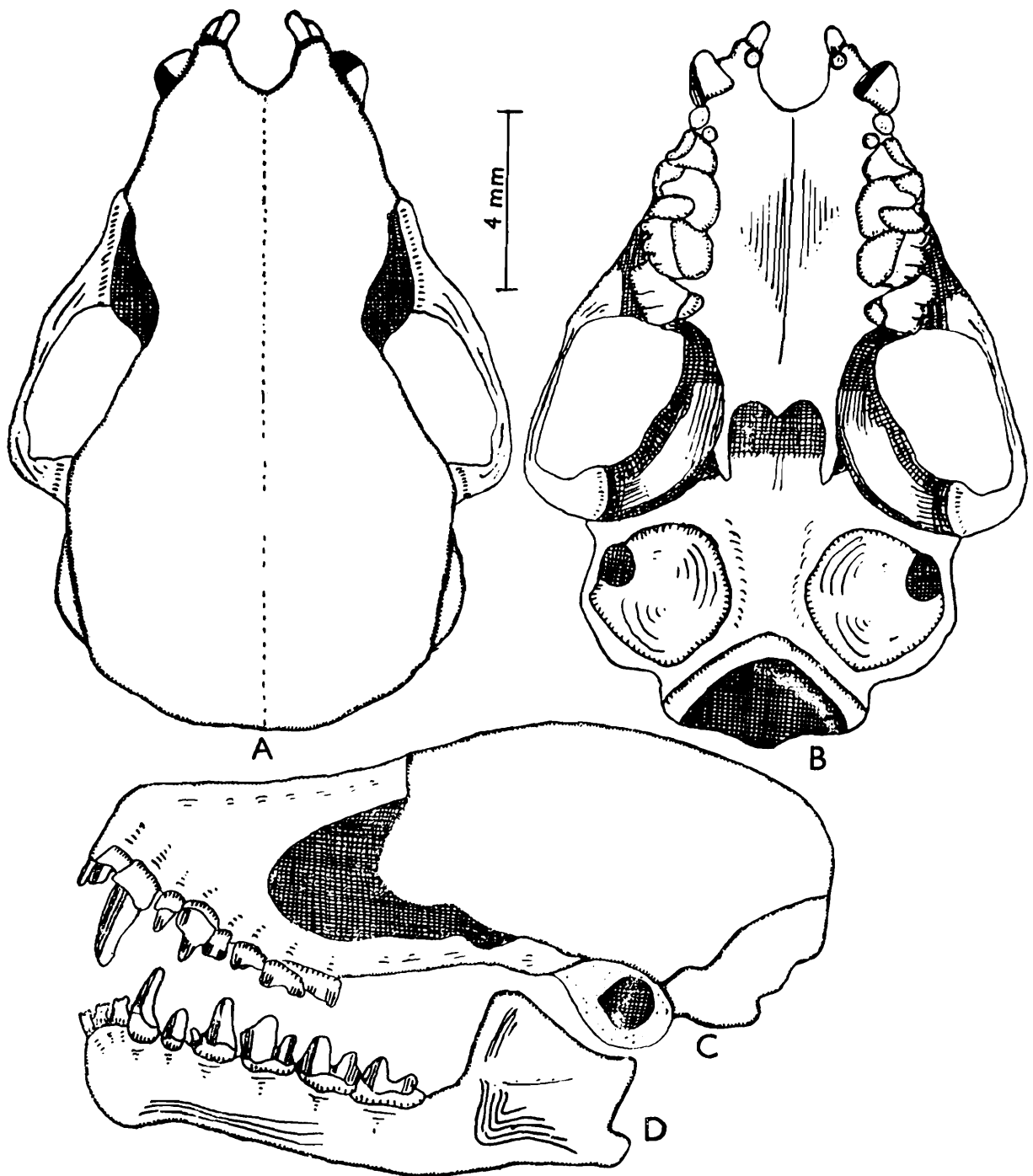


Fig. 9.—*Myotis formosus formosus* (Hodgson),— Skull : (A) Dorsal view. (B) Ventral view, (C) Lateral view. (D) Lower jaw, in lateral view.

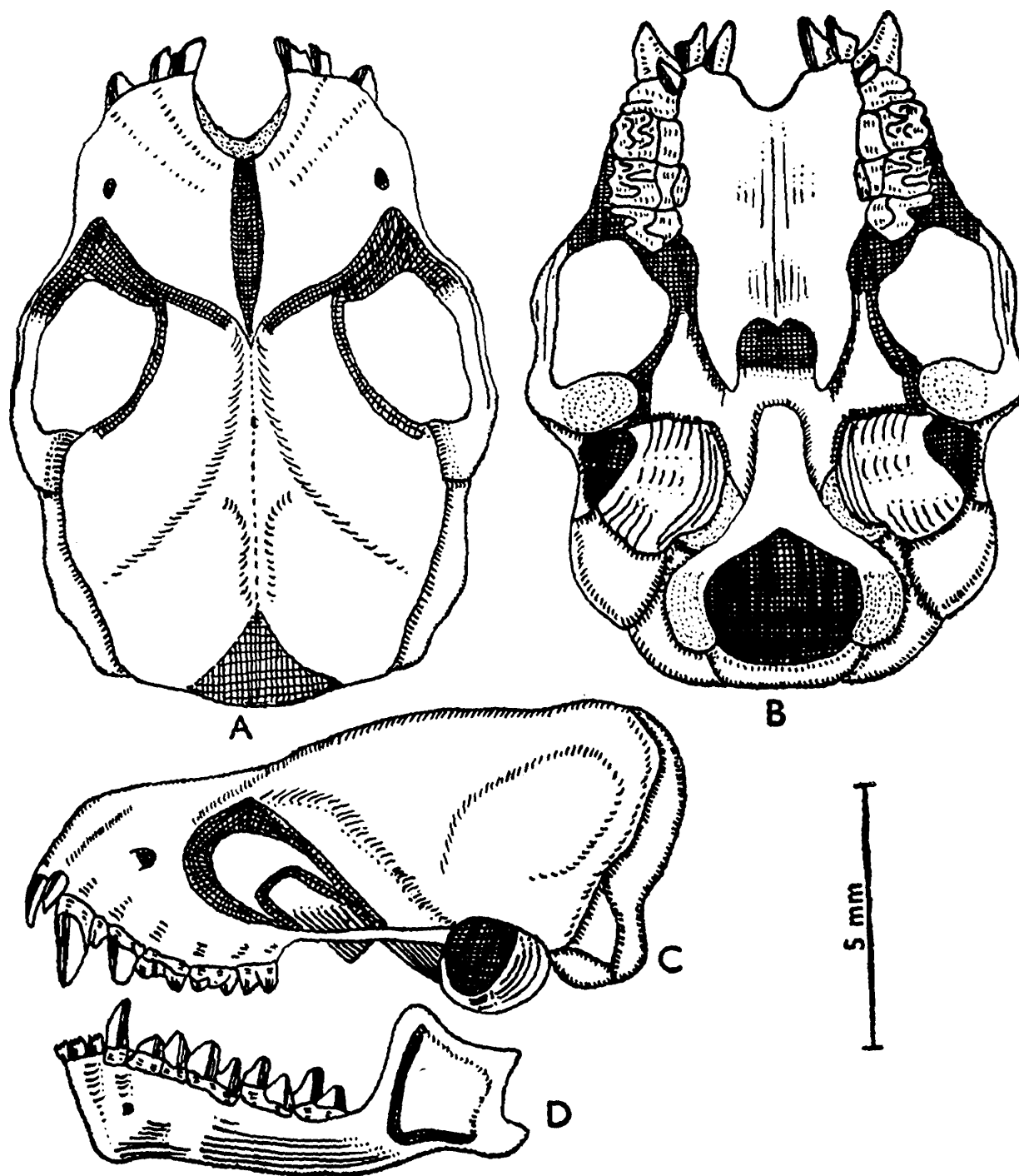


Fig. 10.—*Pipistrellus coromandra coromandra* (Gray). — Skull : (A) Dorsal view. (B) Ventral view. (C) Lateral view, (D) Lower jaw, in lateral view.

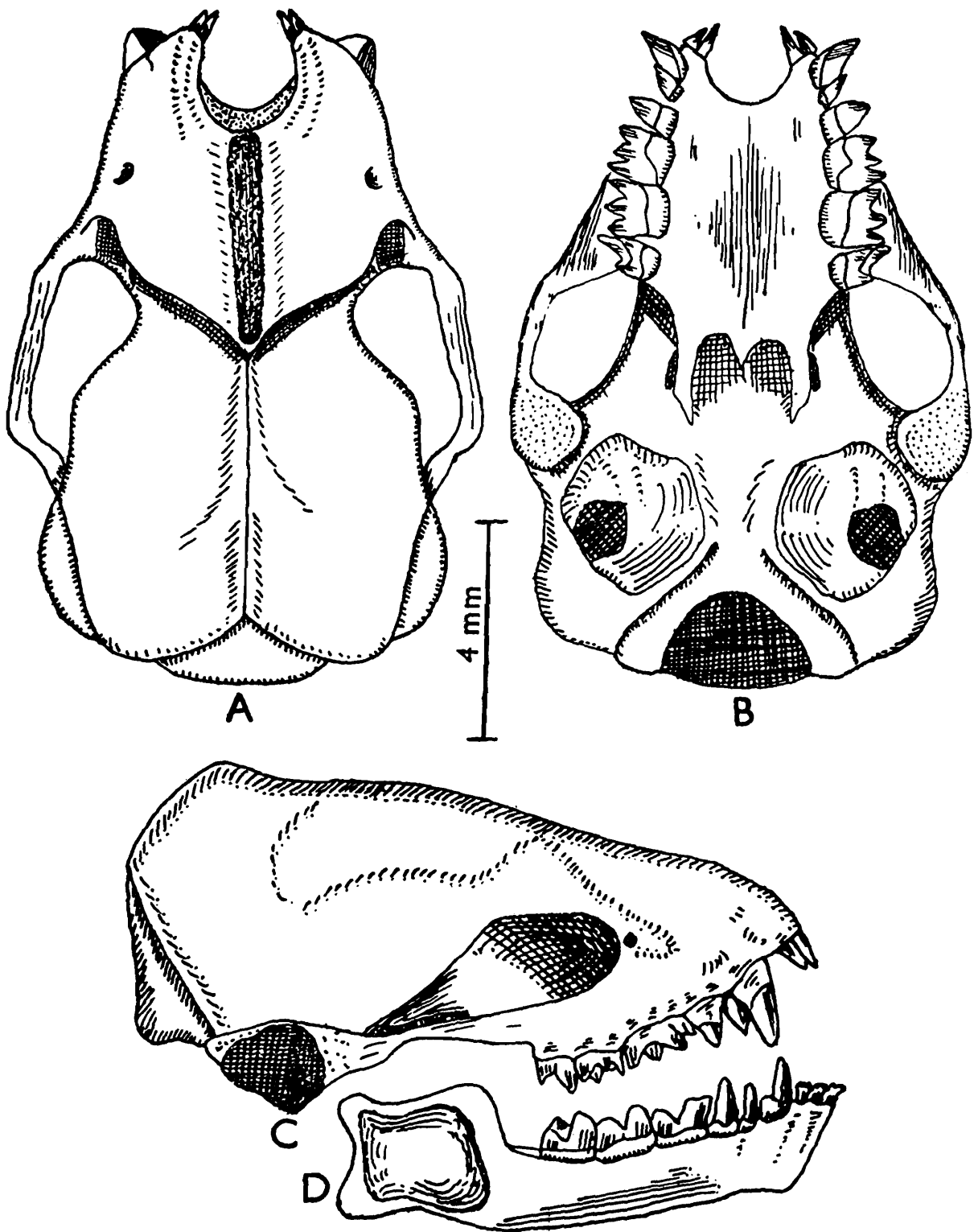


Fig. 11.—*Pipistrellus ceylonicus indicus* (Dobson). — Skull :—(A) Dorsal view. (B) Ventral view. (C) Lateral view. (D) Lower jaw, in lateral view.

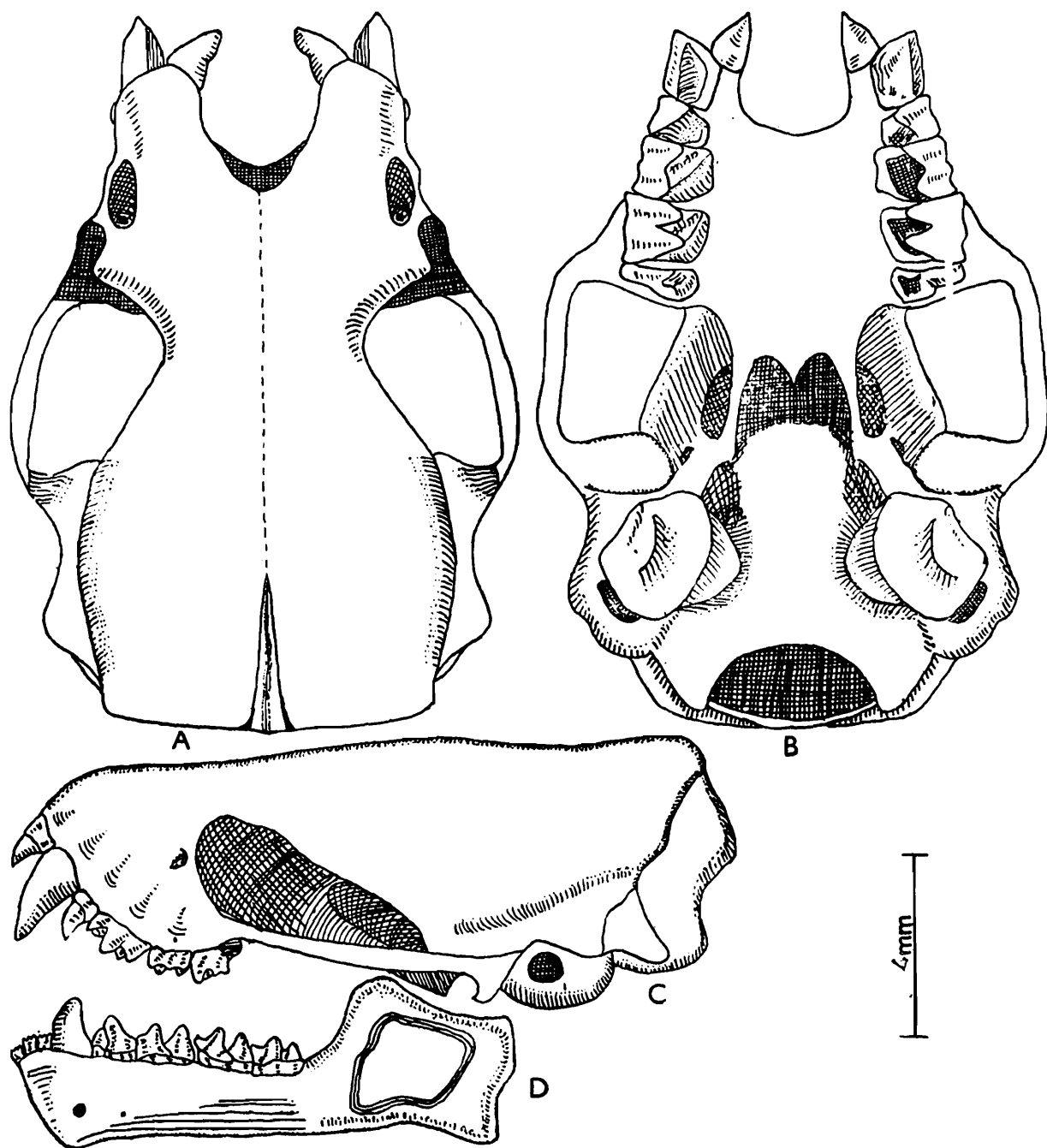
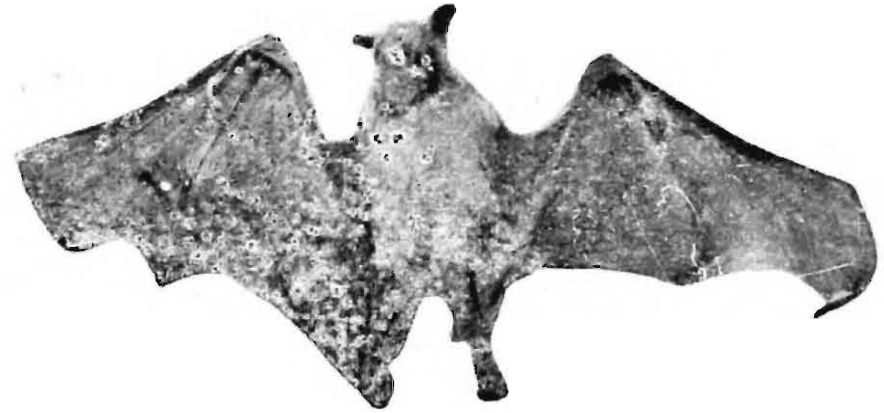


Fig. 12.—*Scotoecus pallidus* (Dobson). — Skull: (A) Dorsal view. (B) Ventral view. (C) Lateral view, (D) Lower jaw, in lateral view.

PLATES



a



b



c



d

Plate 1. *Rousettus leschenalti*. a. Ventral view. *Pteropus g. giganteus*. b. Ventral view
Cynopterus sphinx, *sphinx* c. Ventral view. *Rhinopoma h. hardwicki*. d. Dorsal
view.

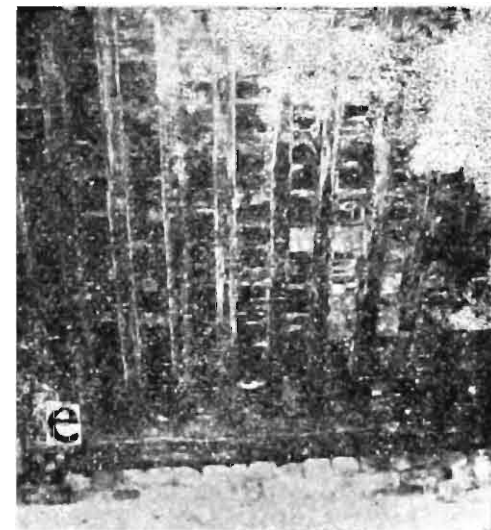
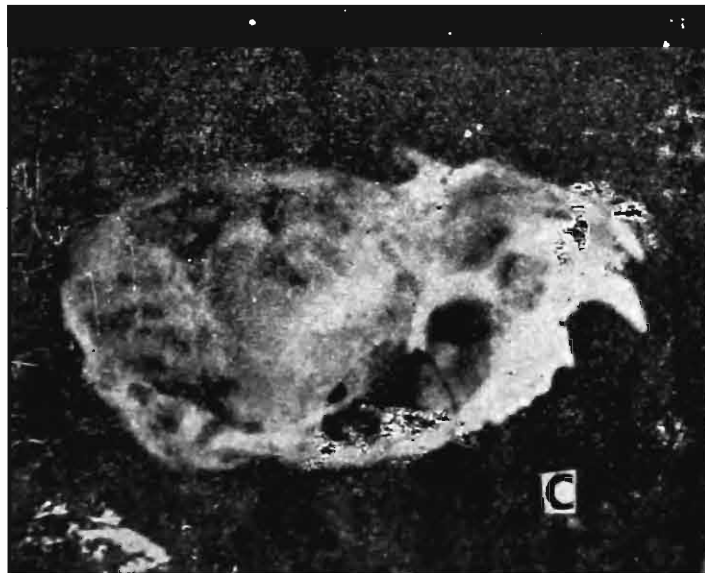
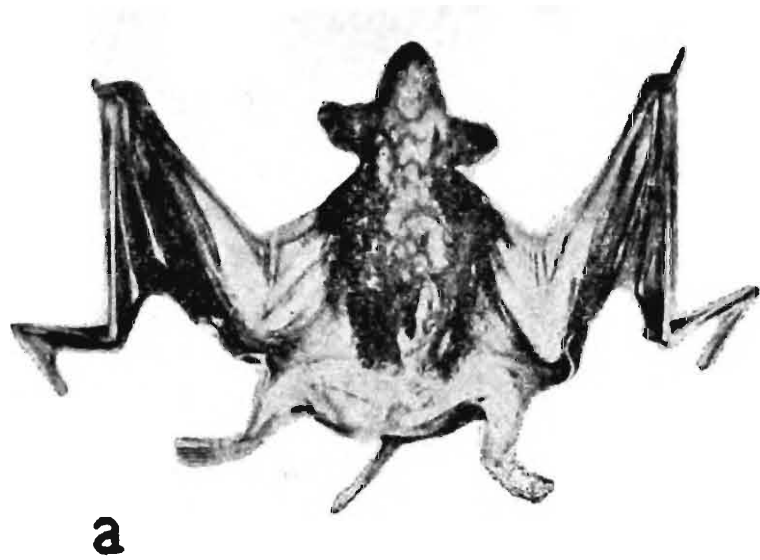


Plate 2 *Taphozous k. kachhensis*. a. Ventral view. b. Dorsal view. *T. m. melanopogon*.. c. skull showing presence of upper incisor. d. Ventral view showing black beard. e. Roosting place in Patna city.



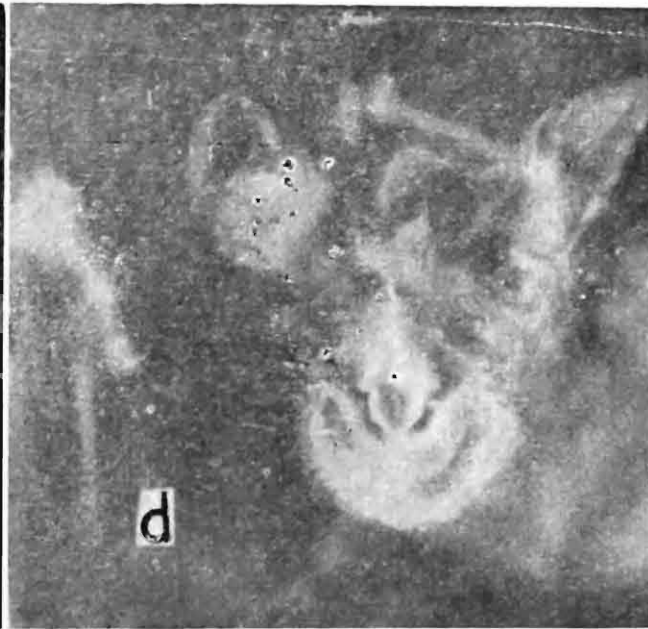
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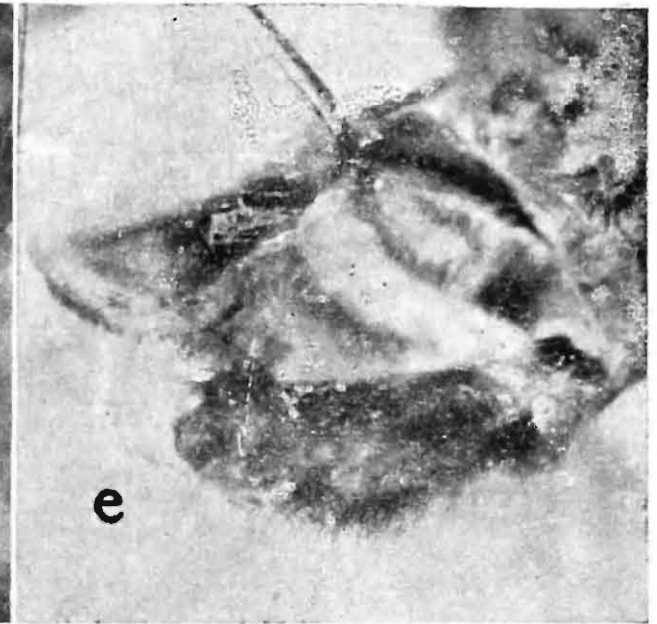
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d



e

Plate 3. *Hipposideros fulvus pallidus*. a. Ventral view. b. Ventral view. c. Frontal view of head showing structure of nose-leaf. *Rhinolophus l. lepidus*. d. Frontal view of head showing structure of nose-leaf. e. Lateral view of head showing antitragus.

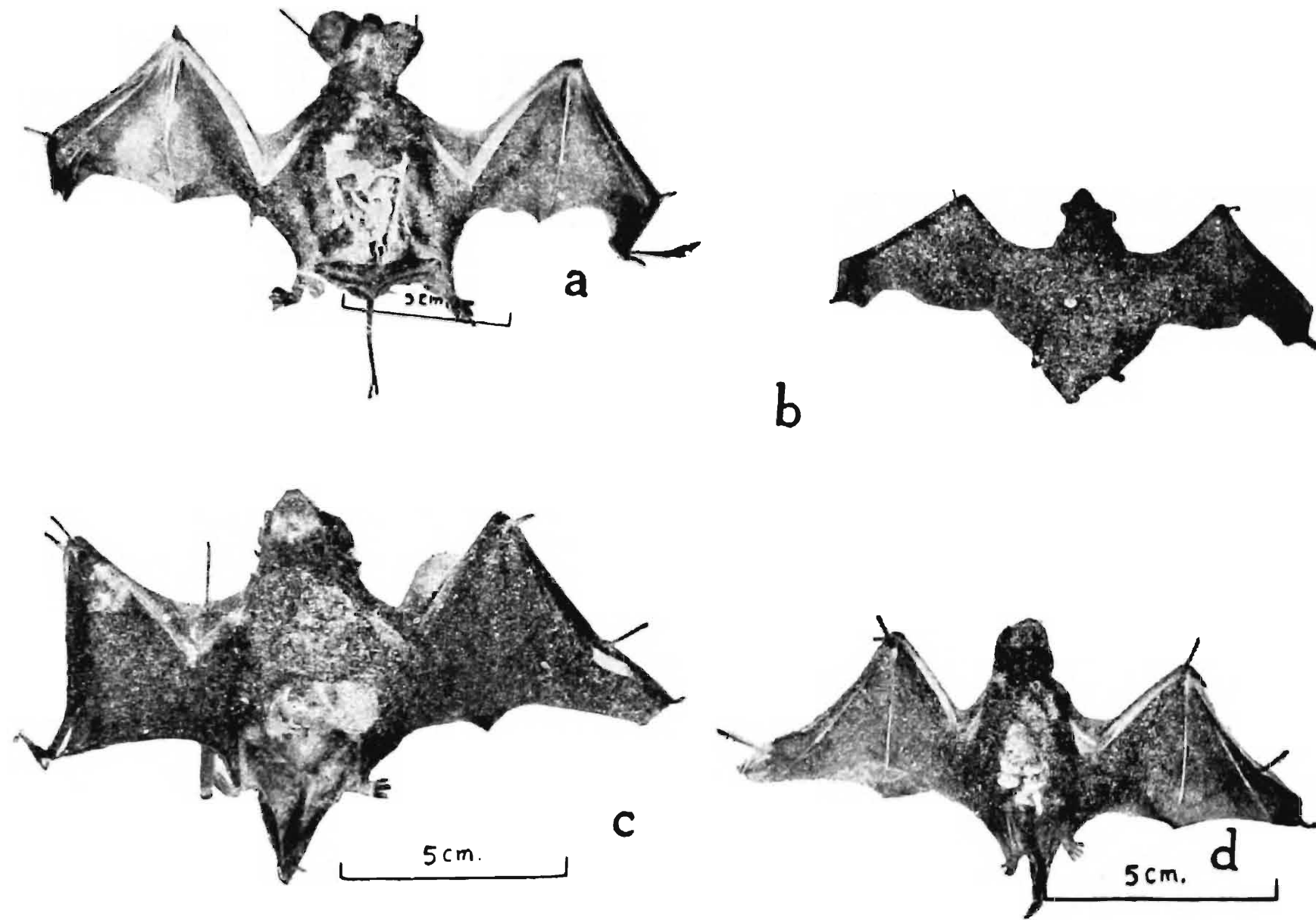


Plate 4. *Tadarida aegyptiaca themasi* a. Ventral view. *Pipistrellus c. coromandra*. b. *P. ceylonicus*. c. Ventral view with two foetuses in situ. *Pipistrellus m. mimus*. d. Ventral view.

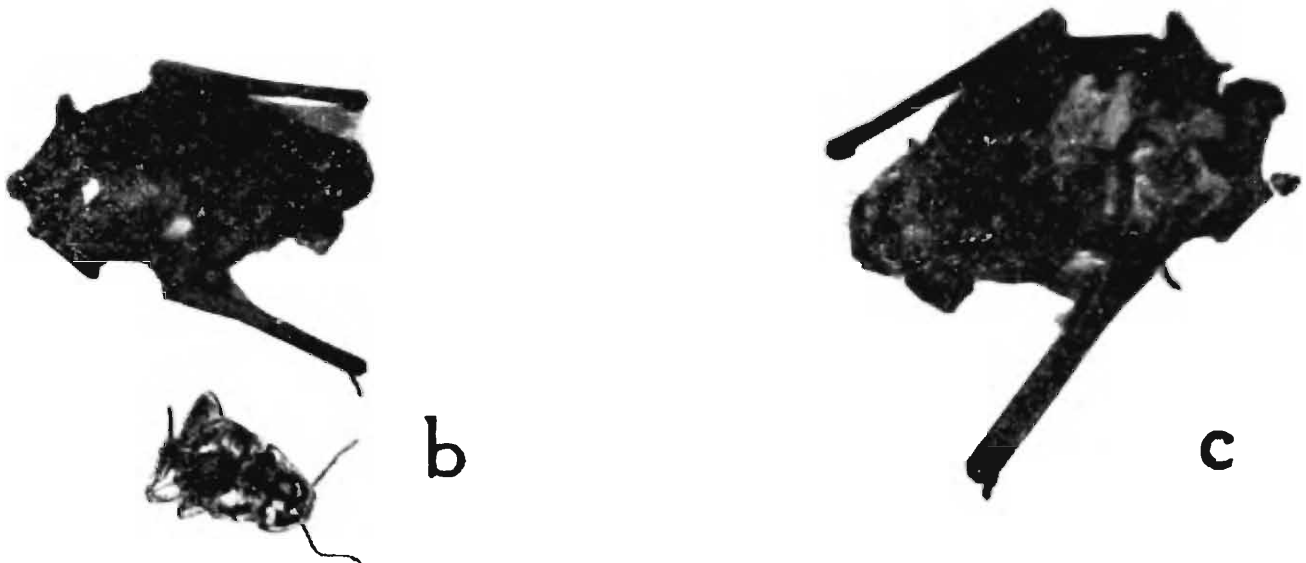
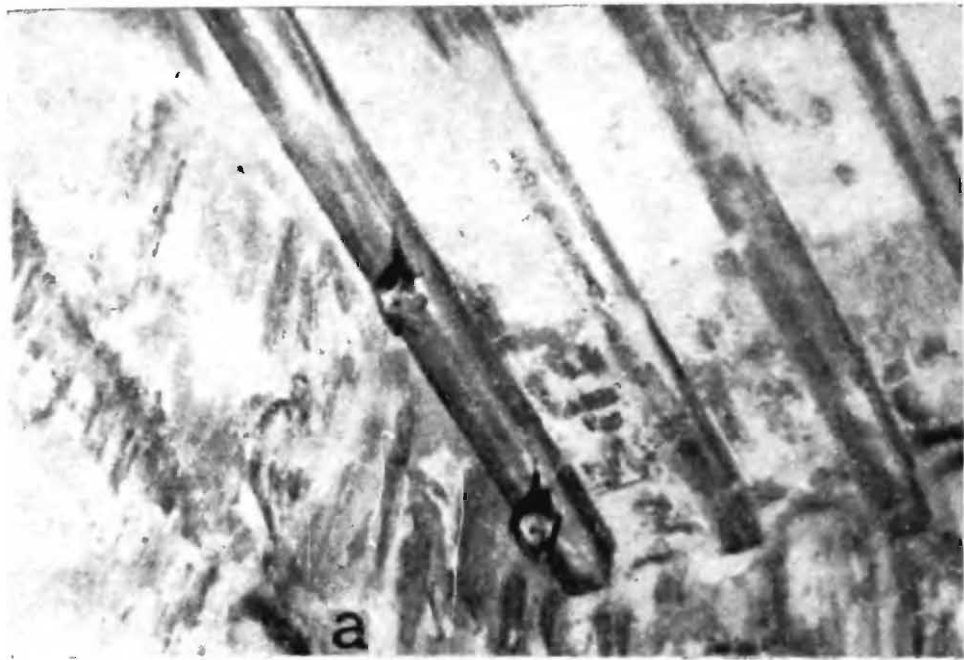
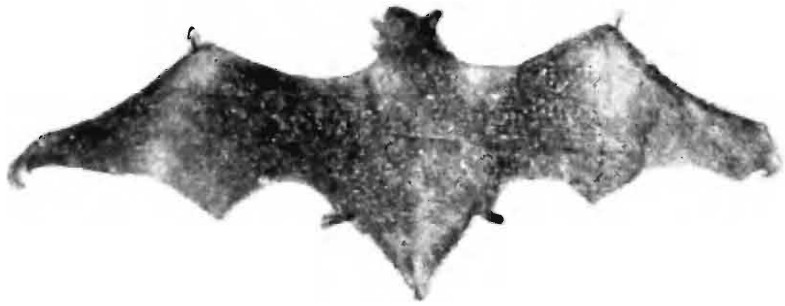


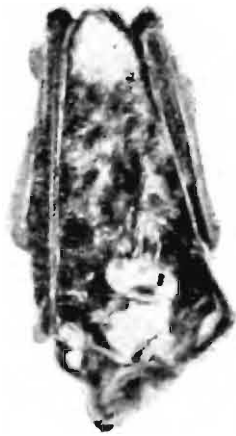
Plate 5. *Megaderma I. Iyra*. a. Two examples hanging from ceiling. *Pipistrellus c. coromandra*. b. with *Blatta* sp. (Insecta: Dictyoptera) from same hole. c. Ventral view with two foetuses in situ.



a



b



c

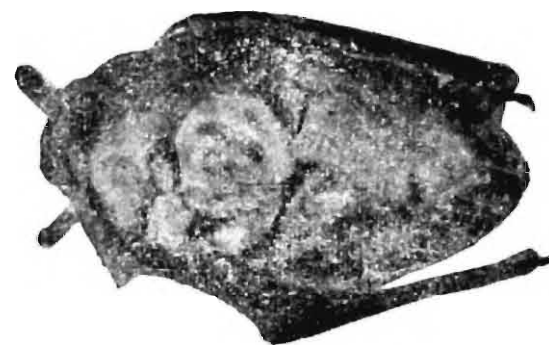


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Plate 6. *Pipistrellus dormeri*. a. Ventral view. b. Dorsal view. c. Ventral view with a fetus in situ. d. Ventral view with two fetuses.



a



b



c



d

Plate 7. *Scotophilus k. kuhlii*. a. Ventral view. *Scotoecus pallidus*. b. Ventral view with a foetus in situ. *Scotophilus h. heathi*. c. Ventral view. d. Dorsal view.