

MISCELLANEOUS PUBLICATION
OCCASIONAL PAPER NO. 63

Records of the Zoological Survey of India

STUDIES ON THE GENUS *CALLOSCIURUS* GRAY
(RODENTIA : SCIURIDAE)

by

S. CHAKRABORTY

Issued by the Director
Zoological Survey of India, Calcutta

**RECORDS
OF THE
ZOOLOGICAL SURVEY OF INDIA**

**MISCELLANEOUS PUBLICATION
OCCASIONAL PAPER NO. 63**

**STUDIES ON THE GENUS *CALLOSCIURUS* GRAY
(RODENTIA : SCIURIDAE)**

By

S. CHAKRABORTY

Zoological Survey of India, Calcutta



सत्यमेव जयते

*Edited by the Director, Zoological Survey of India
1985*

© *Copyright, Government of India, 1985*

Published in March 1985

PRICE : *Inland* : Rs. 40·00
***Foreign* : £ 5·00 \$ 8·50**

**PRINTED IN INDIA AT IMPRINTA, 243/2B, A. P. C. ROAD, CALCUTTA-6 AND
PUBLISHED BY THE DIRECTOR, ZOOLOGICAL SURVEY OF INDIA, CALCUTTA**

STUDIES ON THE GENUS *CALLOSCIURUS* GRAY (RODENTIA : SCIURIDAE)

By

S. CHAKRABORTY

Zoological Survey of India, Calcutta

INTRODUCTION

The genus *Callosciurus* Gray is an enormous taxon occurring over a great territory of the Indochinese and Malaysian subregions of Oriental region. It is represented by a large number of species and subspecies, many of which closely resemble each other and often show considerable amount of colour variation, which make the classification of this genus very difficult. Much work has been done on the taxonomic status, colour variation and distribution of its different species and subspecies. Amongst the earlier workers, Gray (1842), Blyth (1847, 1849, 1855) and Anderson (1871, 1879) have worked on several species in detail, but in many cases they had only a few specimens for investigation. Gray (1867) provided a synopsis of the Asiatic squirrels based on the collection present in the British Museum. Bonhote (1901 a-d, 1908) dealt with in detail, the taxonomy of the different species and subspecies of the genus and provided keys to their identification. Miller (1900, 1902, 1903, 1906), Lyon (1907) and Allen (1940) studied and described different species of the genus from Andalus (=Sumatra), Kalimantan (=Borneo), Mergui Archipelago (Burma) and China. Based on several survey materials occasional reports were published by Stone and Rehn (1902), Thomas (1905, 1914, 1929), Thomas and Wroughton (1909, 1911, 1916), Thomas and Robinson (1921), Wroughton (1908, 1921), Kloss (1908, 1911a-b, 1916, 1921), Robinson (1912, 1913, 1916), Robinson and Wroughton (1911, 1916), Robinson and Kloss (1914, 1915 a-b, 1918, 1922), Ryley (1914), Sody (1928, 1929), Anthony (1941) and Roonwal (1950). Thomas (1915) studied the structure of the bacula of different squirrels and redefined the genus *Callosciurus* on the basis of his findings. Wroughton (1919) summarized the results from the Indian Mammal Survey organized by the Bombay Natural History Society and provided keys to the identification of Indian and Burmese species and subspecies of this genus. Chasen (1940) provided a handlist of the Malaysian species of the genus. Carter (1943) made a detailed study on the distribution, ecology and taxonomy of some Burmese species of *Callosciurus*. In two major works,

Ellerman (1947, 1963) revised the taxonomic status of several species of the genus that occur in India, Bhutan and Burma. Moore (1959, 1960, 1961) and Moore and Tate (1965) studied the material of this genus from different museums and rightly separated the genus *Tamiops* Allen from *Callosciurus*. They also discussed in detail the distribution, reproduction, taxonomy, geographical variation and intergradation in the Indochinese species. But their treatment in many cases, particularly regarding *C. erythraeus* (Pallas) and *C. flavimanus* (I. Geoffroy), is not well understood by the readers and often confusing. However, Medway (1969) and Askins (1977) mostly followed the treatment of Moore and Tate (1965). In fact, most of the species have no definite pelage characteristics and there is great deal of variation among the different subspecies of each species. They are very conservative in their cranial characters. Therefore, each species has to be defined by linking together population that intergrade with each other, no matter how great the colour difference.

In this paper an attempt has been made to make detailed taxonomic reassessment of some species and subspecies of the genus along with their geographical distribution.

ACKNOWLEDGEMENT

I am grateful to Dr. B. K. Tikadar, Director, Zoological Survey of India, for facilities and encouragement. My sincere thanks to Dr. B. Biswas, Emeritus Scientist, for going through the manuscript and many valuable suggestions. I am indebted to Dr. A. K. Mukherjee, Emeritus Scientist, Dr. V. C. Agrawal, Superintending Zoologist and Shri P. K. Das, Zoologist who asked several helpful questions and provided valuable suggestions. Gratitude is expressed to Dr. J. C. Daniel of Bombay Natural History Society, for providing me the facilities of examining the material of the Society.

MATERIAL AND METHOD

By far the greater part of the material studied by me was from the collections present in the Zoological Survey of India and the Bombay Natural History Society, while a few specimens sent by different Universities for identification were also studied. Raw data available in literature have also been included for statistical analysis.

Measurements are taken after Ellerman (1963) and some are self explanatory. To determine the colour of series of study skins in laboratory, I have followed the technique of Moore and Tate (1965). The skins were arranged on a horizontal plane before a window, preferably at a time between 10.00 hours and 16.00 hours, when the sky was blue

but never when the sun would shine directly on the specimens. The skins were oriented with tail towards the window, and the colour comparison was made from a view perpendicular to the surface upon which the specimens lay, and thus from a point directly above the part being compared. Where colour names with initial capital letters are used in the text, direct comparison of the pelage(s) with Ridgway's (1886) colours are implied.

Population range diagrams for different external and cranial measurements have been prepared according to the methods of Dice and Leraas (1936) and Hubbs and Perlmutter (1942). The length of each ordinate represents the extremes of each set of measurements and a central cross-bar the mean ; a narrow shaded rectangle represents a distance equal to one standard deviation from the mean on either side of mean, while the broad rectangle represents a distance equal to twice the standard error of the mean on either side of the mean.

Unless otherwise stated, all measurements in the text and tables are given in millimetres. Scales in Text-figs. indicate 10 mm.

SYSTEMATIC ACCOUNT

Callosciurus erythraeus (Pallas)

Sciurus erythraeus Pallas, 1779, *Nov. Spec. Quad. Glir. Ord.* 337. [The type no longer in existence. The type-locality restricted by Moore and Tate (1965) to Garo Hills, Meghalaya].

Diagnosis :

A large-sized species, head and body on an average more than 200. Hands and feet dark and never contrasted with limbs. Undersurface bright coloured and unbanded except in *C. e. gordonii* (Anderson) and *C. e. atrodorsalis* (Gray), where chin, throat and a part of belly not bright and with an irregular agouti stripe. Occipitonasal length well over 50 except in *atrodorsalis*. Frontal more than one-third of occipitonasal length. Upper incisors usually do not tend to be proodont. Zygomatic plate rarely heavily ridged. Baculum less specialised, consisting of a long, slender, slightly curved shaft or capulus, with a narrow blade or lamina set on the side of it, in the concavity of its general structure.

Callosciurus erythraeus erythraeus (Pallas)

(Table 1, Fig. 1A, B)

Sciurus erythraeus Pallas, 1779, *Nov. Spec. Quad. Glir, Ord.*, 337. (Restricted type-locality : Garo Hills, Meghalaya).

Callosciurus erythraeus wellsi Wroughton, 1921, *J. Bombay nat. Hist. Soc.*, 27 : 775. (Jaintia Hills, Meghalaya).

Material :

1 ♀	Rajapara, Kamrup, Assam	Nov.
1 ♀	Chilpara Reserve Forest, 10 Km. east of Damra, Garo Hills, Meghalaya	
2 ♀	Rongrengiri, Garo Hills, Meghalaya	Jan., Feb.
5 ♂, 2 ♀, 1 unsexed	Tura, Garo Hills, Meghalaya	Feb., Mar.
1 ♂	Garo Hills, Meghalaya	—
1 ♀	Jowai, c 1500 m., Jaintia Hills, Meghalaya	Jun.
4 ♂, 4 ♀	Nongpoh, c 700-1000 m., Khasi Hills, Meghalaya	May, Jun.
1 unsexed	Shillong, Meghalaya	—
3 unsexed	—	—

Description :

Large-sized ; head and body on average 239 ± 4 , tail usually smaller than head and body. Hindfoot on average more than 52.

No remarkable seasonal variation in colour noticed. Mid-dorsum well distinguished from the sides by being glossy, grizzled with black and Orange-Buff against black and Buff of sides. In the region of snout, orange tinge a little more evident than in rest of the dorsum. Distal end of tail distinctly mahogany red, but in specimens from Shillong and Jowai the extreme tip of tail tends to be paler, probably due to old age of the specimens. Entire ventral surface bright chestnut or reddish.

Skull large and massive, occipitonasal length 54-57.4 (mean 56.2 ± 1.03). Sutures distinct, smooth or irregular. Dorsal surface smooth, slightly sloping anteriorly and posteriorly, with a little depression in the anterior part of the frontals. Nasal straight, long, over 28% of the occipitonasal, projecting slightly forward and downward over incisors, broad anteriorly and gradually narrows posteriorly, laterally connected with premaxilla and posteriorly with frontal. Posterior margins of nasal and premaxilla in the same line. Combined width of frontals 18.5-21.5 (mean 20.5 ± 1.1) and always over one-third of the occipitonasal. Orbit large, 16.4-18.1 (mean 17 ± 0.43) and its anterior end reaches up to the posterior margin of nasal ; length of orbit slightly greater than that of nasal. Postorbital process well developed, directed downwards and slightly backwards. Parietal ridges poorly developed, run backwards, gradually approaching each other but never joined. Combined width of parietals always greater than its length. Interparietal absent. Occipital surface almost vertical with three distinct lobes. Palate always less than half of the occipitonasal and extends posteriorly just behind the last

upper molar. Anterior palatine foramina short, posterior palatine foramina almost obliterated. Bulla well developed and more than 18% of the occipitonasal.

Dental characters as given by Ellerman (1963).

Distribution :

India : Meghalaya, Assam in part.

Callosciurus erythraeus erythrogaster (Blyth)

(Table 1, Fig. 1C, D)

Sciurus erythrogaster Blyth, 1842, *J. Asiat. Soc. Beng.*, 11 : 970. (Manipur).

Macroxus punctatissimus Gray, 1867, *Ann. Mag. nat. Hist.* 20 : 283. (Cachar, Assam).

Callosciurus erythraeus nagarum Thomas and Wroughton, 1916, *J. Bombay nat. Hist. Soc.*, 24 : 228. (Sadiya, Assam).

Material :

1 ♀	Pashihat, Siang Dist., Arunachal Pradesh	Mar.
1 ♀	Deomali Forest, Tirap Dist., Arunachal Pradesh	Nov.
1 ♀	Digboi, Lakhimpur Dist., Assam	Nov.
4 unsexed	East Naga Hills, Nagaland	Aug.
1 ♂	Naga Hills, Nagaland	Dec.
1 unsexed	Samagooting, Nagaland	Aug.
2 ♂, 1 ♀	Manipur	Feb., Apr.
1 unsexed	Manipur	—
(holotype of <i>erythrogaster</i>)		
1 ♀	Teliamura, West Tripura, Tripura	Jan.
6 ♂, 2 ♀	Ambassa, North Tripura, Tripura	Jan., Feb.
2 ♂	Ganganagar, North Tripura, Tripura	Dec.
4 ♀	Garjee, South Tripura, Tripura	Nov., Dec.
2 unsexed	Sylhet, Bangladesh	—
1 unsexed	Chittagong, Bangladesh	—
1 ♂	Tamanthi, Upper Chindwin, Burma	Jul.
1 ♂	Chin Hills, c 1300 m, Upper Chindwin, Burma	May
1 ♂, 1 ♀,	—	—
3 unsexed	—	—

Description :

Large in size, head and body on average 232 ± 16 . Tail usually subequal to head and body. Hindfoot more than 52.

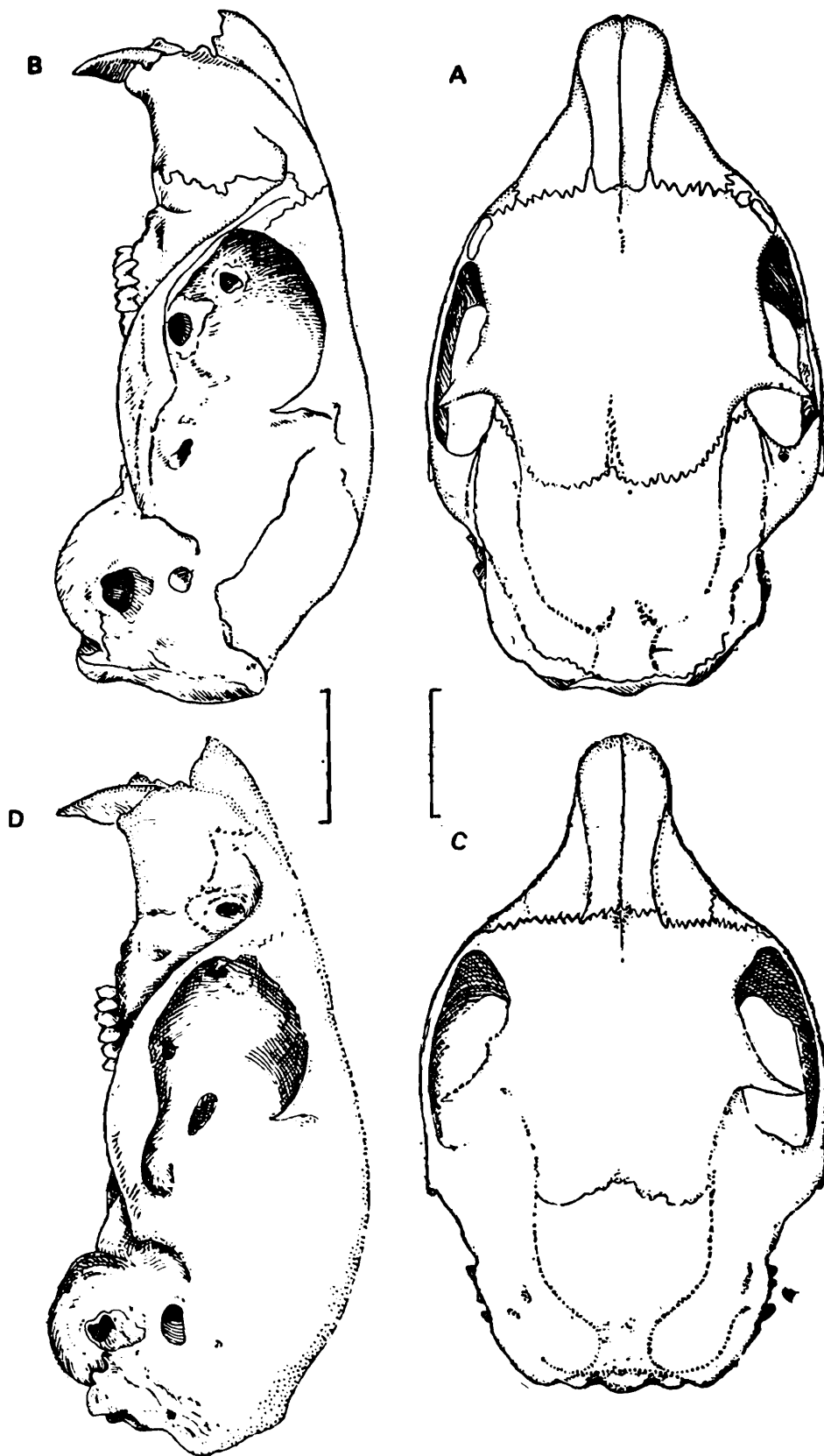


Fig. 1

- A. Dorsal view of skull of *Callosciurus erythraeus erythraeus*
- B. Lateral view of skull of *C. e. erythraeus*
- C. Dorsal view of skull of *C. e. erythrogaster*
- D. Lateral view of skull of *C. e. erythrogaster*

Dorsal colour varies seasonally. In winter (Nov.-Feb.) dorsal pelage densely grizzled with black, which is gradually replaced by brown in the summer and monsoon (Mar.-Aug.). Ear bright Hazel to chestnut brown or concolorous with the back, having a Rufous tinge on the margin.

Undersurface deep red to Claret Brown. Tail with a clear black tip of varying length or even entirely black.

Hindfoot on average slightly longer than that of the nominate subspecies.

Skull structurally similar to that of the nominate subspecies, but nasal tend to be slightly longer than the orbit and frontal depression very poorly marked. Tip of nasal not so prominently directed downward.

Remarks :

Specimens from Tripura are unusually dark and tally with the original description of *Macroxus punctatissimus* Gray. Ellerman (1963) and Moore and Tate (1965) treated *punctatissimus* as a synonym of *erythrogaster*. However, Agrawal and Bhattacharyya (1979) have maintained *punctatissimus* as a distinct subspecies on the basis of a series of dark specimens from Tripura collected during winter. Similar dark specimens were reported by Moore and Tate (1965) from Assam and Mizoram also. It is noticed from the present series that there is a definite tendency of darkening in *erythrogaster* specimens from other localities also during winter. Thus, it is not possible to say definitely about the existence of such a dark subspecies without further collection of specimens from Tripura during summer and monsoon. It is probable that these very dark specimens represent strongly melanistic individual variation in a population of ordinary *erythrogaster*. Therefore, at present *punctatissimus* is best treated as a synonym of *erythrogaster*.

Distribution :

Widely distributed. India : Assam (Mikir Hills, Cachar, Lakhimpur), Arunachal Pradesh (Tirap and Siang districts), Meghalaya (Syndai in Jaintia Hills), Nagaland, Manipur, Mizoram and Tripura. Bangladesh : South-eastern part. Burma : West of Chindwin river in Upper Chindwin district.

***Callosciurus erythraeus atrodorsalis* (Gray)**

(Table 1)

Sciurus atrodorsalis Gray, 1842, *Ann. Mag. nat. Hist.*, 10 : 263. [From 'Bhotan' corrected by Ryley (1914) to Moulmein, Burma].

Sciurus hyperythrus Blyth, 1855, *J. Asiat. Soc. Beng.*, 24 : 474. (Tenasserim, Burma).

Material :

3 ♂, 5 ♀,	Moulmein Dist., Burma	Mar., Apr.,
18 unsexed		Aug., Oct.
3 unsexed	Mooleyet Range, Tenasserim, Burma	—
1 unsexed	Tenasserim, Burma	—
(holotype of <i>hyperythrus</i>)		
4 unsexed	South of Irrawaddy, Burma	—
2 ♀	East of Irrawaddy, Burma	—
1 unsexed	Shwaygwyin, Tenasserim, Burma	—

According to Sclater (1891) the localities like 'South of Irrawaddy', 'East of Irrawaddy' are somewhat vague and do not seem to be quite reliable.

Description :

Small-sized subspecies, head and body on average 186 ± 24.5 . Tail usually smaller than head and body. Hind foot on average less than 52.

In all the specimens except three from Moulmein, a black band on the back is present in various degrees. This band 8-33 mm. in width, begins from the base of tail and extends generally up to mid-dorsum but in three (two from Moulmein and one from south of Irrawaddy) it reaches up to neck, and in one from Shwaygwyin up to forehead; in four from Moulmein it is poorly developed and restricted to the posterior part of the dorsum. Rest of the dorsum distinctly brown or grayish brown, speckled with black. Forehead, facial region and ear with a Rufous tinge except in one specimen from Shwaygwyin where forehead blackish. Colour of tail as mentioned by Ellerman (1963), very variable; tail hairs except those of the tip usually have variable number of alternating yellow and black bands, but in seven specimens yellow bands are replaced by brown and in one from south of Irrawaddy, hairs entirely dark brown. Tail-tip generally pale yellowish, but whitish in four and brown in one. Vibrissae entirely white in 14, black in eight and black and white in other specimens. Belly chestnut in colour except in one from Moulmein where it is brown. In 29 specimens chin and throat grayish with yellow speckling which continues into the belly for some distance in the form of a stripe, while in the remaining specimens chin and throat chestnut. Hands and feet gray grizzled and concolorous with the limbs. The holotype of *hyperythrus* agrees well with the description given by Moore and Tate (1965).

Skull structurally similar to that of the nominate subspecies, but much smaller in all respects. Occipitonasal 49.7 ± 1.41 and smaller than all other subspecies except *C. e. gordonii* Anderson by more than one standard deviation from the mean (Fig. 2).

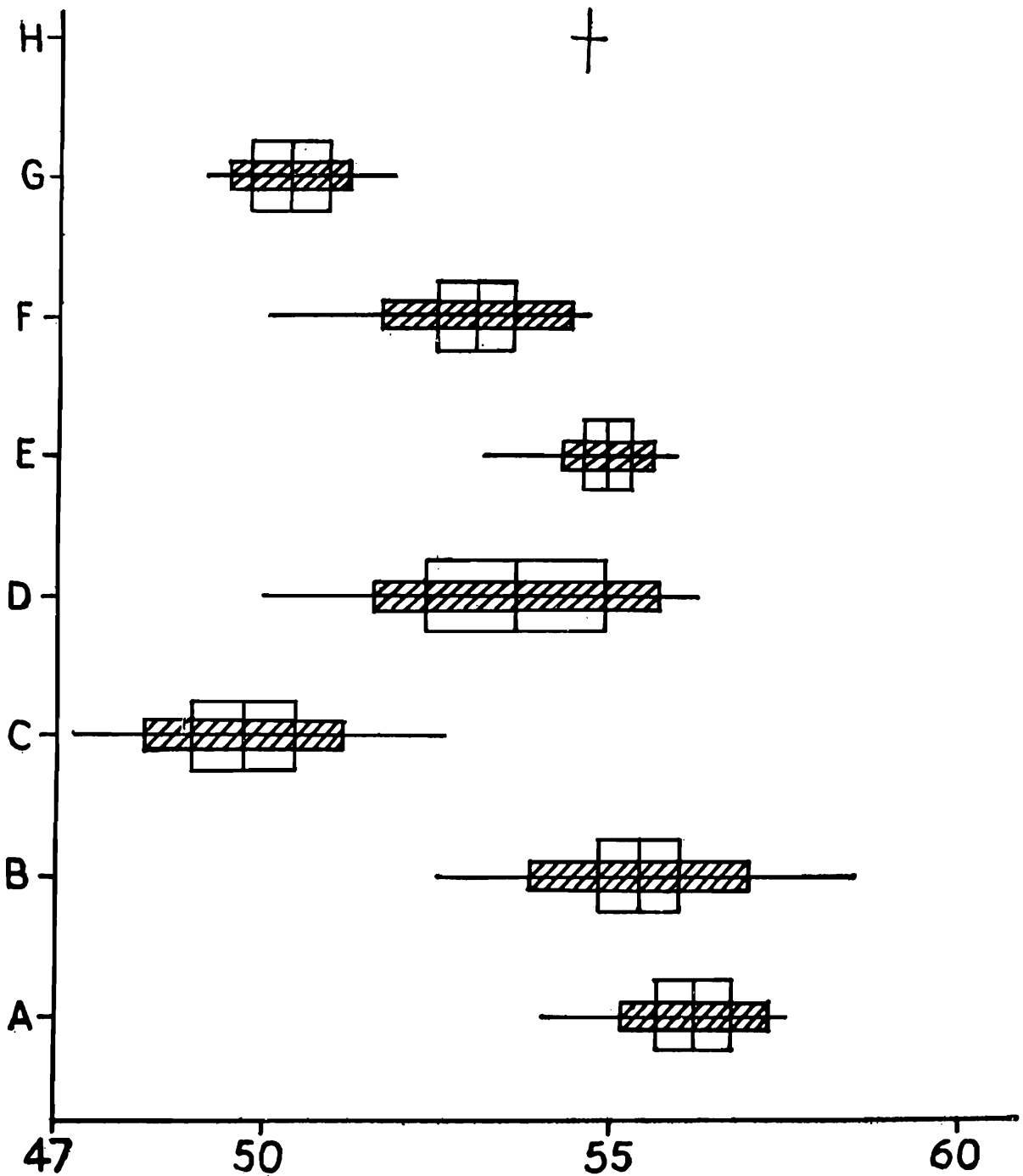


Fig. 2

Graphic representation of occipitonasal length (in mm) in eight subspecies of *Callosciurus erythraeus*.

A. *C. e. erythraeus* ; B, *C. e. erythrogaster* ; C, *C. e. atrodorsalis* ; D, *C. e. kinneari* ; E, *C. e. crotalius* ; F, *C. e. intermedius* ; G, *C. e. gordonii* ; H. *C. e. bhutanensis*.

Remarks :

Gray (1842) described *atrodorsalis* as 'back blackish, slightly grizzled, cheeks and whiskers yellowish' Blanford (1891) in his key to the non-flying squirrels gave its specific characters as with either a black dorsal patch or white whiskers or both. Blyth (1849), Robinson and Wroughton (1916) and Robinson and Kloss (1918) maintained it as a distinct species. Osgood (1932) seemed to lean towards the opinion that *atrodorsalis* is a representative of *C. erythraeus* in southern Burma. Moore and Tate (1965) treated it as a subspecies *C. flavimanus* (I. Geoffroy). From the examination of the present material, it becomes obvious that the characters of *atrodorsalis* mentioned by Blanford (1891) are not so stable as to give it a species rank. Moreover, it differs from *C. flavimanus* in having the hands and feet concolorous with the limbs. Ellerman (1963) studied some specimens in which the feet tended to be pale, but the presence of mid-dorsal stripe also made them different from *C. flavimanus*. Thus, the treatment of *atrodorsalis* as a subspecies of *C. flavimanus* is not convincing and I agree with Ellerman (1963) in considering it as an extremely variable subspecies of *C. erythraeus*.

Blyth (1855) described *Sciurus hyperythrus* on the basis of a specimen from some part of Tenasserim, Burma, having ruddy coloured face. Blanford (1891) kept it under *atrodorsalis* and described it as a 'rufous variety without either black dorsal patch or white whiskers' Sclater (1891) followed this treatment. Robinson and Kloss (1918) regarded *hyperythrus* as subspecies of *C. erythraeus* and stated, 'this subspecies which has generally been referred to a "non-black-backed form of *C. atrodorsalis*" comes in with *C. erythraeus* and *castaneiventris* and has nothing to do with *C. atrodorsalis*' Ellerman (1963) also followed Robinson and Kloss, but none of them gave any reason in favour of their opinions. Moore and Tate (1965) examined and redescribed the type of *hyperythrus* and placed it with *C. flavimanus* as a separate subspecies. But the type of *hyperythrus* differs from *C. flavimanus* in having the hands and feet concolorous with the limbs. The present study reveals that all the specimens of *atrodorsalis* from Moulmein and Mooleyet Range have Rufous facial area, and that those without black band are impossible to distinguish from the type of *hyperythrus*. So, I am inclined to treat *hyperythrus* as a synonym of *atrodorsalis*.

The occurrence of two colour forms in *atrodorsalis*, the more common one with a broad black stripe on the back and the other without it, is still a matter of great taxonomic interest. From the studies of Anderson (1879), Moore and Tate (1965) and the present one it is obvious that the difference between the two are neither a colour phase nor related to sex or age. Though the material is not adequate, yet the difference

does not seem to be seasonal either. Moreover, the occurrence of both the colour phases in the same geographical area (Moulmein) indicates that the difference is not subspecific.

Distribution :

This subspecies occurs in the heavy rainfall area of North Tenasserim, Burma, and apparently to the east of Salween river.

***Callosciurus erythraeus gordonii* (Anderson)**

(Table I, Fig. 3A, B)

Sciurus gordonii Anderson, 1871, *Proc. zool. Soc. Lond.*, 140. (Bhamo, Upper Burma).

Material :

2 ♂	2nd defile of Irrawaddy, Bhamo Dist., Burma	Mar.
5 unsexed (including two syntypes of <i>gordonii</i>)	Bhamo, Bhamo Dist., Burma	Feb., Mar.
1 ♀	Sawaddy, Bhamo Dist., Burma	Jan.
1 ♂	Sagaing, Sagaing Dist., Burma	Oct.

Description :

All the specimens fit in well with the description given by Ellerman (1963) except the following variations.

In two specimens from Bhamo including a syntype, either side of the ventral stripe Buff instead of chestnut or reddish. In the specimen from Sawaddy ventral stripe obscure probably in the process of making the study skin.

Skull very similar to that of the nominate subspecies but much smaller and having a number of depressions on the frontal and parietal regions ; occipitonasal length 50.3 ± 0.86 and differs from that of other subspecies discussed in the present paper except *atrodorsalis* by more than one standard deviation from the mean (Fig. 2). From *atrodorsalis* it differs by the narrower frontal, the combined width of which is 17.3 ± 0.65 against 18.6 ± 0.54 in the former.

Remarks :

Anderson (1871) described *gordonii* on the basis of the presence of a grizzled olive-gray mid-ventral stripe. Blanford (1891) treated it as a

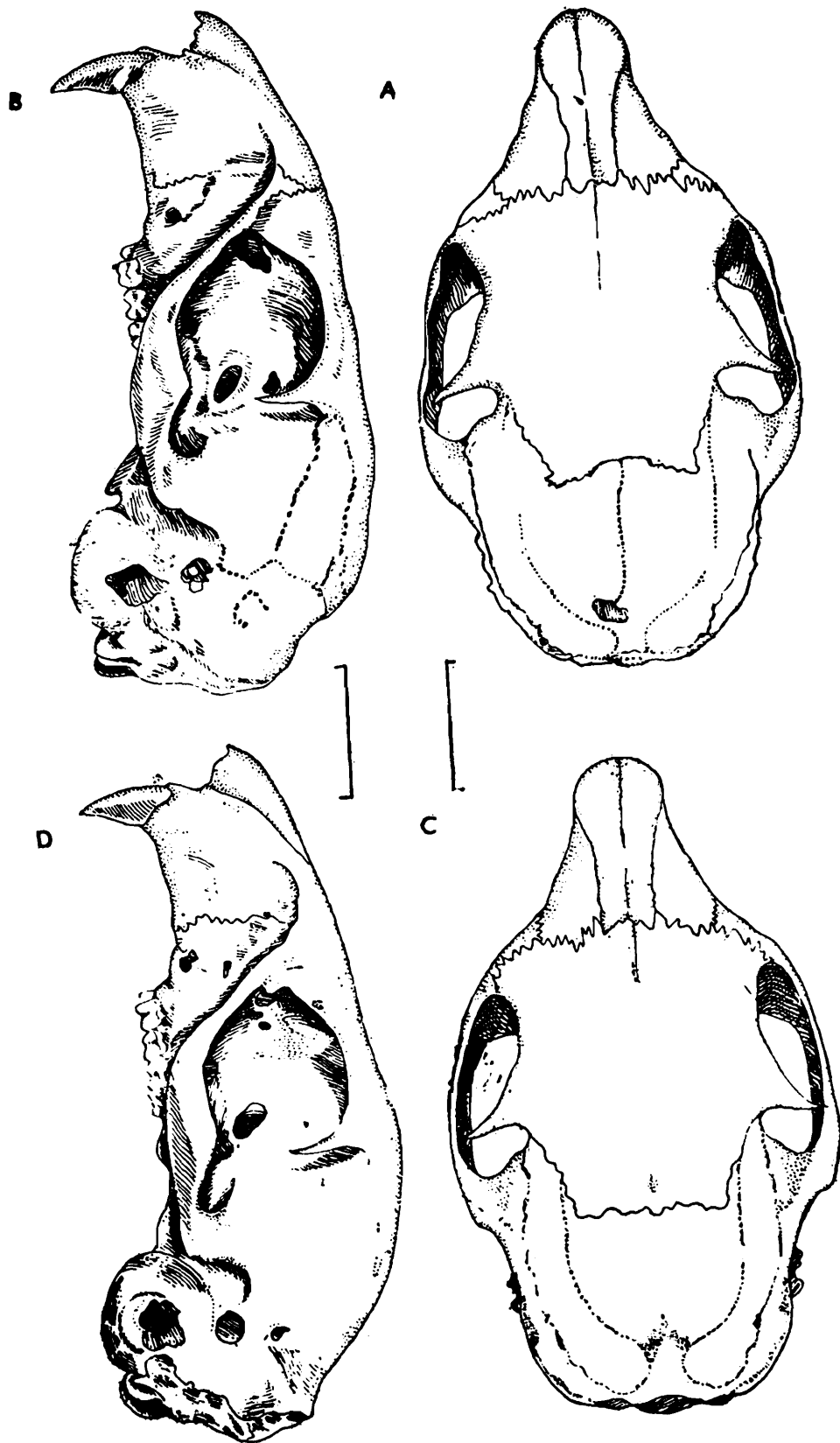


Fig. 3

- A. Dorsal view of skull of *Callosciurus erythraeus gordonii*
- B. Lateral view of skull of *C. e. gordonii*
- C. Dorsal view of skull of *C. e. intermedius*
- D. Lateral view of skull of *C. e. intermedius*

subspecies of *C. erythraeus* and was maintained as such by subsequent workers, namely, Robinson and Kloss (1918), Allen (1925) and Ellerman (1947, 1963). Moore and Tate (1965) made a detailed study of *gordonii* and treated it as a subspecies of *C. flavimanus*. But their treatment does

not seem to be convincing as the hands and feet of all the specimens of *gordoni* at my disposal including the syntypes are dark and not in colour contrast with the limbs.

Distribution :

Burma : Bhamo and Sagaing district. China : Yunnan.

***Callosciurus erythraeus intermedius* (Anderson)**

(Table 1, Fig. 3C, D)

Sciurus gordoni Var. *intermedia* Anderson, 1879, *Zool. Anat. Res. Yunnan*, 241. (Dikrang Valley, Subansiri Dist., Arunachal Pradesh).

Callosciurus castaneiventris aquilo Wroughton, 1921, *J. Bombay nat. Hist. Soc.*, 27 : 601. (Sadiya, Lakhimpur Dist., Assam).

Material-:

2 ♂, 3 ♀	Dening, 700 m., Mishmi Hills, Luhit Dist., Arunachal Pradesh	Mar., Apr., May
1 ♂, 1 ♀	Dreyi, 1700 m., Mishmi Hills, Luhit Dist. Arunachal Pradesh	Jun.
1 ♂	Daffla Hills, Subansiri Dist., Arunachal Pradesh	—
1 ♂	Dikrang Valley, Subansiri Dist., Arunachal Pradesh	—
9 ♀, 1 unsexed	Abor Hills, Siang Dist., Arunachal Pradesh	Mar., Dec.
2 ♂	Sadiya, Lakhimpur Dist., Assam.	Nov., Dec.
2 ♀, 1 unsexed	Assam ?	—

Description :

Medium-sized subspecies, head and body on average 221 ± 13.5 . Tail usually smaller than head and body. Hindfoot smaller than that of other subspecies discussed in this paper except *gordoni* (Fig. 5).

Dorsum including facial region grizzled with gray, brown and black. Tail pale yellowish, grizzled with gray and devoid of any black or dark brown tinge; tail-tip paler than remaining part of tail. Under-surface uniform red or chestnut except in one specimen from Mishmi Hills, in which the mid-ventral region gray grizzled.

Skull differs from that of the nominate subspecies being smaller, occipitonasal length 53 ± 1.37 . A small interparietal present even in some of the adult skulls.

Robinson and Wroughton (1911) described *Sciurus castaneoventris bonhotei* from Chinchien San, Szechwan, China. It was synonymised with *intermedius* by Ellerman (1963). Moore and Tate (1965) treated *bonhotei* as a distinct subspecies of *C. flavimanus*. Since I have no specimen of *bonhotei* to examine I am not in a position to comment on its taxonomic status.

Distribution :

India : Arunachal Pradesh (except Tirap dist.), Assam [extremes northeastern part in Lakhimpur dist. However, Moore and Tate (1965) mentioned eight specimens from south Kamrup]. Burma : North Burma.

***Callosciurus erythraeus crotalius* Thomas and Wroughton**

(Table 1, Fig. 4A, B).

Callosciurus erythraeus crotalius Thomas and Wroughton, 1916, *J. Bombay nat. Hist. Soc.*, 24 : 229. (Hkamti, 26°5 N., 95°55 E., Upper Chindwin, Burma).

Material :

12 ♂, 11 ♀ Hkamti, Upper Chindwin, Burma Jul., Aug.

Description :

Large-sized ; head and body an average 235 ± 9 . Tail usually slightly smaller than head and body. Hindfoot long, on average 56 ± 1.4 .

Mid-dorsum glossy, grizzled with light brown and black. Limbs and posterior half of dorsum gray with fine light yellow speckling. Chin gray with yellowish speckling ; remaining part of undersurface chestnut but paler in the region of limbs. Tail-tip in 17 specimens pale yellow intermixed with a few brown hairs while in six it is almost dark brown with 4-12 pale yellow (? white) hairs. Three to eight cm. of subterminal portion of tail distinctly black, while hairs of the remaining part of the tail grizzled black and light brown.

Anterior slope of the dorsal surface of the skull more prominent than that of the nominate subspecies. Occipitonasal length on average 54.9 ± 0.64 . Nasal usually longer than the orbit.

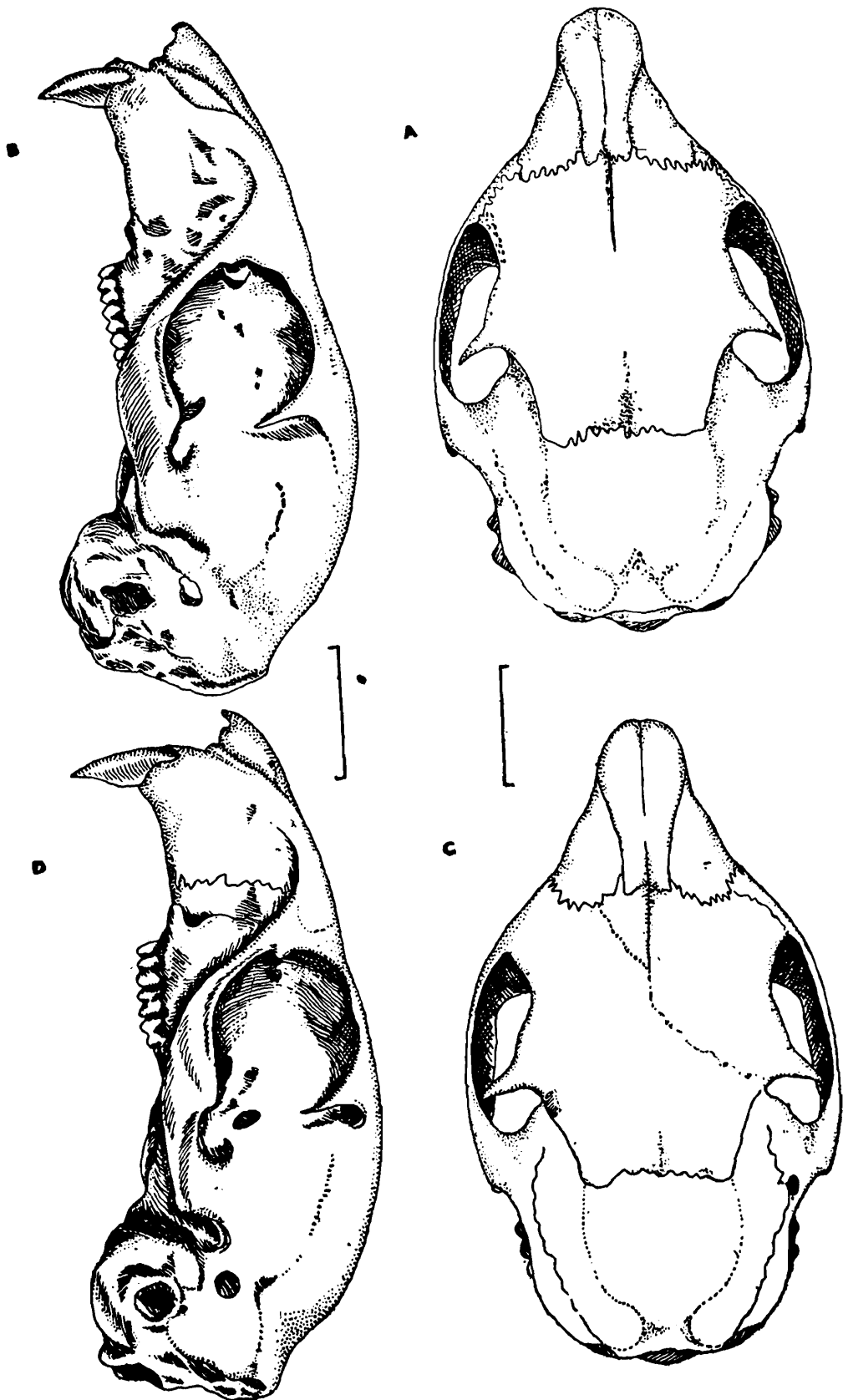


Fig. 4

- A. Dorsal view of skull of *Callosciurus erythraeus crotalius*
- B. Lateral view of skull of *C. e. crotalius*
- C. Dorsal view of skull of *C. e. kinneari*
- D. Lateral view of skull of *C. e. kinneari*

Remarks

To Robinson and Kloss (1918) *crotalius* appeared to be synonymous with *intermedius*. Ellerman (1963), however, maintained it as a separate subspecies and stated, 'This is an average rather than an absolute race..... ..It is very similar to *C. e. castaneiventris* Gray from Hainan but the skull seems to be larger on average' Moore and Tate (1965) merged it with *erythrogaster* due to its limited geographical range. On comparing the specimens of *crotalius* with those of *intermedius*, it becomes obvious that the latter can easily be distinguished from the former by the total absence of black or dark brown tinge in the tail. Moreover, the length of hindfoot is much greater in *crotalius* and differs from *intermedius* by more than two standard deviation from the mean (Fig. 5). The colour of the tail-tip by which *crotalius* differs from *erythrogaster* is constant in all the specimens examined by me as well as in the 29 topotypical specimens examined by Thomas and Wroughton (1916). Carter (1943) indicated that the difference is constant in his sample of 48 specimens from Hkamti northeastward through seven other localities along the west side of Chindwin river. Moreover, the hindfoot in *crotalius* tends to be longer on average than that of the *erythrogaster* (Fig. 5). Merging of *crotalius* with *erythrogaster* simply on the basis of small geographic range is, therefore, not tenable.

Distribution :

Burma : Extreme northern part of Upper Chindwin and Hukong Valley.

Callosciurus erythraeus kinneari Thomas and Wroughton

(Table I, Fig. 4C, D)

Callosciurus erythraeus kinneari Thomas and Wroughton, 1916, *J. Bombay nat. Hist. Soc.*, 24 : 229. (Tatkon, West Bank of Chindwin, Upper Chindwin, Burma).

Material :

2 ♀	32 km. west of Kindat, c. 800 m, Upper Chindwin, Burma.	Jun., Jul.
2 ♂, 4 ♀	Tatkon, west bank of Chindwin, Upper Chindwin, Burma.	Jun., Jul.
1 unsexed	Manlaik, 3 km. south of Kindat, Upper Chindwin, Burma.	Jan.

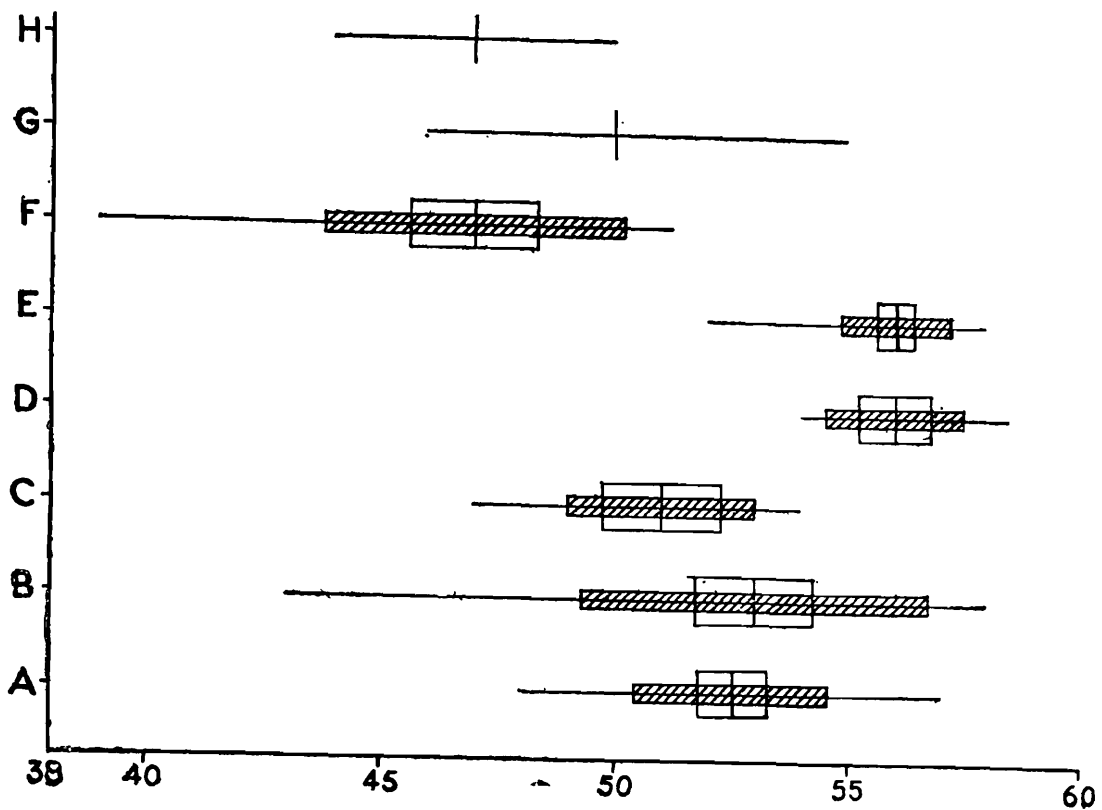


Fig. 5

Graphic representation of hindfoot length (in mm) in eight subspecies of *Callosciurus erythraeus*.

A, *C. e. erythraeus* ; B, *C. e. erythrogaster* ; C, *C. e. atrodorsalis* ; D, *C. e. kinneari* ; E, *C. e. crotalius* ; F, *C. e. intermedius* ; G, *C. e. bhutanensis* ; H, *C. e. gordonii*.

Description :

Medium-sized ; head and body on average 220 ± 14 . Tail usually slightly longer than head and body. Hindfoot rather long, on average 56 ± 1.46 .

Dorsal pelage grizzled black and light yellow. Chin similarly grizzled and in four specimens a narrow grayish stripe extends from chin to chest. Rest of the undersurface reddish to chestnut. Greater part of the tail almost white with occasional gray or brownish bands on some hairs ; tail-tip either entirely dark brown or mixed with a few (3 to 8) white hairs.

Skull similar to that of *crotalius* but in most specimens the interparietal present.

Remarks :

Moore and Tate (1965) synonymised *kinneari* with *erythrogaster*, but the whiteness of the tail, in my view, is sufficient to maintain it as a separate subspecies. Moreover, there is a definite tendency of the hindfoot being longer in *kinneari* than in *erythrogaster* (Fig. 5).

Distribution :

Burma : Southern part of Upper Chindwin on west bank of Chidnwin. A specimen was recorded by Thomas and Wroughton (1916) from Ahlaw, Kabaw Valley.

***Callosciurus erythraeus bhutanensis* (Bonhote)**

(Table I, Fig. 6A, B)

Sciurus erythraeus bhutanensis Bonhote, 1901, *Ann. Mag. nat. Hist.*, (7) 7 : 161. (Bhutan).

Material :

1 ♂	Putlibir, West Bhutan	Mar.
1 ♀	Phuntsholing, West Bhutan	Jan.
2 ♀	Gaylegphug, Central Bhutan	Nov.
2 ♀	Mithangar, East Bhutan	May

Description :

Medium-sized ; head and body on average 221. Tail usually shorter than head and body. Hindfoot on average 50.

Skull very similar to that of the nominate subspecies, but frontal depression very prominent and tip of nasal not prominently directed downwards. Occipitonesal length little over 54.

Remarks :

Detailed taxonomic study of this subspecies has been made by Chakraborty (1975). It can be distinguished by its distinctly reddish facial area including the ears.

Distribution :

Bhutan.

Notes on few more related forms of *C. erythraeus*.

1. *Sciurus griseopectus* Blyth, 1847. *J. Asiat. Soc. Beng.*, 16 : 873. (Type locality unknown).

Material :

1 unsexed	Foochow, China.
1 unsexed	Hsia-men (=Amoy), China.
1 unsexed	? (China)
(Holotype)	

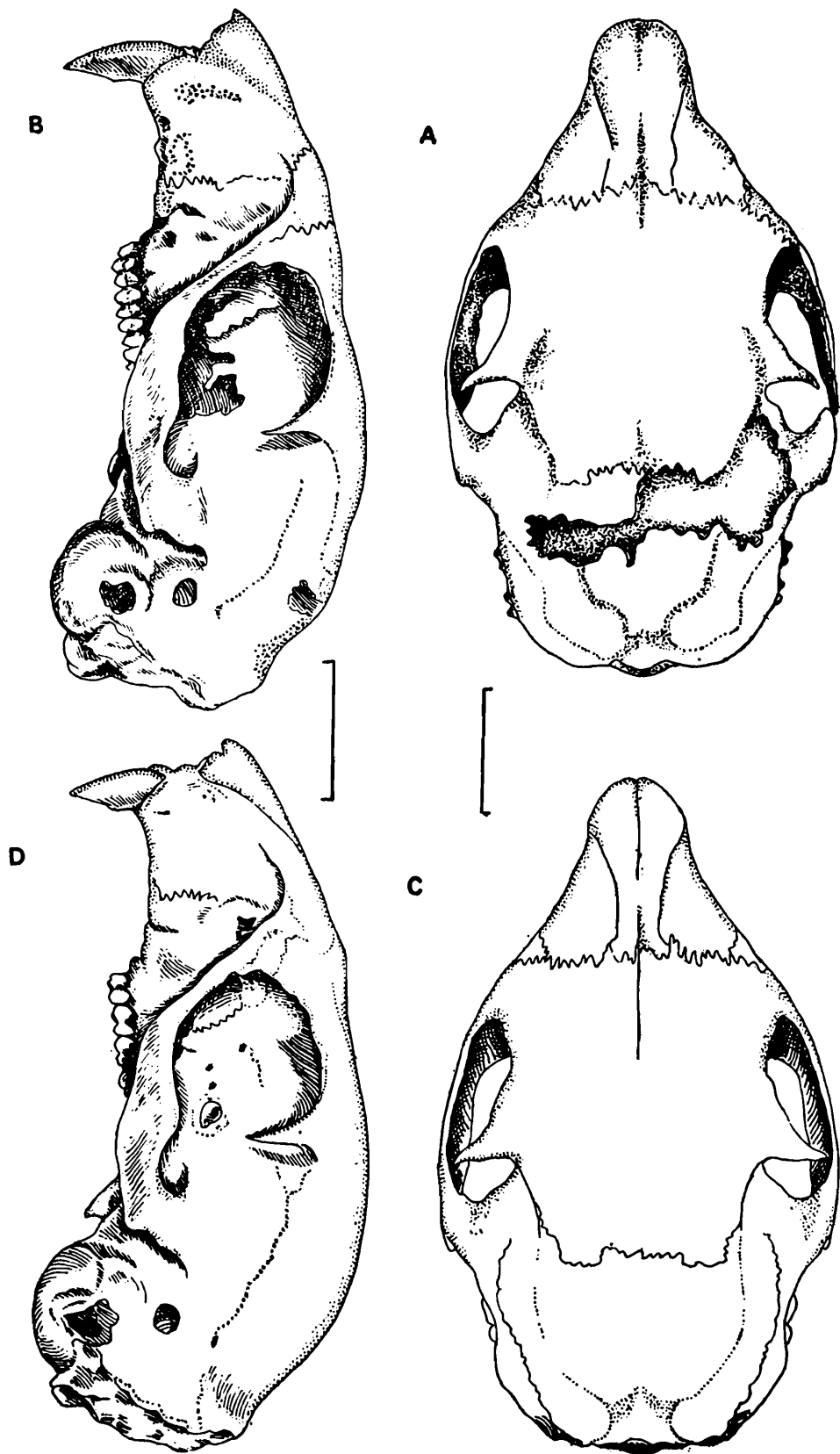


Fig. 6

- A. Dorsal view of skull of *Callosciurus erythraeus bhutanensis*
- B. Lateral view of skull of *C. e. bhutanensis*
- C. Dorsal view of skull of *Callosciurus flavimanus sladeni*
- D. Lateral view of skull of *C. f. sladeni*

Remarks :

Based on a captive specimen from an unknown locality, Blyth (1847) described *griseopectus*, having the throat and breast deep grizzled ash colour which extends to the belly in the form of a median stripe. Anderson (1879) placed it in the synonymy of *Sciurus (callosciurus) castaneiventris* Gray. Sclater (1891) from the examination of the present specimen from Hsia-men (=Amoy), China, deduced that the type of *griseopectus* came from China. Bonhote (1901a) proposed *griseopectus* as a subspecies of *castaneiventris*. Robinson and Kloss (1918) treated both *castaneiventris* and *griseopectus* as separate subspecies of *C. erythraeus*. Ellerman (1963) placed *griseopectus* in the synonymy of *C. e. gordonii* and stated, 'possibly *griseopectus* might be the first name for this form, but its locality is unknown, and it was based on a captivity (*Sic!*) specimen' From a detailed study of the type-specimen of *griseopectus*, Moore and Tate (1965) stated that it cannot be included with *castaneiventris* as the latter has feet too black and tail-tip too different. They attributed some of its characters to *gordonii* and others to *C. caniceps shanicus* (Ryley), and stated 'when material becomes available from an area of intergradation between *gordonii* and *shanicus*, it seems likely that individuals quite like the type of *griseopectus* may be found among them' Here it is worthwhile to mention that both *gordonii* and *shanicus* have been treated as subspecies of *C. flavimanus* by Moore and Tate (1965).

The examination of the present material of *griseopectus* reveals that it differs from the specimens of *gordonii* present in the Z.S.I. collection by the deep grizzled ash coloured throat and breast, and from *shanicus* by the brightness of the belly. Moreover, *griseopectus* cannot be an intergrade between *gordonii* and *shanicus*, as Hsia-men (=Amoy), China, from where a specimen exactly similar to the holotype of *griseopectus* was obtained, is far away from the area of intergradation between *gordonii* and *shanicus*. In fact, from the description of *castaneiventris* given by Moore and Tate (1965), it appears that *griseopectus* comes closer to *castaneiventris* in all respects except for the paleness of hindfoot, which may be attributed to the old age of the present skins.

2. *Sciurus rubeculus* Miller, 1903, *Smithson, Misc. Collns.*, 45 : 22. (Khao Soi Dao, Trong, Thailand).

Material :

1 ♂ Khao Nawng, Bandon, Thailand Jun.

Description :

Mid-dorsum, head and facial regions glossy, grizzled black and brown. Sides slightly paler than mid-dorsum. Hands and feet grayish.

Tail hairs uniformly grizzled black and light brown. Chin and throat grizzled gray and light brown and a similarly coloured broad stripe extends from throat to anus. Sides of the venter bright chestnut.

Remarks :

Ellerman (1963) kept *rubeculus* as a synonym of *C. e. hyperythrus*, while Moore and Tate (1965) treated both *rubeculus* and *hyperythrus* as separate subspecies of *C. flavimanus*. Askins (1977) also treated *rubeculus* as a subspecies of *C. flavimanus*. However, I am unable to draw definite conclusion regarding the taxonomic status of *rubeculus* in view of the fact that I have been able to examine only a single example.

3. *Sciurus erythraeus youngi* Robinson and Kloss, 1914, *Ann. Mag. nat. Hist.*, (8) 13 : 224. (Gunong Tahan, North Pahang, Thailand).

Material :

1 ♂ Gunong Tahan, North Pahang, Thailand Jul.

Description :

Very similar to the specimen of *rubeculus* present in the Z.S.I. collection, but feet much darker.

Remarks :

Moore and Tate (1965) treated it as a synonym of *rubeculus*. Askins (1977) treated *youngi* as a synonym of *C. f. rubeculus*.

Key to the identification of the above listed subspecies of *Callosciurus erythracus* is given below.

- | | | | |
|--|-----|-----|---------------------------|
| 1. Skull small, occipitonasal on average less than 51 | ... | ... | 2 |
| Skull large, occipitonasal on average more than 52 | ... | ... | 3 |
| 2. Frontal narrow, combined width on average less than 18. Mid-ventral gray stripe extends from throat to hinder part of belly | ... | ... | <i>C. e. gordonii</i> |
| Frontal wide, combined width on average more than 18. Mid-ventral gray stripe when present extends from throat to chest only | ... | ... | <i>C. e. atrodorsalis</i> |
| 3. Facial region including ear distinctly red. | ... | ... | <i>C. e. bhutanensis</i> |
| Facial region and ear not red | ... | ... | 4 |
| 4. Tail with a long red or black tuft at tip | ... | ... | 5 |
| Tail without a long red or black tuft at tip | ... | ... | 6 |

5. Tail almost red with a long red tuft at tip	...	...	<i>C. e. erythraeus</i>
Tail almost black with a long black tuft at tip	...	...	<i>C. e. erythrogaster</i>
6. Hindfoot small, on average less than 52	...	...	<i>C. e. intermedius</i>
Hindfoot long, on average more than 55	...	...	... 7
7. About 3 to 8 cm. of subterminal part of tail			
black but extreme tip whitish	...	...	<i>C. e. crotalius</i>
Extreme tip of tail dark brown, rest of tail			
almost white	...	...	<i>C. e. kinneari</i>

Callosciurus flavimanus (I. Geoffroy)

Sciurus flavimanus I. Geoffroy, 1831, in Bêlanger, *Voy. Indes Orient. Zool.*, 148. (Tourane, Annam, Vietnam).

Diagnosis :

A large-sized species, head and body on average well over 200. Tail usually longer than head and body. Undersurface brightly coloured. Hands and feet contrastingly coloured to limbs. Occipitonasal length over 50, frontal wide and combined width more than one-third of occipitonasal. Zygomatic plate rarely heavily ridged. Incisors usually do not tend to be proodont. Baculum less specialised and structurally similar to that of the *C. erythraeus* except in *C. f. phayrei* (Blyth). In *phayrei*, baculum more specialised, the lamina attached to the side of the end of the capulus and developed into a long triangular pointed blade, recurved backwards towards the hilt of the capulus.

Remarks :

Moore and Tate (1965) regarded this species as extremely variable and included forms with ventral agouti stripe under it. But they stated that even in the nominate subspecies only an occasional individual shows feeble indication of a ventral agouti stripe anteriorly. Moreover, it has been observed by me that many subspecies of *C. erythraeus* and *C. caniceps* (Gray) which usually lack a ventral stripe may have some specimens with irregularly developed stripe. It would appear, therefore, that the presence or absence of the irregular ventral stripe has not much taxonomic significance. It follows that inclusion of forms with a ventral stripe under this species by Moore and Tate (1965) is not justified.

Callosciurus flavimanus sladeni (Anderson)

(Table 2, Fig. 6C, D)

Sciurus sladeni Anderson, 1871, *Proc. zool. Soc. Lond.*, 139. (Thizyain, on the Upper Irrawaddy River, Burma).

Sciurus Kemmisi Wroughton, 1908, *Ann. Mag. nat. Hist.*, (8) 2 : 491. (Katha. Upper Irrawaddy River, Burma).

Sciurus sladeni midas Thomas, 1914, *J. Bombay nat. Hist. Soc.*, 23 : 198. (Myitkyina, Burma).

Material :

3 ♂, 1 ♀	Kindat, Upper Chindwin, Burma	Jun., Jul., Nov.
2 unsexed	Upper Burma	—
2 unsexed (Syntypes of <i>sladeni</i>)	Thizyain, on the upper Irrawaddy River, Burma.	Jan.

Description :

Hairs on the back, nape and limbs speckled with broad black and narrow light brown bands making the dorsum look blackish. Number of light brown band on individual hair variable from specimen to specimen. In six specimens it is two and in two specimens it is three. Hands, feet, muzzle and entire ventral surface uniform bright Ochraceous. Hairs above nail black. Outersurface of ear Rufous. About 10 cm. of tail-tip Ochraceous-Rufous; hairs on remaining part of the tail annulated with broad brown or yellow and narrow black bands.

Skull in structure and size very similar to that of *C. e. erythraeus* with some minor differences. Nasals free from each other at the posterior end, and on average slightly larger than orbit. Postorbital process a little more developed.

Remarks :

Callosciurus flavimanus bartoni (Thomas) was regarded as a synonym of *sladeni* by Wroughton (1921) and Ellerman (1963). They were of the opinion that *bartoni* was based on an aberrant individual in which the muzzle and feet were whitish instead of Ochraceous. Moore and Tate (1965), however, maintained *bartoni* as a heterogeneous subspecies because the number of light bands of individual hair on rump, back and nape is less than that in *sladeni*. They also retained a number of subspecies like *C. f. shortridgei* Thomas and Wroughton, *C. f. fryanus* Thomas and Wroughton, *C. f. millardi* Thomas and Wroughton and *C. f. careyi* Thomas and Wroughton under *bartoni*. Since I have not been able to examine any specimens from the type-locality of *bartoni*, I would suggest keeping it separate from *sladeni* pending further study of its material.

Distribution :

Burma : Myitkyina district to south of Upper Chindwin through Katha region.

***Callosciurus flavimanus rubex* (Thomas)**

(Table 2, Fig. 7A, B)

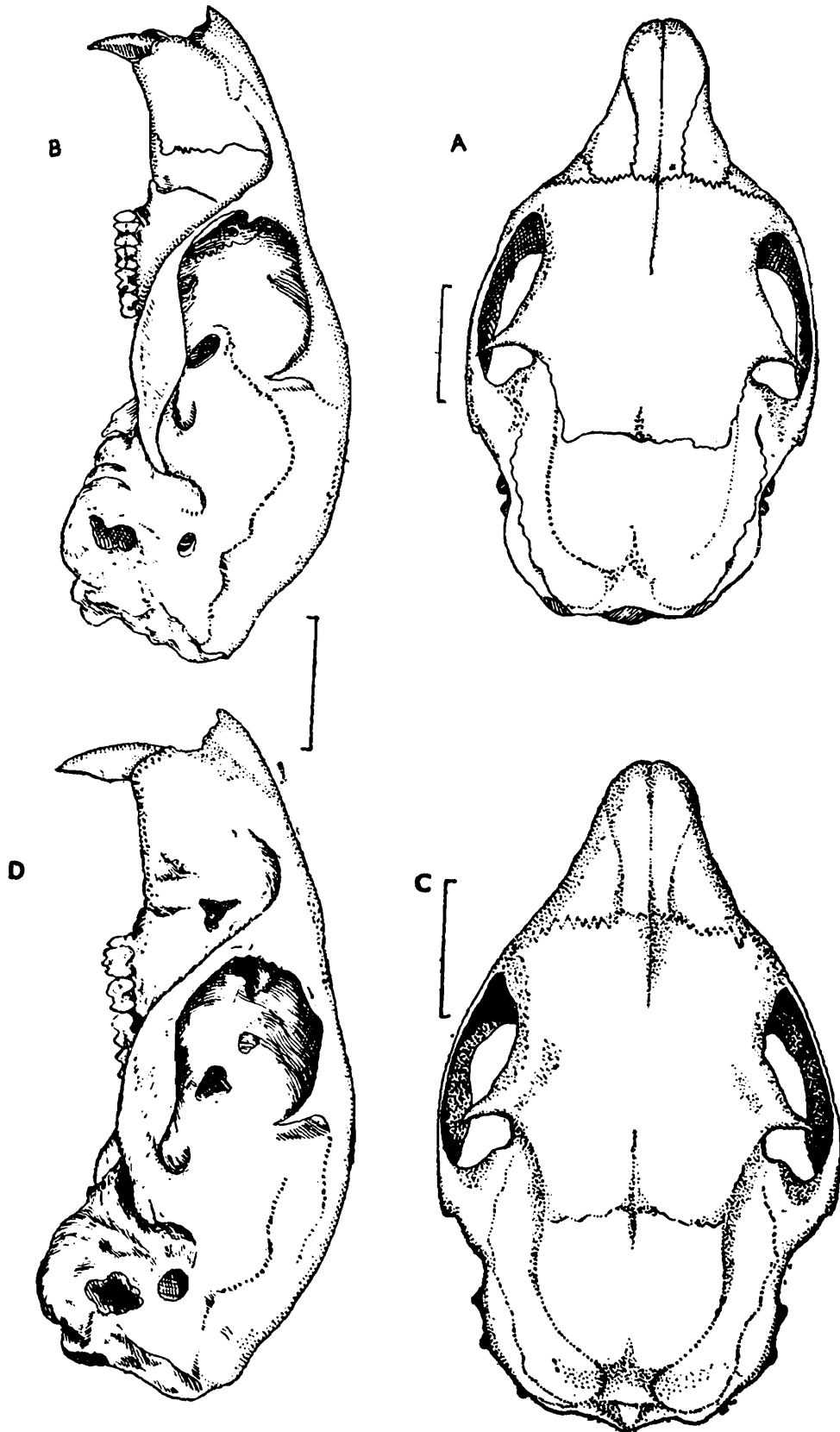
Sciurus sladeni rubex Thomas, 1914, *J. Bombay nat. Hist. Soc.* 23 : 198. (Yin, 112 Km. south of Kindat, Lower Chindwin, Burma).

Fig. 7

- A. Dorsal view of skull of *Callosciurus flavimanus rubex*
- B. Lateral view of skull of *C. f. rubex*
- C. Dorsal view of skull of *C. f. haringtoni*
- D. Lateral view of skull of *C. f. haringtoni*

Material :

2 ♂, 2 ♀ Yin, 112 km. south of Kindat, Lower Chindwin, Burma Jun.

Description :

Small-sized. Head and body, tail and hindfoot on average 214 ± 10.5 , 224 ± 25 and 54 ± 1.5 respectively. Hairs on the back, head and limbs basally slaty, then alternately ringed with narrow yellow and broad Ochraceous-Rufous bands making the dorsum brighter in appearance. Muzzle, hands and feet deep Orpiment-Orange. Outer surface of ear Rufous. Venter deep Ochraceous-Rufous. Tail proximally similar to back, but becomes uniform Orange-Rufous towards tip.

Skull structurally similar to that of *sladeni* but much smaller. Occipitonasal on average 52.8 ± 1.1 and differs from other subspecies except *C. f. phayrei* (Blyth) by more than one standard deviation from the mean (Fig. 8). Nasal subequal to the length of orbit. Moreover, nasals are united at the posterior extremity.

Remarks :

Moore and Tate (1965) treated *rubex* as a synonym of *sladeni*, but my June specimens of *rubex* differ conspicuously from those of *sladeni* taken in the same month in coloration as it is obvious from the above description. Moreover, *rubex* is smaller than *sladeni* in respect of head and body, tail and occipitonasal length (Table 2). Thus, I would like to follow Ellerman (1963) in treating *rubex* as a separate subspecies.

Distribution :

Burma : Lower Chindwin district.

***Callosciurus flavimanus haringtoni* (Thomas)**

(Table 2, Fig. 7C, B)

Sciurus haringtoni Thomas, 1905, *Ann. Mag. nat. Hist.*, 16 : 314. (Moungkan, Upper Chindwin, Burma).

Sciurus haringtoni solutus Thomas, 1914, *J. Bombay nat. Hist. Soc.*, 23 : 199. (Homalin, Upper Chindwin, Burma).

Callosciurus sladeni careyi Thomas and Wroughton, 1916, *J. Bombay nat. Hist. Soc.*, 24 : 233. (Tamanthe, Upper Chindwin, Burma).

Material :

1 ♂, 3 ♀ Homalin, Upper Chindwin Dist., Burma Jul.

1 ♂ Moungkan, Upper Chindwin Dist., Burma Aug.

Description :

On average largest in size of all the subspecies studied in the present paper. Head and body, tail and hindfoot on average 224 ± 7.5 , 260 ± 17 and 58 ± 1 respectively.

Back Cream Buff to almost white with a few entirely black or black-tipped hairs. Head creamy white with a little buffy suffusion on the

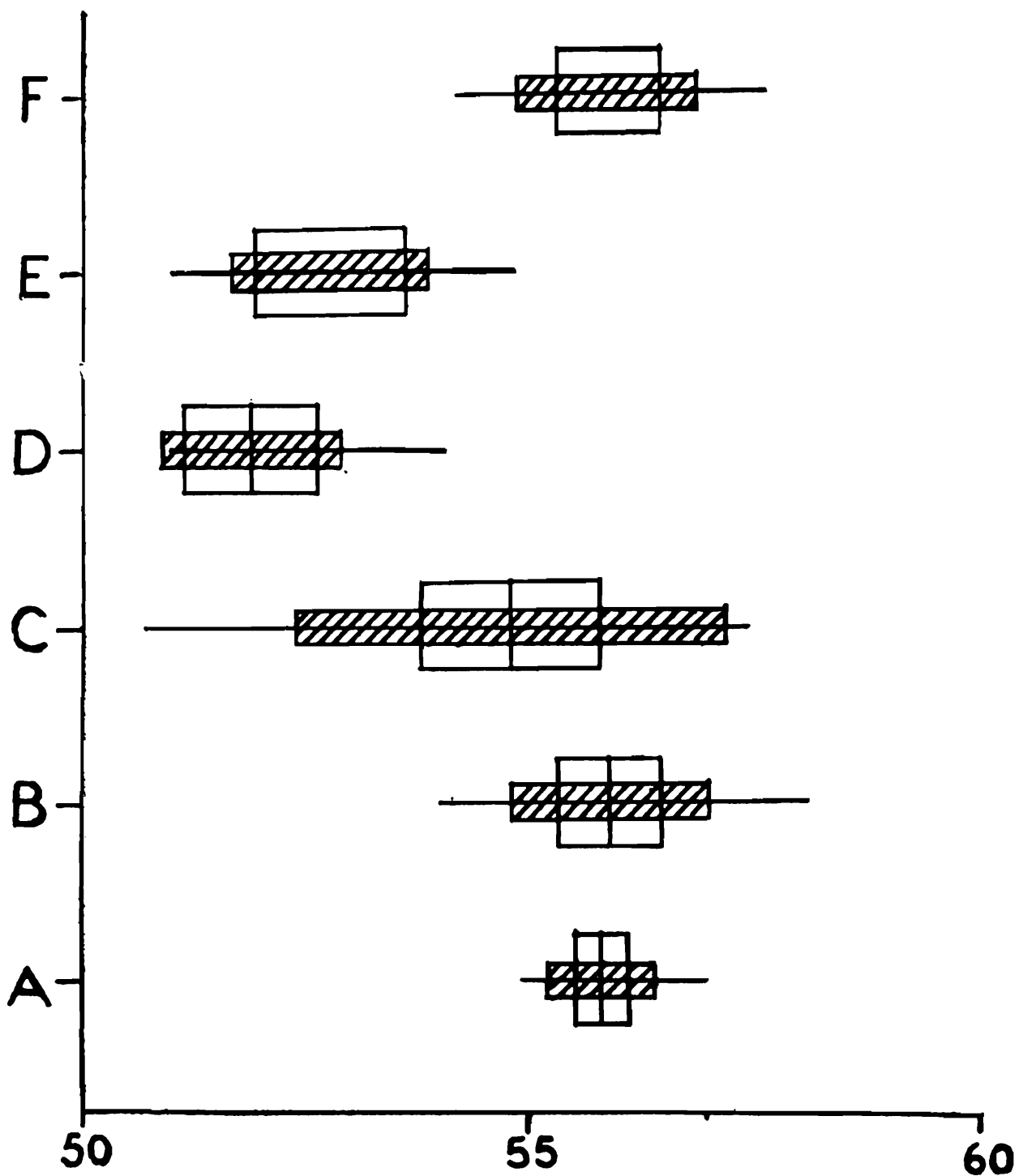


Fig. 8

Graphic representation of occipitonasal length (in mm) in six subspecies of *Callosciurus flavimanus*.

A, *C. f. shortridgei* ; B, *C. f. sladeni* ; C, *C. f. phayrei* ; D, *C. f. blanfordi* ; E, *C. f. rubex* ; F, *C. f. haringtoni*

crown. Ear whitish. Undersurface Tawny Ochraceous in three and Ochraceous Buff in two examples. A blackish brown lateral line of variable width runs from elbow to back of heel, which sharply demarcates dorsum from venter. Hands and feet pinkish Buff in four and dull white in one example. Hairs over the nail black. Entire tail uniform creamy white.

Skull similar to *rubex* but larger, occipitonasal length on average 55.9 ± 1 .

Remarks :

Moore and Tate (1965) found that out of the 40 specimens present in the American Museum of Natural History, New York, only eight have the black line (which demarcates the dorsal and ventral pelage) really strongly developed ; 29 specimens have weak and indistinct black line ; and in 12 the black line is absent. All these specimens were collected between March 20 and 27 and this clearly indicates that the presence or absence of the black line is not a seasonal phenomenon.

Distribution :

Burma : East bank of river Chindwin in the central part of Upper Chindwin district.

***Callosciurus flavimanus phayrei* (Blyth)**

(Table 2, 3, Fig. 9A, B)

Sciurus phayrei Blyth. 1855, *J. Asiat. Soc. Beng.*, 24 : 472, 476. (Martaban, at the mouth of the Salween River, Burma).

Sciurus blanfordii Blyth, 1862, *J. Asiat. Soc. Beng.*, 31 : 333. (Ava, 32 Km. Southwest of Mandalaya, Burma).

Callosciurus griseimanus heinrichi Tate, 1954, *Am. Mus. Novit.*, (1976) : 1. (Maymyo, Mandalay, Burma).

Material :

3 unsexed	Martaban, at the mouth of Salween river, Burma.	—
5 ♂, 2 ♀	Toungoo, Burma	Jan., Mar., Apr., May, Sep., Nov., Dec.
1 ♂, 1 ♀	Kollado, Salween Hill Tracts, Burma	Jan.
1 ♂, 1 ♀	Fort Stadman, Southern Shan States, Burma	Feb., Mar.
1 ♂	Heho, Southern Shan States, Burma	Mar.

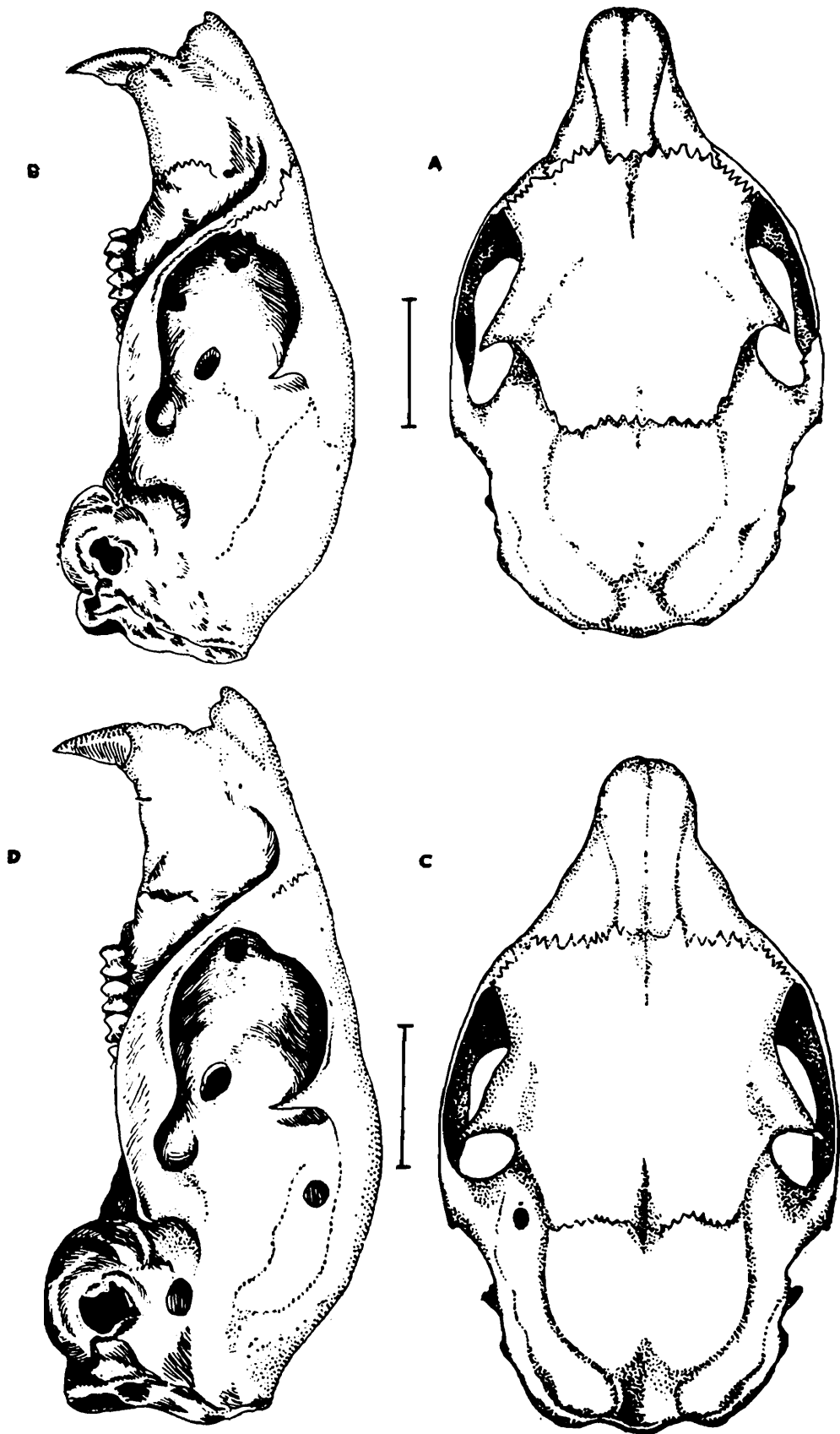


Fig. 9

- A. Dorsal view of skull of *Callosciurus flavimanus phayrei*
- B. Lateral view of skull of *C. f. phayrei*
- C. Dorsal view of skull of *C. f. shortridgei*
- D. Lateral view of skull of *C. f. shortridgei*

2 ♀	Gokteik, c 650 m, Northern Shan States, Burma	Apr.
2 ♂	Se'en, c 430 m, Northern Shan States, Burma	May
1 ♂, 1 ♀	Ngapyinin, Shwebe, Burma	Jul., Aug.
1 unsexed (syntype of <i>blanfordii</i>)	Ava, 32 Km. Southwest of Mandalay Burma	—
2 unsexed	(?) Pudeebye, Burma	Jan.

Description :

Medium-sized, head and body and tail on average 221 ± 9 and 230 ± 12 respectively. Hindfoot smaller than that in other subspecies, being on average less than 50.

Not much seasonal variation is found in colour of pelage. Hairs on back, facial region, ears and limbs State-Gray basally, then alternately ringed with light brown and olive bands. Hands and feet pale yellowish or Chinese Orange. Tail-tip black, but hairs on the remaining part of tail basally whitish, then alternately ringed with black and white bands; undersurface of tail provided with a median whitish or light Rufous line. Venter Orange-Buff or Buff but in some specimens the anal region Rufous and a small area around the mammae white. A blackish brown flank patch present, whose degree of development (area and intensity of colour) varies greatly but not seasonally correlated (Table 3). It is also not geographical as in the specimens of same locality (Toungoo) it is poorly developed in two and well-developed in other specimens. However, it may be related with age.

Skull similar to that of *haringtoni* but slightly smaller. A well developed interparietal present in the juvenile specimen.

Remarks :

Callosciurus f. blanfordi (Blyth) was maintained as a separate subspecies by Ellerman (1963) on the basis of a poorly developed flank patch and smaller skull. But from the table 3 it is obvious that development of the flank patch varies individually and is hardly of any taxonomic significance. Occipitonasal length in *blanfordi* is on average slightly smaller than that of *phayrei* but not holding good even at one standard deviation from the mean (Fig. 8). Combined width of the frontals in *blanfordi* is somewhat narrower than that of *phayrei*, but with marked overlap. Thus, I support Moore and Tate (1965) in treating *blanfordi* as a synonym of *phayrei*.

Moore and Tate (1965) treated *phayrei* as a distinct species on the basis of a number of colour characters, such as the black tail-tip, presence of flank patch, etc. But these characters are used only for subspecific differentiation in the genus *Callosciurus*. Therefore, I would treat *phayrei* as a subspecies of *C. flavimanus*. However, as regards the structure of baculum, it is very different from other subspecies of *C. flavimanus* and comes closer to *C. pygerythrus*. Difference in the structure of baculum definitely indicate reproductive isolation, but I could not be able to study the baculum of the specimen from the type locality of *phayrei* or *blanfordi*, so at the moment for the sake of convenience I have kept *phayrei* as a subspecies.

Distribution :

Burma : This subspecies appears to inhabit chiefly the rain forest from Martaban at the mouth of Salween River north to about Toungoo district, and the strip of tropical deciduous forest along the escarpment of the Shan Highlands from about Toungoo north to at least 80 Km. north of Mandalay.

***Callosciurus flavimanus shortridgei* Thomas and Wroughton**

(Table 2, Fig. 9C, D).

Callosciurus sladeni shortridgei Thomas and Wroughton, 1916, *J. Bombay nat. Hist. Soc.*, 24 : 232. (Minsin, Upper Chindwin, Burma).

Material :

2 ♂, 2 ♀ Hkamti, Upper Chindwin, Burma

Jul., Aug.

Description :

Large-sized ; head and body, tail and hindfoot on average 238 ± 7.5 , 264 ± 22 and 58 ± 1.5 respectively.

Hairs on the back, limbs and facial region basally slaty and then alternately ringed with broad brown and narrow black bands. Hairs on the sides of the body woolly and basally dull white. Hands and feet yellowish or pale brownish. Undersurface light Ochraceous. A small area around mammae pale yellowish. About 5 cm. of tail-tip light Ochraceous, hairs on the remaining part of the tail basally light brown and then annulated with alternate narrow black and broad brown bands.

Skull similar to that of *haringtoni*. Occipitonasal length on average 55.8 ± 0.6 .

Distribution :

Burma : Extreme northern part of Upper Chindwin.

Key to the identification of the above listed subspecies of *Callosciurus flavimanus* is given below.

- | | |
|---|------------------------------|
| 1. Tail-tip black. | ... <i>C. f. phayret</i> |
| Tail-tip not black. | 2 |
| 2. Skull small, occipitonasal length on average less than 53. | ... <i>C. f. rubex</i> |
| Skull large, occipitonasal length on average more than 53. | 3 |
| 3. Back Cream Buff to almost white. | ... <i>C. f. haringtoni</i> |
| Back not Cream Buff or white. | 4 |
| 4. Back darker, more gray, face conspicuously Ochraceous. | ... <i>C. f. sladeni</i> |
| Back paler, more brown, face not ochraceous. | ... <i>C. f. shortridgei</i> |

Callosciurus caniceps (Gray)

Sciurus caniceps Gray, 1842, *Ann. Mag. nat. Hist.*, 10 : 269. (North Tenasserim Burma).

Diagnosis :

Medium-sized species, head and body on average more than 200. Tail generally smaller than head and body except in the nominate subspecies. Undersurface never strikingly coloured. Combined width of frontals usually more than one-third of the occipitonasal length. Upper incisors very generally tending to be proodont. Zygomatic plate rarely heavily ridged. Baculum less specialised and structurally similar to that of the *C. erythraeus* except in *C. c. bimaculatus* (Temminck) where it is more specialised like that of the *C. pygerythrus* (I. Geoffroy).

Callosciurus caniceps caniceps (Gray)

(Table 4, Fig. 10A, B)

Sciurus caniceps Gray, 1842, *Ann. Mag. nat. Hist.*, 10 : 263. (North Tenasserim, Burma).

Sciurus chrysonotus Blyth, 1846, *J. Asiat. Soc. Beng.*, 16 : 873. (Tenasserim Valley, Burma).

Sciurus epomophorus fluminalis Wroughton and Robinson, 1911, *J. fed. Malay St. Mus.*, 4 : 233. (Meping Island, Thailand).

Sciurus epomophorus inexpectatus Kloss, 1916, *J. nat. Hist. Soc. Siam*, 2 : 178. (Koh Lak, Pran, southwest Thailand).

Sciurus helgei Gyldenstolpe, 1917, *Kungl. Svensk. Vet. Handl.*, 57 : 34. (Koh Lak, Pran, southwest Thailand).

Sciurus caniceps helvus Shamcl, 1930, *J. Mammal.*, 11 : 72. (Koh Tau, Thailand).

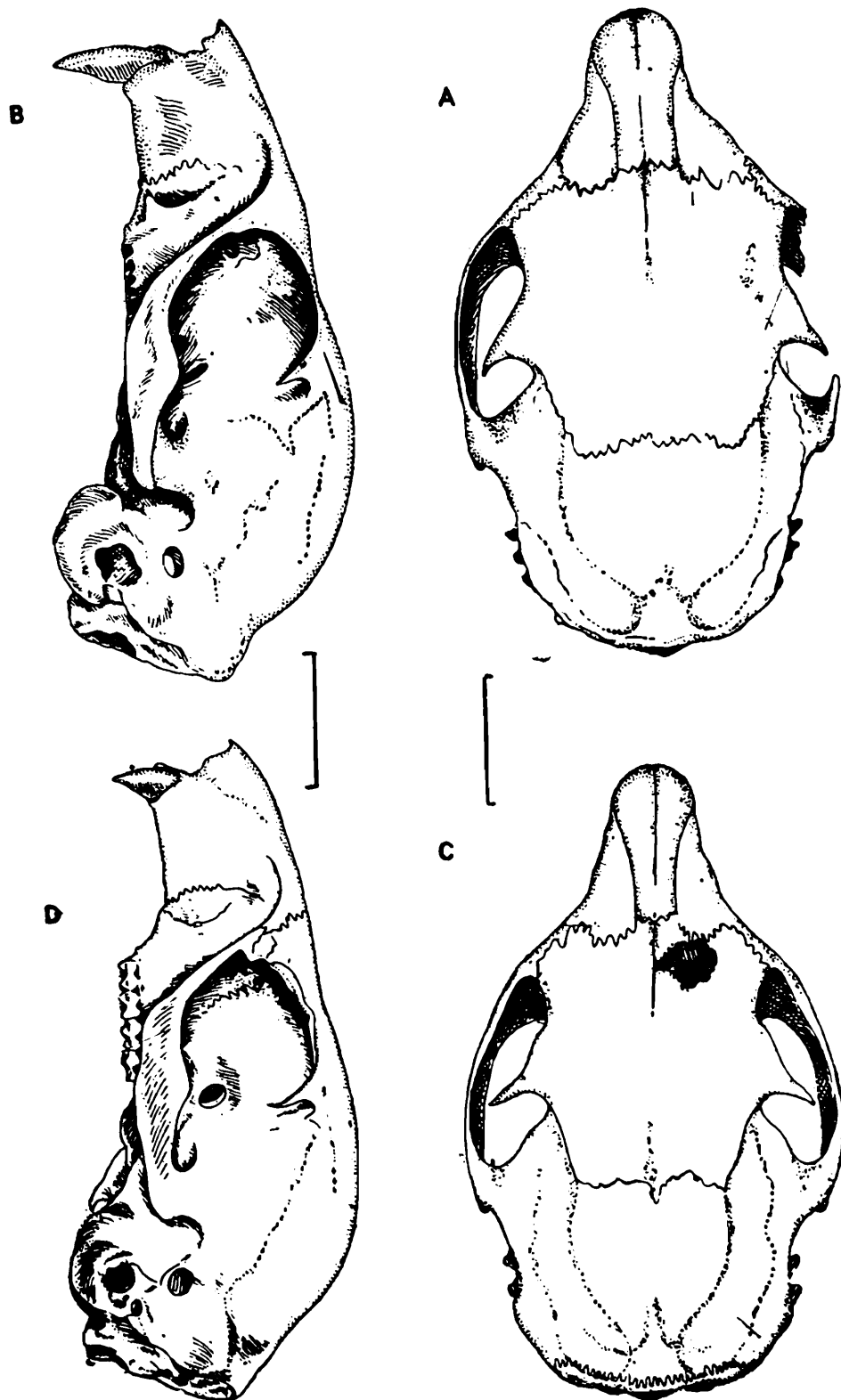


Fig. 10

- A. Dorsal view of skull of *Callosciurus caniceps caniceps*
- B. Lateral view of skull of *C. c. caniceps*
- C. Dorsal view of skull of *C. c. concolor*
- D. Lateral view of skull of *C. c. concolor*

Material :

4 Unsexed (syntypes of <i>chrysonotus</i>)	Tenasserim Valley, Burma	—
4 ♂, 2 ♀, 8 unsexed	Moulmein Dist., Burma	5 specimens of October.
2 unsexed	Burma	—

Description :

Medium-sized, head and body on average 219 ± 14 . Tail longer than head and body, on average 234 ± 7 .

Dorsal colour very variable, in the undated specimens (probably of dry season) it is golden orange ; in four October specimens golden orange colour restricted to the posterior part of the dorsum as a patch, while in another taken in the same month there is merely a tinge of golden orange on the posterior half and all the pelage grizzled with gray and pale yellowish bands. Underface dirty white. Tail dark brown.

Skull structurally similar to that of the *C. e. erythraeus* but much smaller in all respects, and upper incisors tending to be proodont. Occipitonasal length on average 54.6 ± 1.4 .

Remarks :

From an examination of a large number of dated specimens, Moore and Tate (1965) stated that the orange colored dorsal pelage of this subspecies changes to agouti gray seasonally. According to them in the dry season (November to April or May) the dorsal pelage is more often orange, but in rainy season (June to October) it is more often gray. Askins (1977) have also found that in north and northeast Thailand during the cold and dry seasons specimens have bright orange-rufous back, neck and nape contrast with the dark silver-gray nose, feet and tail and the light silver-gray underparts, while the specimens taken in the rainy season have gray underparts usually with a slight suffusion of reddish brown, and reddish brown patches behind the ears. Population from the rainshadow area in southwest Thailand do not show obvious seasonal changes and Moore and Tate (1965) considered this population as intermediate between *bimaculatus* and *caniceps*. However, according to Askins (1977) most of the specimens are distinct from both *bimaculatus* and *caniceps* and they may eventually considered as a separate subspecies.

Ellerman and Morrison-Scott (1951) treated *inexpectatus* Kloss as a separate subspecies and kept *helgei* Gyldenstolpe as its synonym. Moore

and Tate (1965) and Askins (1977) treated both of them as synonyms of the nominate subspecies. I have neither specimens of *inexpectatus* nor of *helgei* to examine and so, I have followed Moore and Tate (1965) regarding their taxonomic status.

Distribution :

Burma : North Tenasserim and Moulmein district. Thailand : North of Prachuap, except for much of the eastern part of the northeast ; also, Koh Tao off the eastern coast of Peninsular Thailand.

According to Gyldenstolpe (1914) in Thailand this subspecies is common only in the bamboo-forests in the north and seemed to live in rather high altitudes.

Callosciurus caniceps concolor (Blyth)

(Table 4, Fig. 10C, D)

Sciurus concolor Blyth, 1855, *J. Asiat. Soc. Beng.* 24 : 274. (From the vicinity of Malacca, Malaysia).

Sciurus caniceps adangensis Miller, 1908, *Smithson. Misc. Collns.*, 45 : 17. (Adang Island, Butang Island, southwestern Thailand).

Sciurus concolor terutavensis Thomas and Wroughton, 1909, *Ann. Mag. nat. Hist.*, (8) 4 : 535. (Telok Udang, Teratau Island, Thailand).

Callosciurus erubescens Cabrera, 1917, *Boln, R. Soc. esp. Hist. nat.*, 17 : 518. (Selanger, Malaysia).

Callosciurus concolor telibius Thomas and Robinson, 1921, *Ann. Mag. nat. Hist.*, (9) 7 : 121. (Pulau Telibun, Trang, southeastern Thailand).

Callosciurus moheius Thomas and Robinson, 1921, *Ann. Mag. nat. Hist.*, (9) 7 : 122. (Northern half of Pulau Mohea, c. 48 km. east of Thailand coast).

Callosciurus moheius mohillius Thomas and Robinson, 1921, *Ann. Mag. nat. Hist.*, (9) 7 : 122. (Southern half of Pulau Mohea, Thailand).

Material :

1 unsexed (holotype of <i>concolor</i>)	Vicinity of Malacca, Malaysia	—
2 unsexed	Perak, Malaysia	—
1 ♂, 1 ♀	Bentong, Pahang, Malaysia	Female of Jan.
1 unsexed	Nyalas, Malacca, Malaysia	Oct.
1 ♂	Klang Gates, Selanger, Malaysia	Jan.
2 ♀	Bukit Jong, Trengganu, Malaysia	Sep.
1 ♂, 1 ♂	Pulau Teratau, Thailand	Feb., Dec.
1 ♂, 1 ♀	Pulau Rewi, Butang Islands, southeastern Thailand	Apr., Nov.

Description :

Small-sized ; head and body, tail and hindfoot on average 205 ± 7 , 199 ± 16.5 and 44 ± 1.5 respectively. Ear on average smaller than that of the other subspecies.

A Buff spot behind each ear present in the holotype which was not mentioned in the earlier literature. Dorsum of all the specimens similar to that of the holotype except in the intensity of dull ruddy Ferruginous tinge. In the female specimen from Bentong this tinge is very conspicuous but restricted to the posterior part of back ; in specimens from Pulau Teratau and Pulau Rawi, Ferruginous tinge restricted to the region of head and thigh only, while in remaining examples it is uniformly diffused all over the dorsum. Tail-tip in five specimens blackish, mingled with hoary white, while in others markedly dark brown ; remaining part of tail has hairs basally buffy, then annulated with pale brown and black bands, but total number of bands less than nine. In eight specimens, a medium Buff line could be noticed on the ventral side of tail. Undersurface in six specimens including those of Pulau Teratau and Pulau Rawi uniform silvery gray and similar to that of the holotype of *concolor*, but in remaining specimens there is dark gray median line like that of *C. c. bimaculatus* (Temminck).

Skull much smaller than that of nominate subspecies, occipitonasal on average 50.5. Frontal relatively narrow, combined width of which almost subequal to the length of orbit.

Remarks :

Moore and Tate (1965) treated *C. c. adangensis* (Miller) as a distinct subspecies occurring in the area of intergradation between *concolor* and *bimaculatus* and differing from both in having a broad Buff medium line along the ventral side of the tail. Askins (1977) also followed Moore and Tate (1965). But the presence of such stripe is a common feature in squirrels, and is present in most of the specimens of *bimaculatus* and *concolor*, and is obscured in some specimens during making of the study skins. In fact, topotypes of *adangensis* can not be distinguished from series of *concolor* specimens and thus treated here as a synonym.

Distribution :

Malaysia : Malay Peninsula (Patani southwards). Thailand : Lower Peninsula north to about Trang and islands of southwestern Peninsula.

Callosciurus caniceps shanicus (Ryley)

(Table 4, Fig. 11A, B)

Sciurus atrodorsalis shanicus Ryley, 1914, *J. Bombay nat. Hist. Soc.*, 22 : 263.
(Gokteik, c 650 m, Northern Shan States, Burma).

Material :

2 ♂, 1 ♀	Gokteik, c 650 m, Northern Shan States, Burma	Apr.
1 ♀	Hsipaw, c 413 m, Northern Shan States, Burma	Jan.
1 unsexed	Mongha, Northern Shan States, Burma	Apr.
4 ♂	Pyaunggaung, c 851 m, Northern Shan States, Burma	May
2 ♂, 1 ♀	South-east of Maymyo, Mandalay, Burma	Apr., Jul.
1 ♂, 1 ♀	Kalaw, c 1300 m, Southern Shan States, Burma	Jun., Oct.

Description :

Small-sized ; head and body, tail and hindfoot on average 206 ± 10 , 185 ± 12.5 and 47 ± 2.2 respectively.

Colour of dorsum variable, normally agouti gray. In six specimens of April, May and July a blackish patch present on the posterior part of back. Facial region Orange-Buff or Buff-Yellow. Tail-tip dark gray with a few yellowish hairs ; hairs on the remaining part of tail generally annulated with black and pale yellow bands, but in the specimen collected in October, pale yellow bands are replaced by Rufous ones. Venter brighter than in other subspecies as the hairs Slate-Gray on bases and Buff or Orpiment Orange at tips. Undersurface of limbs concolorous with the belly, but in three a tendency to become brighter is marked.

Skull structurally similar to that of the nominate subspecies but smallest of all the subspecies discussed in this paper. Occipitonasal length on average 49.5 ± 1.2 and differs from that of other subspecies except *concolor* by more than one standard deviation from the mean (Fig. 12). From *concolor* it differs by the smaller length of orbit and the difference is significant by more than one standard deviation from the mean.

Remarks :

Moore and Tate (1965) treated *shanicus* as a subspecies of *C. flavimanus* without giving any convincing reason. It comes nearer to *C. caniceps* by having hands and feet concolorous with the limbs, venter not

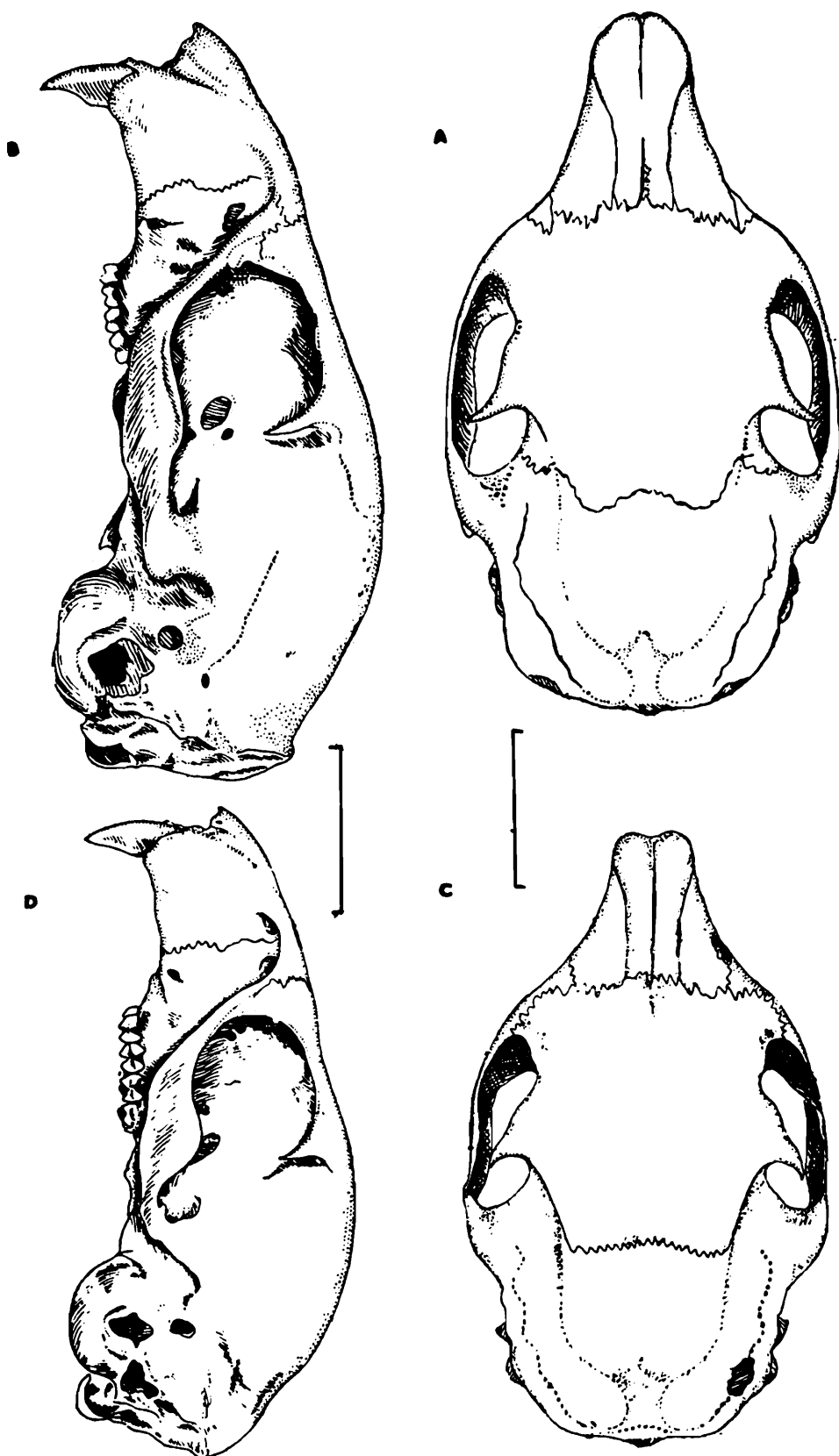


Fig. 11

- A. Dorsal view of skull of *Callosciurus caniceps shanicus*
- B. Lateral view of skull of *C. c. shanicus*
- C. Dorsal view of skull of *C. c. bimaculatus*
- D. Lateral view of skull of *C. c. bimaculatus*

being very bright and the tendency of upper incisors becoming proodont. Thus, I agree with Ellerman (1963) in treating *shanicus* as a subspecies of *C. caniceps*.

Distribution :

Burma : Shan highlands and Mandalay district. Ellerman (1963) included Tavoy district within its range, which I think is doubtful.

Callosciurus caniceps bimaculatus (Temminck)

(Table 4, Fig. 11C, D)

- Sciurus bimaculatus* Temminck, 1859, *Equisses Zool. Cote, de Guine*, p. 251. (Peninsula of Malacca).
- Sciurus epomophorus* Bonhote, 1901, *Ann. Mag. nat. Hist.*, (7) 7 : 272. (Selanga, Thailand).
- Sciurus caniceps davisoni* Bonhote, 1901, *Ann. Mag. nat. Hist.*, (7) 7 : 273. (Bankachon, South Tenasserim, Burma).
- Sciurus matthaeus* Miller, 1903, *Smithson. Misc. Collns.*, 45 : 19. (St. Matthew's Island, Burma).
- Sciurus lucas* Miller, 1903, *Smithson. Misc. Collns.*, 45 : 20. (St. Luke Island, Burma).
- Sciurus epomophorus milleri* Robinson and Wroughton, 1911, *J. Fed. Malay. St. Mus.*, 4 : 233. (Trang, Thailand).
- Sciurus caniceps fallax* Robinson and Kloss, 1914, *Ann. Mag. nat. Hist.*, (8) 13 : 225. (Pennan or Pangnan Island, Thailand).
- Callosciurus epomophorus panjius* Thomas and Robinson, 1921, *Ann. Mag. nat. Hist.*, (9) 7 : 119. (Panjang Island, Thailand).
- Callosciurus epomophorus nakanus* Thomas and Robinson, 1921, *Ann. Mag. nat. Hist.*, (9) 7 : 120. (Naka Island, Thailand).
- Callosciurus epomophorus mapravis* Thomas and Robinson, 1921, *Ann. Mag. nat. Hist.*, (9) 7 : 120. (Maprau Island, Thailand).
- Callosciurus epomophorus panjioli* Thomas and Robinson, 1921, *Ann. Mag. nat. Hist.*, (9) 7 : 120. (Panjang Anak Island, Thailand).
- Callosciurus epomophorus pipidonis* Thomas and Robinson, 1921, *Ann. Mag. nat. Hist.*, (9) 7 : 121. (Pipidon Island, Thailand).
- Callosciurus epomophorus tabaudius* Thomas, 1922, *J. Bombay nat. Hist. Soc.*, 28 : 1067. (Tavoy Island, Burma).
- Callosciurus epomophorus hastalis* Thomas, 1923, *J. Bombay nat. Hist. Soc.*, 29 : 377. (Hastings Island, Burma).

Material :

2 ♂	Kisseriang Island, Mergui, Archipelago, Burma	Jan.
1 ♂, 1 ♀	King's Island, mergui Archipelago, Burma	Sep., Nov.
1 ♂, 1 ♀, 3 unsexed	Mergui Dist., Burma	Mar., Apr., Sep., Dec.
2 ♂, 2 ♀	Nathaymine, Mergui Dist., Burma	Apr.
2 ♂, 1 ♀	Bankachon, South Tenasserim, Burma	Apr., Dec.
1 ♂	Tagoot, South Tenasserim, Burma	Apr.
1 ♂, 1 ♀	Victoria Point, South Tenasserim, Burma	Nov.
1 ♂, 1 ♀	South Tenasserim, Burma	Mar.
1 ♂, 1 ♀	Pennan Island, Thailand	May
1 ♂	Lam-ra, Trang, Thailand	Jan.
1 ♀	Krongman, Trang, Thailand	Feb.

Description :

Large-sized ; head and body, tail and hindfoot on average 232 ± 10 , 219 ± 13 and 48.5 ± 3.5 respectively.

Hairs on back and facial region basally slaty, then alternately ringed with Buff and black bands ; in two specimens (March and December), Buff bands replaced by Ochraceous-Rufous. On the sides of the body, Buff bands replaced by Tawny Ochraceous. A brownish flank-patch present or at least indicated in most of the specimens examined. Hands and feet grizzled black and white. Colour of the tail-tip varies individually, dark brown in three, brown in four and pale brown in other specimens irrespective of localities. On the remaining portion of tail, hairs slaty on base, then alternately ringed with Buff and dark gray bands ; number of bands never exceeding nine. Ventral surface gray with a faint medial Broccli Brown streak.

Bacula of three specimens (from King's Island, Nathaymine and Kisseriang Island) were examined and found to be structurally similar to that of *C. pygerythrus*.

Skull very similar to that of the nominate subspecies except in the length of orbit which is slightly smaller on average. Occipitonasal length on average 55.6 ± 1.2 .

Remarks :

From the structure of the baculum it appears that this subspecies may not be related to the species with narrow-bladed baculum. However, as the bacula of specimens from only three different localities of such a widely distributed subspecies were examined, at present it is maintained under *C. caniceps*.

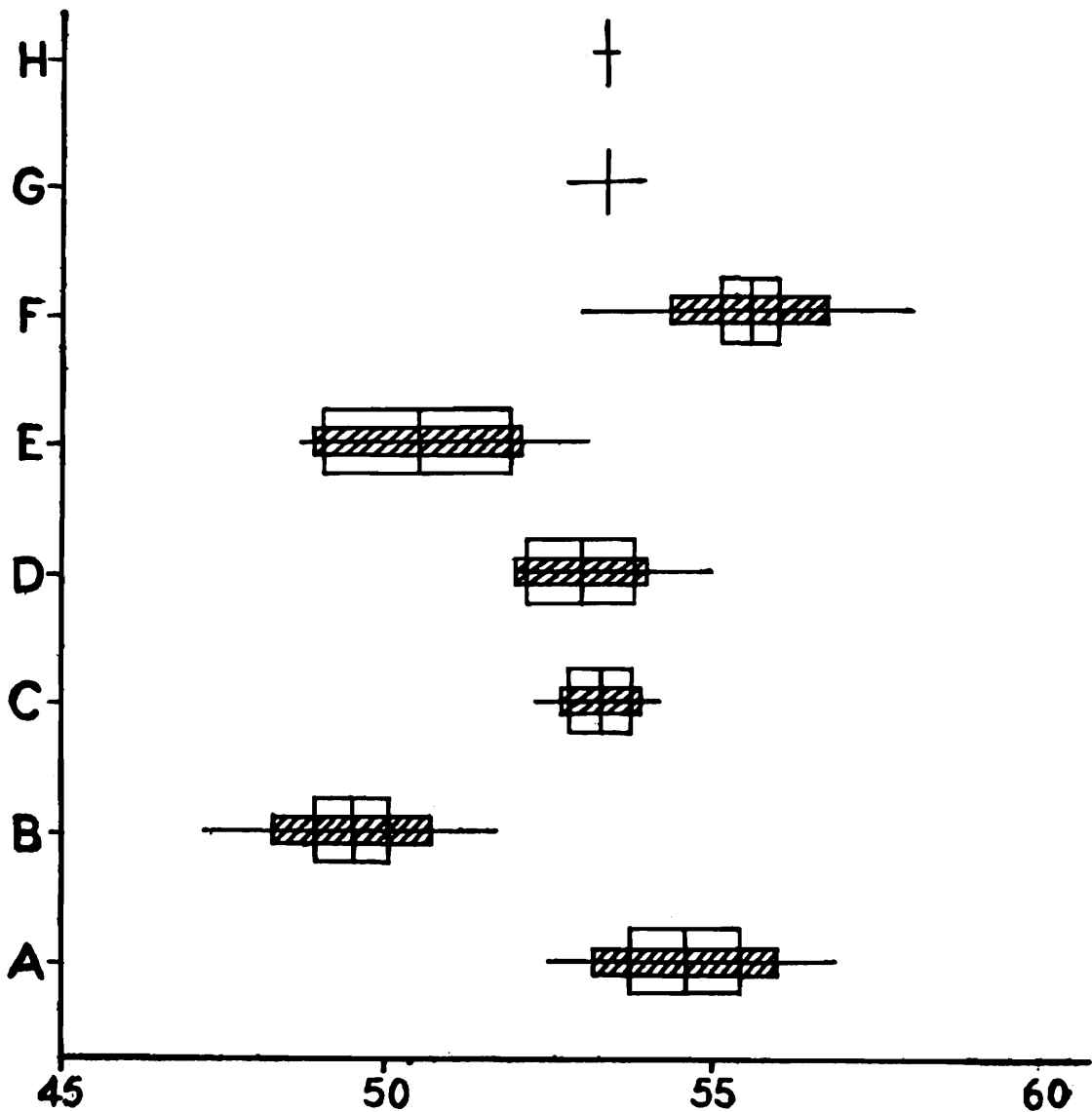


Fig. 12

Graphic representation of occipitonasal length (in mm) in eight subspecies of *Callosciurus caniceps*.

A, *C. c. caniceps* ; B, *C. c. shanicus* ; C, *C. c. sullivanus* ; D, *C. c. crumpi* ; E, *C. c. concolor* ; F, *C. c. bimaculatus* ; G, *C. c. lancavensis* ; H, *C. c. samuiensis*

Moore and Tate (1965) and Askins (1977) maintained *C. c. fallax* (Robinson and Kloss) as a separate subspecies on the basis of its pale tail-tip. But the specimens from Bankachon have similar pale tail-tip and are indistinguishable from topotypical specimens of *fallax*. Thus, *fallax* is treated here as a synonym of *bimaculatus*. The specimens of *C. c. milleri* (Robinson and wroughton) present in the ZSI collection also shows no difference from those of *bimaculatus* having brown tail-tip. Thus, *milleri* was rightly treated as a synonym of *bimaculatus* by Moore and Tate (1965).

Distribution :

Burma : South Tenasserim, Mergui district, Mergui Archipelago (Kisseriang Island, King's Island, Tavoy Island, Hasting's Island, James

Island, Clara Island, Sir John Makolm Island, St. Matthew Island, St. Luke Island). Thailand : Peninsular Thailand, Salanga Island, Pennam Island, Panjong Island, Naka Island, Maprau Island, Panjang Anak Island, Takopah Island, Pipidon Island, Piam Island, Pasir Raja Island, Tongka Island. Malaysia : Penninsula of Malacca.

***Callosciurus caniceps lancavensis* (Miller)**

(Table 4)

Sciurus lancavensis Miller, 1903, *Smithson. Misc. Collns.*, 45 : 16. (Lankawi Island, Lower Penninsular Thailand).

Material :

1 ♂, 1 ♀ Lankawi Island, Lower Peninsular Thailand Feb., Mar.

Description :

Dorsum grizzled with black, dull Ferruginous and white. Ferruginous tinge a little more prominent in the female specimen. Only the extreme tip of tail dark brown, hairs on the remaining part of tail annulated with brownish yellow and black bands ; there are at least 11 such bands in each hair.

Skull similar to that of nominate subspecies.

Remarks :

Moore and Tate (1965) treated *lancavensis* as intermediate between *concolor* and *bimaculatus*, due to its sharply marked dark brown tail-tip like many specimens of *bimaculatus*, and Ferruginous tinge on the dorsum like *concolor*. Askins (1977) also treated *lancavensis* as a synonym of *concolor*. However, I found that *lancavensis* differs from both of them in the number of bands on the tail hairs, which are at least 11 as against nine or less in the other two subspecies. Moreover, dark brown region of tail-tip is very small in this subspecies as compared with that of *bimaculatus*. I would, therefore, maintain *lancavensis* as a distinct subspecies.

Distribution :

Known only from the type-locality.

***Callosciurus caniceps samuiensis* (Robinson and Kloss)**

(Table 4)

Sciurus concolor samuiensis Robinson and Kloss, 1914, *Ann. Mag. nat. Hist.*, (8) 13 : 226. (Samui Island, off Bandon, Thailand).

Material :

1 ♂, 1 ♀ Samui Island, Off Bandon, Thailand May

Description :

Hairs on back and limbs grizzled black, pale yellow and pale Rufous. Nape, sides of the body, cheek and inguinal region distinctly Ochraceous. Hairs on the forehead short and annulated with black and dull white bands. Feet slightly paler than limbs. Tail-tip black, remaining portion of tail has hairs with black and whitish bands. Undersurface of female specimen silvery gray, but in male dull gray. A mid ventral agouti stripe present in both specimens.

Skull similar to that of the nominate subspecies.

Remarks :

Moore and Tate (1965) synonymized *samuiensis* with *bimaculatus*, but the former differs from the latter by the distinct Ochraceous shade on the nape, sides of the body and the inguinal region. This Ochraceous shade is reported by Robinson and Kloss (1915b) to be constant in a series of 40 specimens from Samui Island. I would, therefore, treat *samuiensis* as a distinct subspecies.

Distribution :

Known only from the type-locality.

***Callosciurus caniceps sullivanus* (Miller)**

(Table 4)

Sciurus sullivanus Miller, 1908, *Smithson. Misc. Collns.*, 45 : 17. (Sullivan's Island, Mergui Archipelago, Burma).

Material :

1 ♂, 1 ♀	Sullivan's Island, Mergui Archipelago, Burma	Feb., Mar.
3 ♀	Pilai, Elphinstone Island, Mergui Archipelago, Burma	—

Description :

Large-sized ; head and body on average 224 ± 10 .

In females, hairs on back annulated with broad Ochraceous, narrow pale yellow and gray bands making the dorsum distinctly Ochraceous. Back of male specimen is grayish as the gray bands of the hairs are

broad. Head grayish in both sexes. Ventral surface dull gray, but with Rufous tinge on the posterior part. Sides of body and cheek distinctly Saturn Red. Tail-tip dark brown.

Skull similar to that of the nominate subspecies except in the length of orbit which on average slightly smaller.

Remark :

Moore and Tate (1965) regarded *sullivanus* as a synonym of *bimaculatus*. But the distinct Saturn Red coloration of the cheek and sides of the body of all the five specimens warrants its validity.

Distribution :

Burma : Mergui Archipelago (Elphinstone and Sullivan's Islands).

Callosciurus caniceps crumpi Wroughton

(Table 4)

Callosciurus caniceps crumpi Wroughton, 1916, *J. Bombay nat. Hist. Soc.*, 24 : 425.
(Sedenchon, c 2000 m, Sikkim).

Material :

2 ♂, 1 ♀, Sedenchon, c. 2000 m, Sikkim Nov.
1 subadult ♀

Description :

Small-sized ; head and body on average 206 ± 4 . Hindfoot relatively longer, on average 49.5 ± 1.4 .

There are some differences in the colour of adult and subadult specimens as described below :

Subadult ♀—Hairs on back grizzled yellow and black. Nasal region distinctly reddish brown. Hands and feet dark gray. Ventral surface grayish with a reddish brown tinge on the middle.

Adult—Entire dorsum except tail-tip reddish brown and in the facial region reddish brown tinge more prominent. Tail-tip black. Outer side of belly reddish, rest of undersurface gray. A white patch of about 16 sq. mm. area present on the head of female specimen, probably a case of partial albinism.

Skull similar to that of nominate subspecies, except in the length of orbit which is on average smaller.

Remarks :

Moore and Tate (1965) treated *crumpi* as a synonym of *C. erythraeus* with which it resembles superficially. But it differs from *C. erythraeus* by the gray undersurface and tendency of upper incisors being proodont, and it comes closer to *C. caniceps* also by these two characters. Thus, *crumpi* is treated here as a separate subspecies of *C. caniceps*.

Distribution :

India : Sikkim.

Key to the identification of the above listed subspecies of *Callosciurus caniceps* is given below.

- | | | |
|--|------------------------------|---|
| 1. Occipitonasal and frontal less than 51 and 18 respectively. | ... | 2 |
| Occipitonasal and frontal more than 52 and 19 respectively. | ... | 3 |
| 2. Undersurface brighter, being Buff or Orpiment Orange, dorsum without any Ferruginous tinge. | ... <i>C. c. shanicus</i> | |
| Undersurface duller, being silvery gray, dorsum with a Ferruginous tinge. | ... <i>C. c. concolor</i> | |
| 3. Dorsum with a golden tinge or golden patch. | ... <i>C. c. caniceps</i> | |
| Dorsum without a golden tinge or golden patch. | ... | 4 |
| 4. Facial region distinctly raddish brown. | ... <i>C. c. crumpi</i> | |
| Facial region not reddish brown. | ... | 5 |
| 5. Cheek and sides of body brightly coloured. | ... | 6 |
| Cheek and sides of body not brightly coloured except in the region of flank. | ... | 7 |
| 6. Cheek and sides of body Ochraceous. | ... <i>C. c. samuiensis</i> | |
| Cheek and sides of body Saturn Red. | ... <i>C. c. sullivanus</i> | |
| 7. Hairs of tail have 11 or more bands. | ... <i>C. c. lancavensis</i> | |
| Hairs of tail have nine or less number of bands. | ... <i>C. c. bimaculatus</i> | |

***Callosciurus pygerythrus* (I. Geoffroy)**

Sciurus pygerythrus I. Geoffroy, 1831, in Belanger, *Voy. Indes Orient. Zool*, 145. (Pegu, Burma).

Diagnosis :

Small-sized, head and body on average less than 200. Tail usually smaller than head and body.

Colour typically duller than in the three species discussed earlier. Seasonal flash mark in the pelage of thigh contrasts with the ordinary agouti dorsal surface by being lighter.

Skull smaller than those of the three species discussed above; occipitonasal length less than 50. Frontal generally approximates to one-third of occipitonasal or less. There is a tendency for the zygomatic plate to be more powerfully ridged than in the three species discussed earlier. The incisors generally tend to be projected forward.

Baculum compound, specialised, being broad-bladed.

Callosciurus pygerythrus pygerythrus (I. Geoffroy)

(Table 5, Fig. 13A, B)

Sciurus pygerythrus I. Geoffroy, 1831, in Belanger, *Voy. Indes Orient. Zool.*, 145. (Pegu, Burma).

Material :

2 ♂, 4 unsexed	Rangoon, Burma	Jan., 2 undated
1 unsexed	Lower Pegu, Burma	—
2 ♂	Tamabin, 40 km. north of Pegu, Burma	Jan., May
1 ♂, 2 ♀	48 to 56 km. southeast of Prome, Burma	Jan., Oct.
1 ♂	Prome, Burma	—
1 ♀	48 km. northwest of Toungoo, Burma	Jan.
1 ♀	Toungoo, Burma	Nov.
1 unsexed	Burma	—

Description :

Head and body ; tail and hindfoot on average 179 ± 9 , 175 ± 10 and 43 ± 2 respectively.

Dorsum including facial region speckled olive brownish to grayish. Colour of hands and feet variable, often tending to be yellowish and slightly paler than that of limbs. Tail with a short but distinct black tip ; hairs on the remaining portion of tail have alternate black and light brown bands. Ventral surface varies from light reddish to Orange-Buff, but throat region always lighter. Hip-patch whitish and found in the skins of May and October.

Skull, structurally does not differ greatly from that of *C. e. erythraeus*. but much smaller. Occipitonasal length on average 45.8 ± 13 . Frontal

narrow and less than one-third of occipitonasal except in three out of 11 skulls examined where it is a little more. Orbit subequal to frontal. In some skulls, parietal ridges unite to form a short but well-developed sagittal crest. Nasal on average smaller than that in the other subspecies except in *C. p. janetta* (Thomas). Upper first molar relatively small.

Distribution :

Burma : Pegu, Rangoon and Toungoo districts.

***Callosciurus pygerythrus janetta* (Thomas)**

(Table 5, Fig. 13C, D)

Sciurus pygerythrus janetta Thomas, 1914, *J. Bombay nat. Hist. Soc.*, 23 : 203. (Mandalay, Burma).

Material :

2 ♂	Yin, Lower Chindwin, Burma	Jun.
1 ♂, 1 ♀	Mount Popa, Myingyan, Burma	Sep.
1 ♂	Kyouk Myoung, Shwebo, Burma	Jul.
2 ♂, 2 ♀	Mingum, Sagaing, Burma	Jan., Oct.
1 juv. ♀	Mandalay, Burma	—
2 ♀, 1 unsexed	Burma	Jan., 1 undated

Description :

Head and body, tail and hindfoot on average 189 ± 10 , 179 ± 12 and 43.5 ± 2.5 respectively. Ear on average slightly larger than in other subspecies but the difference is not significant even at one standard deviation from the mean.

Dorsum slightly paler than in nominate subspecies, being suffused with Buff. Hands and feet almost white in most of the specimens, but in some mixed with black hairs. Tail-tip black, hairs on remaining part of tail with alternate narrow black and broad white or light brown bands ; a few hairs on ventral surface of tail entirely white or light brown. Ventral surface varies from whitish to Buff, but in a specimen from Mingum sides olivaceous. A broad white hip-patch present in six specimens.

In juvenile specimen, entire body covered with cream-coloured fur.

Skull small, occipitonasal length on average 45.8 ± 1.1 Upper first molar larger than that of nominate subspecies. Nasal shortest of all the subspecies. Frontal always less than one-third of occipitonasal. Orbit a little more than frontal width.

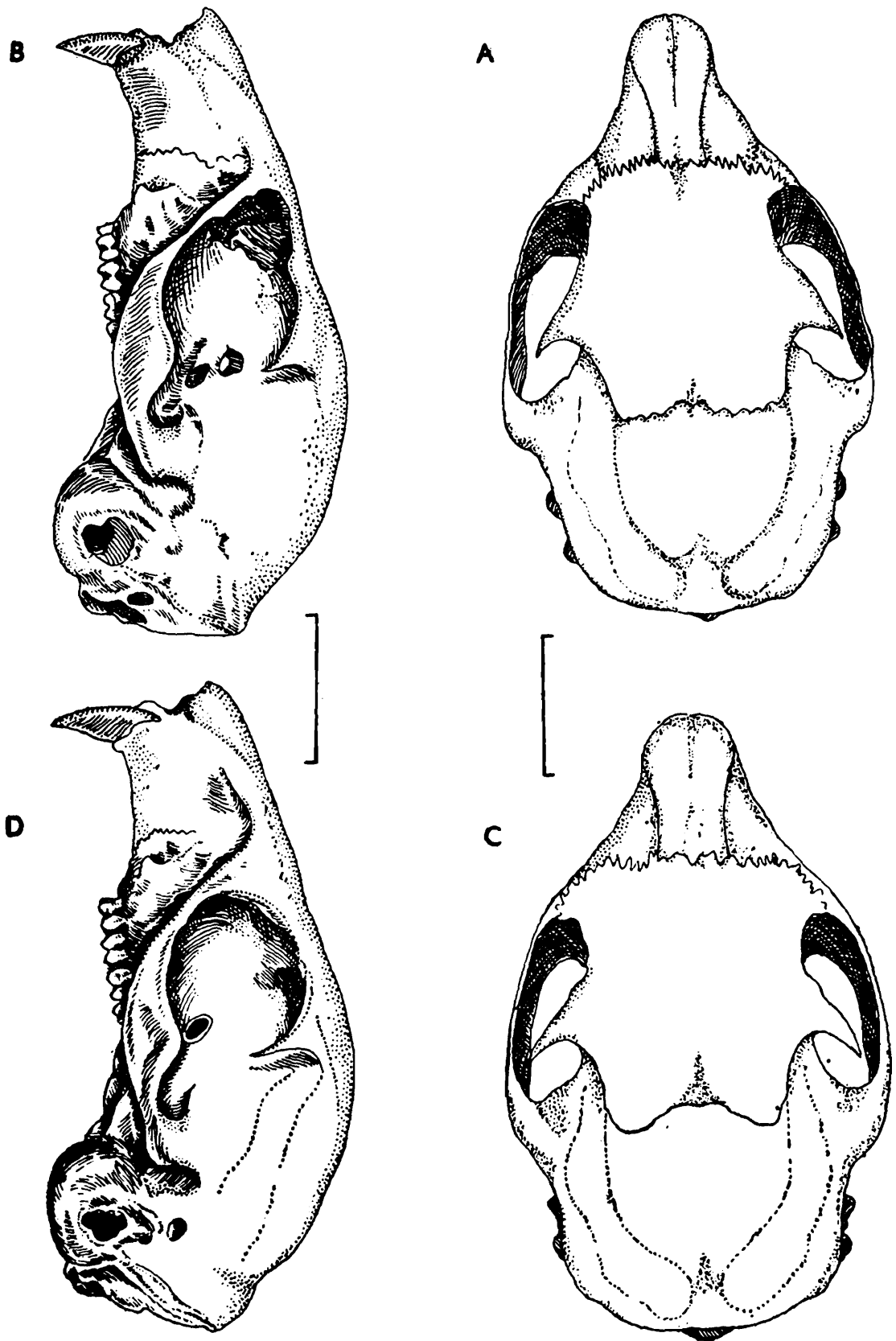


Fig. 13

- A. Dorsal view of skull of *Callosciurus pygerythrus pygerythrus*
- B. Lateral view of skull of *C. p. pygerythrus*
- C. Dorsal view of skull of *C. p. janetta*
- D. Lateral view of skull of *C. p. janetta*

Distribution :

Burma : Lower Chindwin, Myingyan, Mandalay, Sagaing and Shewbo districts.

***Callosciurus pygerythrus lokroides* (Hodgson)**

(Table 5, Fig. 14A, B)

Sciurus lokroides Hodgson, 1836, *J. Asiat. Soc. Beng.*, 5 : 232. (Nepal).*Sciurus assamensis* Gray, ex-M'Clelland, 1843, *List Mamm.*, 143. nom. nud.*Macroxus similis* Gray, 1867, *Ann. Mag. nat. Hist.*, 20 : 281. (Sikkim).*Material :*

2 ♂, 5 ♀	Mongpu, c 1177 m., Darjeeling, West Bengal	Apr., May, Aug.
3 ♂	Gopaldhara, c 1437 m, Darjeeling, West Bengal	May, Jun.
1 ♂	Narbong, c 610 m., Darjeeling, West Bengal	Mar.
1 ♂, 3 ♀, 1 juv. ♀, 6 unsexed	Darjeeling, West Bengal	One of Aug., rest undated
1 ♀	Sangser, Darjeeling, West Bengal	Aug.
1 ♀	Sevok, Darjeeling, West Bengal	Mar.
1 ♂	Pashok, Darjeeling, West Bengal	Jul.
1 ♂	Tindharia, Darjeeling, West Bengal	Apr.
1 ♂, 1 ♀ 3 unsexed	Sikkim	Jan., Dec., 3 undated
2 ♂, 1 ♀ 1 unsexed	Hitoura, Nepal	May, Jun.
1 ♂	Kon River, Nepal	Nov.
1 unsexed	Katmandu, Nepal	—
2 ♀	Hathiban, Nepal	Jun.
1 ♀	Kawapani, Nepal	May
1 unsexed	Chalnakhel, Nepal	May
1 unsexed	Bhimpedh, Nepal	—
2 ♀	Geylegphug, Central Bhutan	Nov.

Description :

Size highly variable. Head and body varies from 198-222 (mean 185 ± 14). Tail on average 180 ± 13 . Hindfoot and ear smaller than in other subspecies but the differences are not significant even at one standard deviation from the mean.

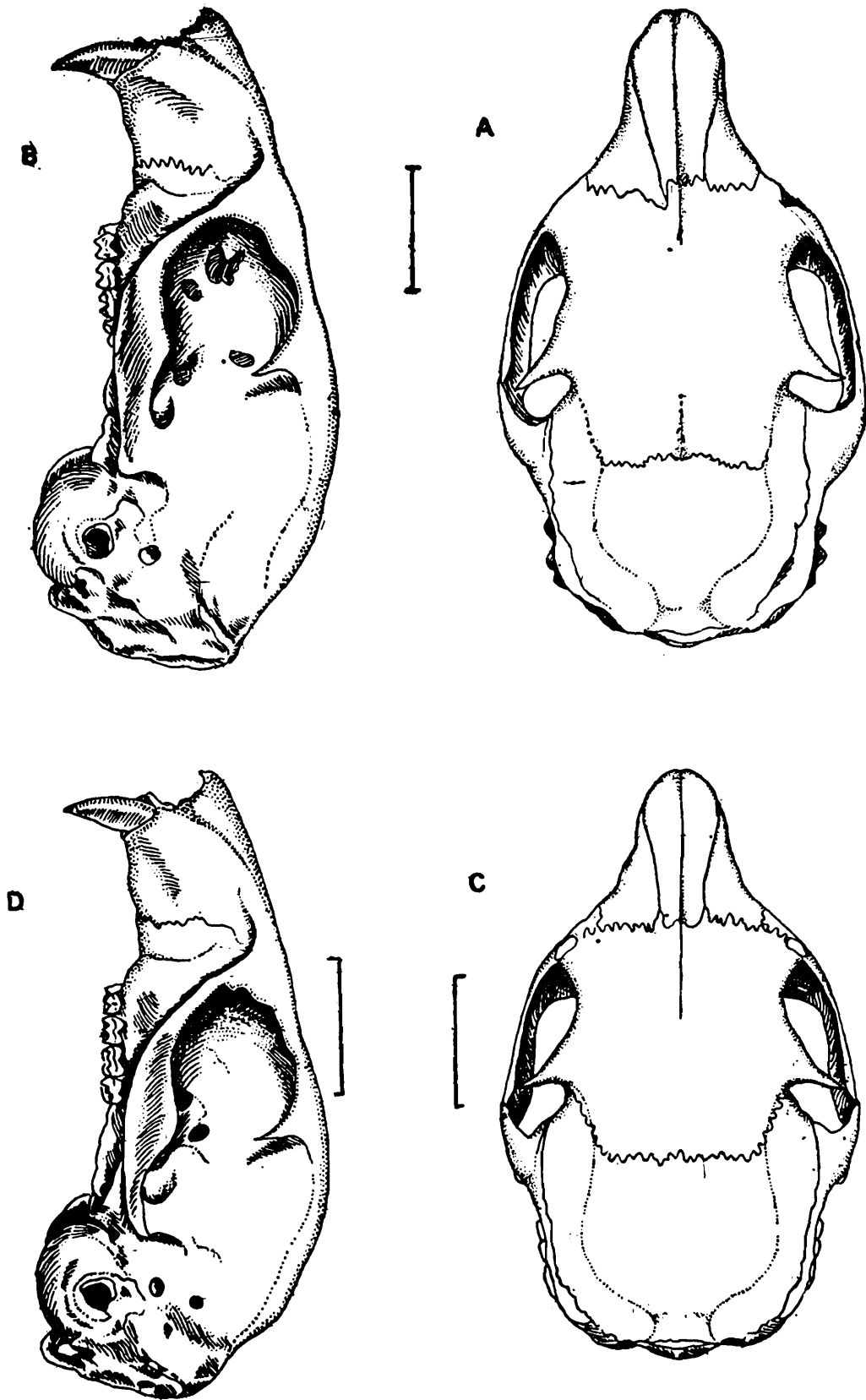


Fig. 14

- A. Dorsal view of skull of *Callosciurus pygerythrus pygerythrus*
- B. Lateral view of skull of *C. p. lokroides*
- C. Dorsal view of skull of *C. p. blythi*
- D. Lateral view of skull of *C. p. blythi*

Dorsum grizzled black and Cinnamon, sides Orange- Buff to light Ochraceous-Rufous. Ear dull whitish. Hands and feet grizzled black and white. Tail without a demarcated black tip and hairs of the tail annulated with alternate Buff and black bands ; in most specimens an yellowish midventral stripe on tail present. Ventral surface whitish, but in some specimens there is a light Saturn Red tinge in the region of belly. Rufous hip-patch present in all specimens of June, July, one of May and in two undated specimens.

Skull larger than that of other subspecies except *C. P. stevensi* (Thomas). Occipitonasal length on average 48.2 ± 1.4 . Frontal generally just over one-third of occipitonasal except in four out of 32 skulls, where it is less. Orbit a little less than frontal.

Distribution :

India : Sikkim, Northern West Bengal. [Ellerman (1963) included Manipur within its range. In Z.S.I. collection there are three badly damaged skins of *C. pygerythrus* from Manipur, subspecific identification of which is not possible. However, theoretically Manipur should come within the range of next subspecies]. Nepal. Bhutan.

***Callosciurus pygerythrus blythi* (Tytler)**

(Table 5, Fig. 14C, D)

Sciurus blythi Tytler, 1854, *Ann. Mag. nat. Hist.*, 14 : 172. (Dacca, Bangladesh).

Sciurus lokroides mearsi Bonhote, 1906, *Ann. Mag. nat. Hist.*, (7) 18 : 338. (Chinbyit, Lower Chindwin, Burma).

Tomeutes mearsi virgo Thomas and Wroughton, 1916, *J. Bombay nat. Hist. Soc.*, 24 : 419, 421. (Tatkon, Upper Chindwin, Burma).

Material :

1 ♂, 1 ♀	North Cachar, Assam	Sep., Oct.
1 ♀	North Kamrup, Assam	Jan.
1 ♀	South Kamrup, Assam	Nov.
7 ♂, 5 ♀	Jamduar, Goalpara, Assam	Mar., Apr.
1 ♂	Raimona, Goalpara, Assam	Apr.
1 ♂	Jangta, Darrang, Assam	Nov.
1 ♂	Lokra, Balipara, Darrang, Assam	Nov.
2 ♀	Burnihat, Khasi Hills, Meghalaya	May.
3 ♂, 6 ♀	Mongpoh, c 700-1000 m, Khasi Hills, Meghalaya	May, Jun.

3 ♀	Khasi and Jaintia Hills, Meghalaya	Nov., Dec.
4 ♀	Rongrengiri, Garo Hills, Meghalaya	Jan., Nov.
1 ♂	Rangapani, Garo Hills, Meghalaya	Feb.
2 ♂, 1 unsexed	Garo Hills, Meghalay	Feb. Jun., 1 undated.
1 unsexed	Lushai, Mizoram	—
1 unsexed	Dikrang, Subansiri Dist., Arunachal Pradesh	—
2 unsexed	Samagooting, Nagaland	—
2 unsexed	Nagaland	—
4 ♂, 2 ♀	Tatkon, Upper Chindwin, Burma	Feb., Apr., Jun.
1 ♂	Homalin, Upper Chindwin, Burma	Jul.
1 ♀	Hkamti, Upper Chindwin, Burma	Aug.
2 ♂, 1 ♀	Kindat, Upper Chindwin, Burma	Jan., Feb., Apr.
1 ♂, 2 unsexed	Preparis Islands, Burma	—

Description :

Size highly variable. Head and body 145-210 (mean 187 ± 12.6). Tail and hindfoot on average 183 ± 14.7 and 42 ± 2.6 respectively.

Colour of back variable ; generally hairs are annulated with black and buffy brown or orange bands. A ring of Buff or light orange colour present around each eye in most of the specimens. Tail-tip not black and hairs on tail have alternate black and brown or light brown or even white bands ; undersurface of tail have a brown medial line. Ventral surface whitish but with a light orange tinge particularly at the base of limbs. White hip-patch present in some specimens collected during April to October but absent in remaining specimens.

Skull moderate in size ; occipitonasal length on average 47.5 ± 1.2 . Frontal usually less than one-third of the occipitonasal. Orbit a little more than frontal.

Remarks :

Based on three colour characters, Moore and Tate (1965) treated *C. p. mearsi* (Bonhote) as a separate subspecies and synonymized *T. m. virgo* Thomas and Wroughton with it. The colour in *blythi* varies widely

and all the three colour characters of *mearsi* mentioned by Moore and Tate (1965) are shared by one or other specimen of *blythi*. Topotypical specimens of *virgo* are indistinguishable from many specimens of Meghalaya and Assam. So, I agree with Ellerman (1963) in considering both *mearsi* and *virgo* as synonyms of *blythi*.

Distribution :

India : Assam (except northeastern part of Lakhimpur district), Meghalaya, Nagaland (except northern part), Arunachal Pradesh (Subansiri district and probably Kameng district), Mizoram, and probably Manipur. Burma : Upper Chindwin and Prepara Islands. Bangladesh.

***Callosciurus pygerythrus stevensi* (Thomas)**

(Table 5, Fig. 15A, B)

Sciurus stevensi Thomas, 1908, *J. Bombay nat. Hist. Soc.*, 18 : 246. (Near Beni Chang, c 1219 m, Abor-Miri Hills, Siang district, Arunachal Pradesh).

Material :

1 ♂	Near Kalek, Siang Dist., Arunachal Pradesh	—
2 ♀	Rotung, Abor Hills, Siang Dist., Arunachal Pradesh	Mar.
3 ♀	Balek, Abor Hills, Siang Dist., Arunachal Pradesh	Mar.
1 ♂	Deomali, Tirap Dist., Arunachal Pradesh	Nov.

Description :

From the measurements of three skins, it appears that there is no difference from other subspecies as regard size, but in two, tail longer than head and body.

Hairs on the back and head slaty at bases, then alternately banded with brown and black. On the sides of the body blackness reduced. Hairs on the dorsal surface of tail basally Buff, then alternately ringed with equal-sized brown and black bands, but in the region of tail-tip black bands of hairs are broader than brown ; hairs on the undersurface of tail have alternate Buff and light brown bands. Undersurface of body covered with uniform dark gray hairs having very minute whitish tips, making it dull gray in appearance.

Skull large, occipitonasal length on average 48.6 ± 0.7 and differs from other subspecies except *blythi* and *lokroides* by more than one standard deviation from the mean. Frontal less than one-third of occipitonasal. Orbit a little more than frontal.

Distribution :

India : Assam (Lakhimpur district), Arunachal Pradesh (Siang, Luhit and Tirap districts), and Nagaland (probably restricted to northern half).
Burma : West of Chindwin river in the extreme northern part of Upper Chindwin.

Callosciurus pygerythrus bellona (Thomas and Wroughton)

(Table 5)

Tomeutes mearsi bellona Thomas and Wroughton, 1916, *J. Bombay nat. Hist. Soc.*, 24 : 419. (Kin, Lower Chindwin, Burma).

Material :

4 ♂, 4 ♀ Kin, Lower Chindwin, Burma Jan.

Description :

Head and body, tail and hindfoot on average 179 ± 8.5 , 176 ± 7.2 and 43 ± 2.2 respectively.

Hairs on back and hindlimb grizzled black and yellow. Orange-Rufous tinge on sides of body. Forelimb and facial region grizzled black and dirty white. White hip-patch present in all specimens and just above white patch there is an Orange-Rufous patch. Ventral surface Ochraceous-Buff. Colour of tail similar to that of *blythi*.

Skull small, occipitonasal length on average 46 ± 0.8 . Frontal less than one-third of occipitonasal. Orbit a little less than frontal.

Distribution :

Burma : Lower Chindwin district.

Key to the identification of the above listed subspecies of *Callosciurus pygerythrus* is given below.

- | | |
|---|--------------------------|
| 1. Undersurface dull gray. | <i>C. p. stevensi</i> |
| Undersurface not dull gray. | ... 2 |
| 2. Tail-tip black. | ... 3 |
| Tail-tip not black. | ... 4 |
| 3. Undersurface whitish or Buff. | <i>C. p. janetta</i> |
| Undersurface light reddish to Orange-Buff. | <i>C. p. pygerythrus</i> |
| 4. Hip-patch when present red in colour. | <i>C. p. lokroides</i> |
| Hip-patch when present white in colour. | ... 5 |
| 5. White hip-patch with an Orange-Rufous patch over it. | <i>C. p. bellona</i> |
| White hip-patch without any Orange-Rufous patch over it. | <i>C. p. blythi</i> |

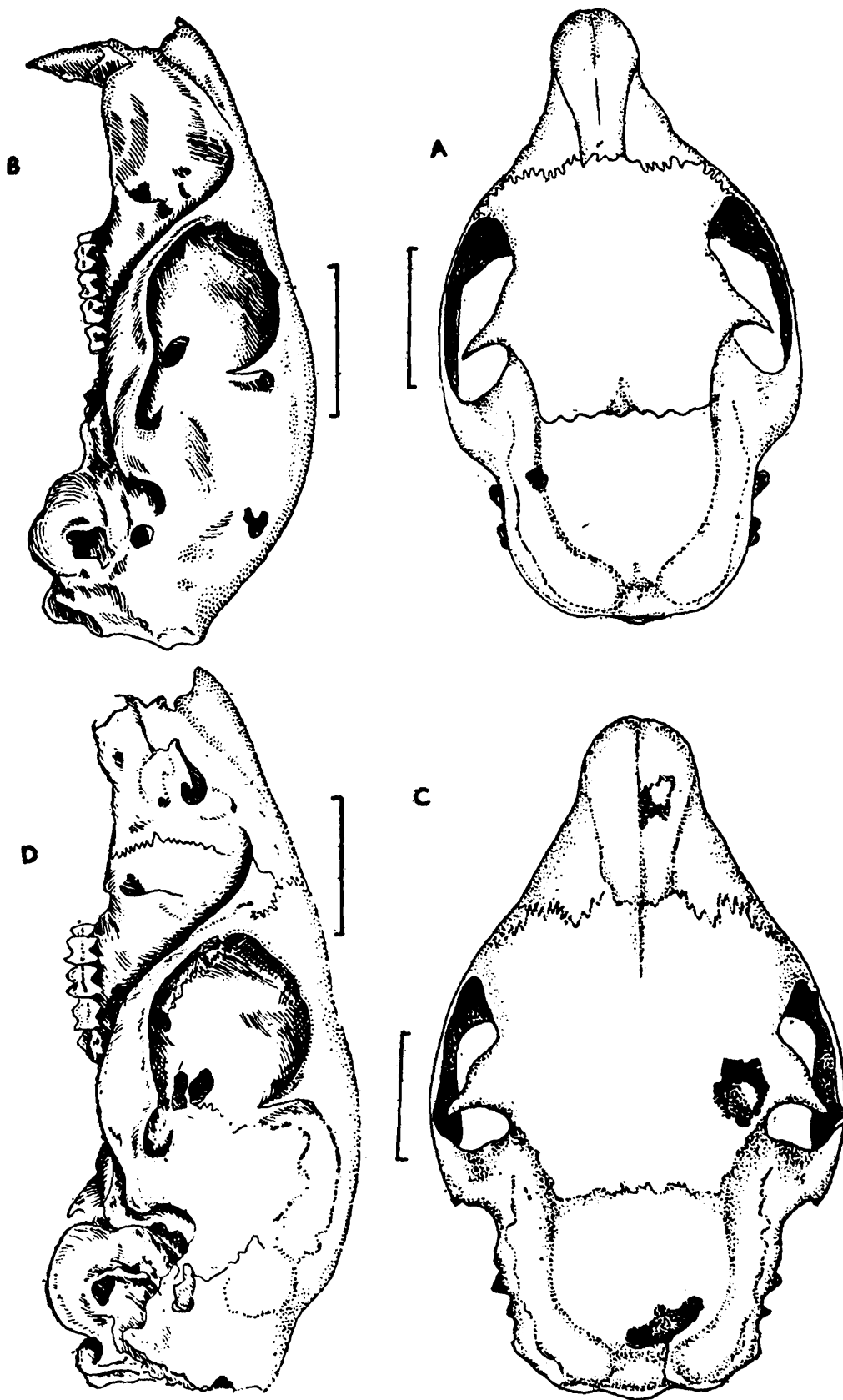


Fig. 15

- A. Dorsal view of skull of *Callosciurus pygerythrus lokroides*
 B. Lateral view of skull of *C. p. stevensi*
 C. Dorsal view of skull of *Callosciurus prevosti prevosti*
 D. Lateral view of skull of *C. p. prevosti*

Callosciurus prevosti (Desmarest)

Sciurus prevostii Desmarest, 1822, *Encycl. Méth. Mamm.*, 335. (Malacca, Malaysia).

Diagnosis :

Blackish above, bright below. With or without a white lateral stripe which in some forms so broadened that it covers most of the thigh. Frontal broad, more than 21 and greater than that in other species discussed earlier. The upper incisors generally proodont. Zygomatic plate rarely heavily ridged. Baculum less specialised and structurally similar to that of *C. e. erythraeus*.

Callosciurus prevosti prevosti (Desmarest)

(Table 6, Fig. 15 C, D)

Sciurus prevostii Desmarest, 1822, *Encycl. Méth. Mamm.*, 335. (Malacca, Malaysia).

Sciurus rafflesi var. *Indica* Müller and Schlegel, 1844, in Temm., *verb. nat. gesch.*

Med. Overz. bezitt., Zool., 86. (Malacca, Malaysia).

Material :

1 ♂, 2 unsexed	Malacca, Malaysia	—
1 ♂	Nyalas, Malacca, Malaysia	Oct.
1 ♂, 1 ♀	No history	—

Description :

All the specimens fit in well with the description given by Bonhote (1901b) having following variations.

In the region of cheek lateral stripe faintly grizzled light gray. Black stripe below the white entirely absent in two. In males, hairs on the shoulder gray at bases and white apically. Tail-tip and ventral side of tail light brown, rest of tail black. A small region just below anus whitish. Feet in female dirty white.

Skull very similar to that of *C. caniceps caniceps* but frontal much broader with an anterior depression. Orbit relatively smaller. Occipitonasal length 56 and 57.4 in two measurable skulls. Posterior margins of nasals and frontals almost straight. Interparietal absent. Bullae not much enlarged (10.5 mm.).

Distribution :

Malaysia : From about Triang, Pahang, and Negri Sembilan southwards.

Callosciurus prevosti humei (Bonhote)

(Table 6, Fig. 16A, B)

Sciurus prevosti humei Bonhote, 1901, *Ann. Mag. nat. Hist.*, (7) 7 : 170. (Klang, Selangor, Malaysia).*Material :*

1 ♀ Tanjong Malim, Perak Selangor boundary, Malaysia Apr.

Description :

Above black, below reddish but chin a little gray grizzled. White lateral stripe broadest in the region of hip and gradually narrows towards forelimb. Forelimb and shoulder Geranium Red. Cheek grizzled white and gray. Sides of neck white. Hindfoot chestnut. Tail black.

Skull similar to that of nominate subspecies. Occipitonasal 56.6.

Distribution :

Malaysia : Southern Perak and Selangor.

Callosciurus prevosti wrayi (Kloss)

(Table 6)

Sciurus prevosti wrayi Kloss, 1911, *J. Fed. Malay St. Mus.*, 4 : 148. (Kuala Lipis, Pahang, Malaysia).*Material :*

1 ♂ Tamengoh, Upper Perak, Malaysia Jul.

Description :

Mid-dorsum from tip of nose to base of tail deep shining black. White lateral stripe extends from heel to about shoulder and broadest on the outsides of thigh. Shoulder Tawny. Forelimb and hindfoot Rose Red. Chin, cheek, sides of the neck and muzzle almost white but somewhat grizzled gray in the region of cheek and chin. Whiskers spring from a small but sharply defined white area. Basal part of tail black, then brown and at tip light brown ; hairs on the tail near anal region have minute white tips. Venter and undersurface of hands and feet Rose Red but hairs just below white stripe have black bases.

Skull similar to that of nominate subspecies but a little larger, occipitonasal length 60.5.

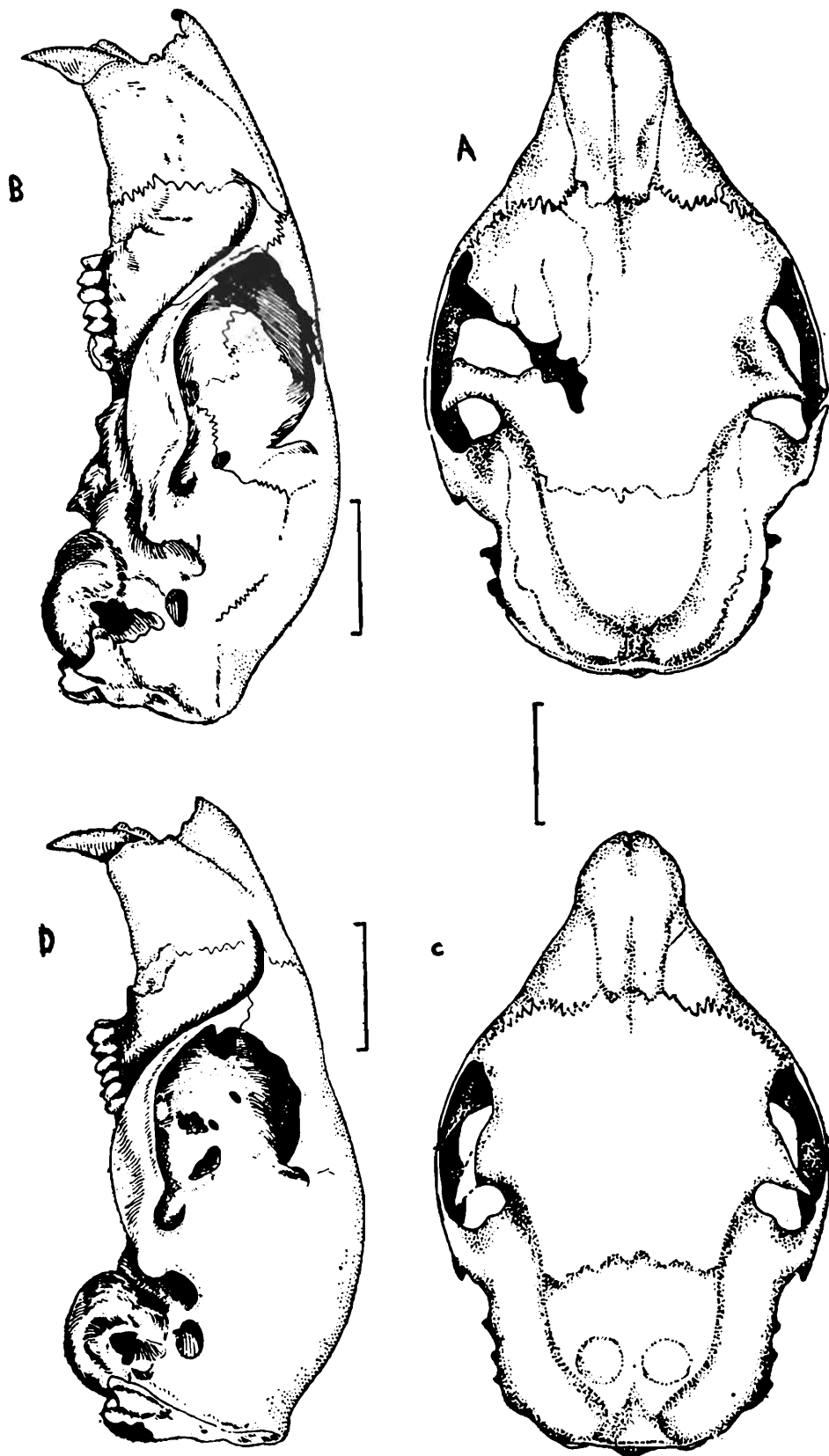


Fig. 16

- A. Dorsal view of skull of *Callosciurus prevosti humei*
- B. Lateral view of skull of *C. p. humei*
- C. Dorsal view of skull of *C. p. rafflesi*
- D. Lateral view of skull of *C. p. rafflesi*

Distribution :

Malaysia : From Thai border south to Kuala Lipis district, Pahang, and the Dindings, Perak.

Callosciurus prevosti rafflesi (Vigors and Horsfield)

(Table 6, Fig. 16C, D)

Sciurus rafflesi Vigors and Horsfield, 1828, *Zool. Jour.*, 4 : 113. (Andalas).

Sciurus redimitus Boon Mesch, 1829, *N. Verb. Ned. Inst. Amster.*, 2 : 243. (Andalas).

Sciurus rufogularis Gray, 1842, *Ann. Mag. nat. Hist.*, 10 : 263. (Andalas).

Sciurus prevosti var. *sumatranus* Schlegel, 1863, *Ned. Tijdschr. Dierk.*, : P. 125. (Andalas).

Sciurus melanops Miller, 1902, *Proc. Acad. nat. Sci. Philad.*, P. 151. (Indragiri River, East Andalas).

Material :

4 ♂, 1 ♀, 7 unsexed Menangerie specimen

Description :

Dorsum black with a few brown hairs. A small white spot present below each eye. White lateral stripe extends from thigh to near shoulder. No sublateral black stripe. Cheek and sides of neck grizzled iron gray. Shoulder and forelimb Orange-Ochraceous except in one where it is chestnut. Tail dark brown, but slightly paler at tip and undersurface. Venter bright chestnut.

Skull similar to that of the nominate subspecies, but from the available material bullae appear to be slightly larger (11.2-12.3). Occipitonasal length on an average 56.6.

Remarks :

Miller (1902) described *Sciurus melanops* from eastern Andalas and compared with *humei*. He perhaps did not get the opportunity of examining the specimens of *rafflesi*, which exactly fits with the description of *malanops* given by him. Thus, *melanops* is treated here as a synonym of *rafflesi*.

Distribution :

Andalas : In part.

Callosciurus prevosti sarawakensis (Gray)

(Table 6)

Macroxus sarawakensis Gray, 1867, *Ann. Mag. nat. Hist.*, 20 : 277. (Sarawak).*Sciurus prevosti kuchingensis* Bonhote, 1901, *Ann. Mag. nat. Hist.*, (7) 7 : 170. (Kuching, Sarawak).*Material :*

1 unsexed Matang, Sarawak —

Description :

Head, nape and back black. Thigh grizzled Cream-Buffer and gray. White lateral stripe narrow and restricted in between the bases of limbs. Tail-tip dark brown, remaining part of tail with hairs basally dark brown and apically Cream-Buffer. A faint blackish sublateral stripe present below white. Ventral surface, shoulder, cheek and sides of neck deep chestnut, but with a little fulvous tinge on shoulder. Skull not examined.

Distribution :

Sarawak : Southwestern part.

Callosciurus prevosti borneoensis (Müller and Schlegel)

(Table 6)

Sciurus rafflesii var. *borneoensis* Müller and Schlegel, 1844, in Temm., *Verb. nat. gesch. Ned. Overz. Bezitt.*, Zool., 86. (Pontianak, West Kalimantan).*Material :*

1 unsexed Kalimantan —

Description :

Very similar to *sarawakensis*, but the sides of the body just above white lateral lines have hairs similarly grizzled as on thigh. However, the cheek and sides of the neck a little blackish. Skull not examined.

Distribution :

Kalimantan : Western Part.

Callosciurus prevosti pluto (Gray)

(Table 6)

Macroxus pluto Gray, 1867, *Ann. Mag. nat.*, *Hist.* 20 : 283. (Sarawak, probably from northern portion).*Material :*

1 unsexed Kalimantan —

Description :

Entire dorsum including limbs and tail rich glossy black. No white lateral stripe, instead there is an indication of dark gray stripe in between bases of limbs. Ventral surface deep chestnut.

Skull structurally similar to that of the nominate subspecies but appears to be much smaller, occipitonasal length 53.3.

Distribution :

Kalimantan : In part. Sarawak : Northern part.

Callosciurus prevosti atricapillus (Schlegel)

(Table 6)

Sciurus atricapillus Schlegel, 1863, *Ned Tijdschr. Dierk.*, 1 : 27. (Kapuas river, West Sarawak).

Material :

1 ♂ Ulu Anyut, Sarawak. Aug.

Description :

Very different from all other subspecies. Hairs on entire dorsum including limbs and tail (except tail-tip) grizzled pale yellowish, black and light brown ; black bands are relatively broad on the back making it darker, whereas, brown and pale yellowish bands are more prominent on shoulder and thigh respectively. Tail-tip dark brown. White lateral stripe restricted in between bases of limbs. Chest and undersurface of limbs Ochraceous-Rufous, remaining part of ventral surface chestnut but hairs just below the lateral stripe are black on bases.

Skull similar to that of the nominate subspecies but appears to be smaller. Occipitonasal length 52.

Distribution :

Sarawak : Western part.

Callosciurus prevosti carimonensis (Miller)

(Table 6)

Sciurus prevosti carimonensis Miller 1906, *Proc. U. S. natn. Mus.*, 31 : 261. (Great Karimon Island, Rhio Archipelago).

Material :

1 ♂ (damaged skin) Great Karimon Island, Rhio Archipelago Aug.

Remarks :

The only skin available to me differs in no way from that of *rafflesi* but due to damaged condition of the skin and lack of the skull it is at present kept as such.

Distribution :

Known only from the type locality.

Key to the identification of the above listed subspecies of *Callosciurus prevosti* is given below.

- | | | | |
|--|--------|-----|---|
| 1. White lateral stripe absent. | ... | ... | <i>C. p. pluto</i> |
| White lateral stripe present. | ... | ... | ... 2 |
| 2. Hairs on back grizzled black, light brown and pale yellow. | | | ... <i>C. p. atricapillus</i> |
| Back uniform black. | ... .. | ... | ... 3 |
| 3. White lateral stripe extends from heel to tip of nose. | | | ... <i>C. p. prevosti</i> |
| White lateral stripe broken at shoulder or restricted in between bases of limbs. | ... .. | ... | ... 4 |
| 4. Hairs on thigh black at bases and Cream-Buff at tips. | ... .. | ... | ... 5 |
| Hairs on thigh black. | ... .. | ... | ... 6 |
| 5. Hairs just above white lateral stripe black on bases and Cream-Buff at tips. | | | ... <i>C. p. borneoensis</i> |
| Hairs just above white lateral stripe wholly black. | ... .. | ... | ... <i>C. p. sarawakensis</i> |
| 6. Sides of neck iron-gray, | | ... | ... <i>C. p. rafflesi</i> with
<i>C. p. carimonensis</i> |
| Sides of neck white. | ... .. | ... | ... 7 |
| 7. Shoulder Geranium Red. | ... .. | ... | ... <i>C. p. humei</i> |
| Shoulder Tawny. | ... .. | ... | ... <i>C. p. wrayi</i> |

***Callosciurus vittatus* (Raffles)**

Sciurus vittatus Raffles, 1821, *Trans. Linn. Soc.*, 13 : 259. (Bencoolen, West Andalus).

Diagnosis :

Colour extremely variable ; dorsum usually grizzled light brown and black or gray. A narrow pale white lateral stripe and a broad sublateral black stripe generally present in between the bases of limbs. Tail in most subspecies shorter than head and body length. The upper incisors very rarely proodont. The zygomatic plate rarely heavily ridged. Frontal width more than one-third of occipitonasal length. Baculum less specialised and structurally similar to that of the *C. e. erythraeus*.

Callosciurus vittatus dulitensis (Bonhote)

(Table 7, Fig. 17A, B)

Sciurus vittatus dulitensis Bonhote, 1901, *Ann. Mag. nat. Hist.*, (7) 7 : 451. (Mount Dulit, Sarawak).*Material :*

3 ♂ Paku Saribas, Sarawak Oct.

Description :

Dorsum and tail fit in well with original description (Bonhote 1901d). Undersurface light Orange-Buff but in one there is a poorly marked grayish midventral stripe.

Skull structurally very similar to that of the *C. e. erythraeus* but much smaller. Occipitonasal length 47.5.

Remarks :

According to Bonhote (1901d) this subspecies is distinguished from the nominate one by the grizzled tail and non reddish tail-tip. Stone and Rehn (1902) mentioned that in a pair of specimens from Andalas, the male has red tail-tip but not the female. Moreover, some of the specimens of *dulitensis* examined by Bonhote (1901d) have a little Rufous tinge near the tail-tip. Thus, it appears that characters, differentiating the two subspecies are not very constant.

Remarks :

Chasen (1940), Tate (1947), Askins (1977), and Medway (1978) treated *C. vittatus* as synonym of *C. notatus* (Boddaert). Medway (*op. cit.*) maintained most of the subspecies discussed below under *C. notatus*. At the moment due to lack of *C. notatus*, material, I have treated provisionally as distinct.

Distribution : Sarawak.**Callosciurus vittatus tenuirostris (Miller)**

(Table 7, 8)

Sciurus tenuirostris Miller, 1900, *Proc. Acad. Sci. Wash.*, 2 : 221. (Tioman Island, Malaysia).*Material :*

1 ♂, ♀ Juara Bay, Tioman Island, Malaysia Jun., Sep.

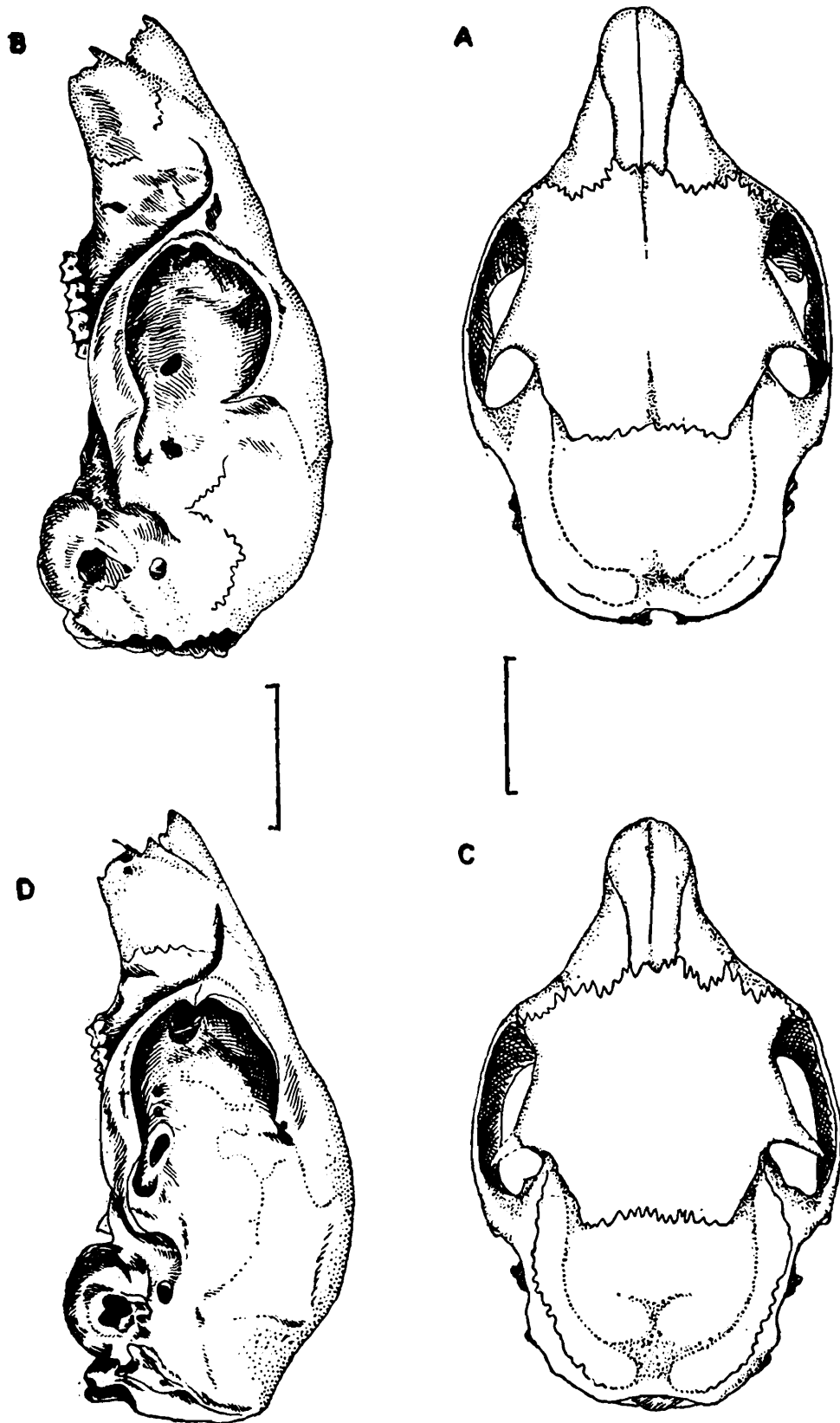


Fig. 17

- A. Dorsal view of skull of *Callosciurus vittatus dulitensis*
- B. Lateral view of skull of *C. v. dulitensis*
- C. Dorsal view of skull of *Callosciurus nigrovittatus nigrovittatus*
- D. Lateral view of skull of *C. n. nigrovittatus*

Description :

Both the specimens fit in well with the description of the nominate subspecies as given by Bonhote (1901d), except the white lateral stripe which is very poorly marked in these specimens. Undersurface light Orange-Rufous.

Skull a little larger and frontal relatively narrower than that of *dulitensis*. Rostrum slightly narrower than that of nominate subspecies (Table 8).

Distribution :

Malaysia : on Tiomen, and probably Tulai

Callosciurus vittatus miniatus (Miller)

(Table 7)

Sciurus notatus miniatus Miller, 1900, *Proc. Acad. Sci. Wash.*, 2: 70. (Trang, Thailand).

Material :

2 unsexed	Malacca, Malaysia.	—
2 ♀	Bukit Jong, Trengganu, Malaysia.	Sep.
1 ♂	Chong, Trang, Thailand.	—
3 ♂	No history.	—

Description :

Back including head and limbs black but speckled with Straw Yellow. Hairs on limbs have much broader Straw Yellow bands than hairs on back. Muzzle and areas around eyes deep Chrome. Lateral stripe of Primrose Yellow colour ; black sublateral stripe relatively less developed. A small but conspicuous white patch present behind ear in two specimens. Tail concolorous with back but a little paler and the tip reddish. Chest and belly vary from Madder Brown to deep Madder Brown. Chin and undersurface of limbs grizzled gray and Straw Yellow.

Skull large, occipitonasal on average 50.4. Frontal relatively narrower than *dulitensis*.

Distribution :

Malaysia : Malay Peninsula (south to North Johore on the west coast ; south to about Pahang river on the east coast ; sporadic in south Johore). Thailand : Peninsular part.

Callosciurus vittatus scotti (Kloss)

(Table 7, 9)

Sciurus vittatus scottii Kloss, 1911, *Ann. Mag. nat. Hist.*, (8) 7 : 117. (Little Redang Island, East coast of Malay Peninsula, Malaysia).

Sciurus vittatus plasticus Kloss, 1911, *Ann. Mag. nat. Hist.*, (8) 7 : 117, (Great Redang Island, East coast of Malay Peninsula, Malaysia).

Sciurus vittatus perhentiani Kloss, 1911, *Ann. Mag. nat. Hist.*, (8) 7 : 118. (West Perhentian Island, East coast of Malay Peninsula, Malaysia).

Material :

1 ♂ (paratype of <i>scottii</i>)	Little Redang Island, East Coast of Malay peninsula, Malaysia.	Aug.
1 ♂, 1 ♀ (Paratypes of <i>perhentiani</i>)	West Perhentian Island, East coast of Malay Peninsula, Malaysia.	Sept., Oct.
1 ♂, 1 ♀ (Paratypes of <i>plasticus</i>)	Great Redang Island, East coast of Malay Peninsula. Malaysia.	Aug.

Description :

Similar to *miniatus* in colour.

Skull smallest of all the subspecies, occipitonasal length on average 44.4.

Remarks :

Kloss (1911b) distinguished *scotti* from *miniatus* on the basis of colour characters and smaller skull. But the colour differences mentioned by him do not hold good even for the paratype of *scotti* present in the Z.S.I. collection. Unfortunately, the skull of the paratype of *scotti* under my disposal is badly damaged and unsuitable for measurement, but the skulls of the paratypes of *plasticus* and *perhentinni* (which are actually synonyms of *scotti*) are smaller than that of *miniatus*. Thus, *scotti* can be distinguished from *miniatus* on the basis of smaller skull.

Kloss (1911b) separated *plasticus* and *perhentiani* from *scotti* on the basis of larger skull and paler dorsum. But the paratypes of *plasticus* and *perhentiani* are indistinguishable from the paratype of *scotti* in respect of coloration. Moreover, the skulls of *plasticus* and *perhentiani* are in no way larger than that of *scotti* (on the basis of data available from literature) (Table 9).

The tail of *perhentiani* was described as more yellowish than that of *scotti* and *plasticus* (Kloss 1911b). But the tail hairs of all the paratypic specimens of three subspecies have Straw Yellow bands broader than the black bands, making the tail a little paler than back. Thus, I am inclined to treat *plasticus* and *perhentiani* as synonyms of *scotti*.

Distribution :

Malaysia : East coast of Malay Peninsula (Little Redang Island, Great Redang Island and West Perhentian Island).

Callosciurus vittatus proteus (Kloss)

(Table 7)

Sciurus vittatus proteus Kloss, 1911, *Ann. Mag. nat. Hist.*, (8) 7 : 118. (East Perhentian Island, East coast of Malay Peninsula, Malaysia).

Material :

1 ♀ East Perhentian Island, East coast of Sep.
Malay Peninsula, Malaysia.

Description :

Colour of dorsum very similar to that of the *miniatus*. Chin gray, speckled with Straw Yellow ; remaining part of undersurface Buff with a faint Rufous tinge on throat and belly. Kloss (1911b) stated that dark sublateral stripe is obscured, but in the present specimen it is well evident.

Skull small, occipitonasal length 46.3. Frontal narrow.

Distribution :

Known only from the type-locality.

Callosciurus vittatus subluteus (Thomas and Wroughton)

(Table 7)

Sciurus vittatus subluteus Thomas and Wroughton, 1909, *Ann. Mag. nat. Hist.*, (8) 3 : 440. (Sikarang, South-East Johore, Malaysia).

Material :

1 ♂ Tanjong Surat, Johore, Malaysia. Jul.

Description :

General colour of dorsum somewhat gray and fits in well with the original description. Tail-tip reddish, Ventral surface soiled pale yellow.

Skull medium sized, occipitonasal length 49.1. Frontal relatively broad.

Distribution :

Malaysia : Extreme South-East Johore.

Key to the identification of the above listed subspecies of *Callosciurus vittatus* is given below.

1. Undersurface Madder Brown.	2
Undersurface not Madder Brown.	3
2. Skull large, occipitonasal more than 49. ... ..	...<i>C. v. miniatus</i>
Skull small, occipitonasal less than 45. ... ..	...<i>C. v. scotti</i>
3. Abdomen soiled pale yellow.	<i>C. v. subluteus</i>
Abdomen not soiled pale yellow, ... ..	... 4
4. Chest and belly Buff.	<i>C. v. proteus</i>
Chest and belly not Buff. ... ..	... 5
5. Undersurface light Orange-Rufous.	<i>C. v. tenuirostris</i>
Undersurface light Orange-Buff.	<i>C. v. dulitensis</i>

***Callosciurus nigrovittatus* (Horsfield)**

Sciurus nigrovittatus Horsfield, 1823, *Zool. Res. Java*, P. 149. (West Java).

Diagnosis :

Closely allied to *C. vittatus*, but ventral surface grayish. Tail much shorter than head and body. Frontal width more than one-third of occipitonasal. Upper incisors generally proodont. Zygomatic plate not heavily ridged. Baculum less specialised and structurally similar to that of *C. erythraeus*.

***Callosciurus nigrovittatus nigrovittatus* (Horsfield)**

(Table 10, Fig. 17C, D)

Sciurus nigrovittatus Horsfield, 1823, *Zool. Res. Java*. P. 149. (West Java).

Sciurus grisei-venter 1. Geoffroy, 1831, in Belanger, *Voy. Indes Orient Zool*. P. 147. (West Java).

Material :

1 ♂, 1 ♀ Tjibodas, West Java. Feb.

Description :

Medium-sized ; head and body in present specimens reaching up to 183.

Dorsal hairs coarse, slaty at bases then finely grizzled black and brown. Face and areas around the ears have light orange tinge. Black sublateral stripe prominent and extends from the base of hindlimb to that of forelimb. White lateral stripe almost absolent. Tail-tip black, remaining part of tail has hairs light brown at base, then alternately ringed with black, light brown and pale yellow bands, but black bands are narrower on the ventral side. Chin light orange, remaining part of under-surface gray with an indication of dark medial stripe.

Skull very similar to that of *C. c. caniceps* but much smaller, occipitonasal length 46.5. Frontal width less than 40% of occipitonasal.

Distribution :

Java.

***Callosciurus nigrovittatus bilimitatus* (Miller)**

(Table 10)

Sciurus bilimitatus Miller, 1903, *Smithson. Misc. Collns.*, 45 : 8. (Trengganu, Malaysia.)

Material :

1 ♀ Ulu Selama, North-East Perak, Malaysia May

Description :

Large-sized ; head and body 223.

Dorsal hairs soft. Dorsal colour similar to that of the nominate subspecies, except the tail-tip which is concolorous with the remaining part of tail. White lateral stripe and black sublateral stripe well developed but white stripe extends a little more than that of black. Chin, throat and anal region bright Ochraceous. Robinson and Wroughton (1911) described chest and belly as bright Ochraceous, but in the present specimen hairs on these regions slaty at base and apically Pearl Gray making the appearance much lighter than in the nominate subspecies.

Skull very similar to that of the nominate subspecies, occipitonasal length 47.5. Frontal relatively broad being more than 40% of occipitonasal.

Distribution :

Malaysia : Northern part.

***Callosciurus nigrovittatus microrhynchus* (Kloss)**

(Table 10, 11)

Sciurus (bilimitatus) microrhynchus Kloss, 1908, *J. Fed. Malay St. Mus.*, 2 : 144. (Tioman Island, Malaysia).

Material :

1 ♂	(damaged skull only)	Juara Bay, Pulau	Jun., Jul.
1 ♀	(without skull)	Tiomen, Malaysia.	—

Description :

Medium-sized ; head and body 182.

Dorsal hairs soft and long. Colour in general fits in well with the original description. White lateral stripe well developed but not extending beyond the black sublateral stripe.

Only skull available for examination is a damaged one. The breadth of combined nasals is said to be less than that of the *bilimitatus* (Kloss 1908), but the same is not evident in the present specimen (Table 11).

Distribution :

Malaysia : Tioman Island.

Callosciurus nigrovittatus johorensis (Robinson and Wroughton)

(Table 10, 11)

Sciurus nigrovittatus johorensis Robinson and Wroughton, 1911, *J. fed. Malay St. Mus.*, 4 : 166. (Pelepak, Johore, Malaysia).

Material :

1 ♀	Zool. Garden specimen	—
2 unsexed	Malay Peninsula	—
2 unsexed (skull only)	No history	—

Description :

Dorsal hairs very short and coarse. As regard coloration this subspecies is exactly similar to *microrhynchus*.

Skull similar to that of the nominate subspecies. Occipitonasal length 48 or more.

Remarks :

Robinson and Wroughton (1911) distinguished this subspecies from *microrhynchus* on the basis of somewhat robust rostrum and longer toothrow, but the same is not very evident from the measurements given in literature as well as in the present specimens (Table 11). However, on the basis of very short and coarse dorsal hairs, it is maintained here as a separate subspecies.

Distribution :

Malaysia : The southern portion of the Malay Peninsula from Johore through Malacca, Negri Sembilan and southern Pahang to Selangor.

Callosciurus nigrovittatus bocki (Robinson and Wroughton)

(Table 10)

Sciurus nigrovittatus bocki Robinson and Wroughton, 1911, *J. Fed. Malay St. Mus.*, 4 : 167. (Pajo, Padang highlands, Andalas).

Material :

1 ♂, 1 ♀ Sungei Kumbang, Korinchi, West Andalas. Apr.

Description :

Small-sized ; head and body less than 180.

Hairs soft and those on the dorsal part of body slate black at base, then alternately banded with light brown and black ; black bands very narrow in the region of ear, forehead, limbs and sides of the body, making these regions browner than back. Hairs on the dorsal part of tail light Ochraceous at base, then grizzled light brown and black. Lateral and sublateral stripes well developed. Chin, sides of neck and undersurface of tail bright Ochraceous. Venter grayish white in male and Pearl Gray in female.

Skull similar to the nominate subspecies but much smaller, occipito-nasal reaching up to 43 in the present specimens.

Remarks :

Robinson and Wroughton (1911) mentioned the presence of a pale whitish patch behind each ear and regarded it as a distinctive character, but no such patch was found in the present specimens. However, small size and bright Ochraceous colour of the undersurface of the tail make *bocki* distinctive from other subspecies.

Distribution :

Andalas.

Key to the identification of the above listed subspecies of *Callosciurus nigrovittatus* is given below.

- | | | | | | |
|--|-----|-----|-----|----------------------------|---|
| 1. Dorsal hairs coarse. | ... | ... | ... | ... | 2 |
| Dorsal hairs soft. | ... | ... | ... | ... | 3 |
| 2. White lateral stripe absolescent | ... | ... | ... | <i>C. n. nigrovittatus</i> | |
| White lateral stripe distinct. | ... | ... | ... | <i>C. n. johorensis</i> | |
| 3. Large-sized, head and body more than 200. | ... | ... | ... | <i>C. n. bilimitatus</i> | |
| Small-sized, head and body less than 200. | ... | ... | ... | ... | 4 |
| 4. Undersurface of tail bright Ochraceous. | ... | ... | ... | <i>C. n. bocki</i> | |
| Undersurface of tail not bright Ochraceous. | ... | ... | ... | <i>C. n. microrhynchus</i> | |

Callosciurus germaini germaini (Milne-Edwards)

Sciurus germaini Milne-Edwards, 1867, *Rec. Zool., Paris*, 19 : 193. (Palau Condor, off Cambodian coast, Kampuchia).

Material :

1 unsexed (Paratype of <i>germaini</i>)	Pulau Condor, off Cambodian Coast, Kumpuchia	—
---	---	---

Description :

Entire dorsum including the tail Seal Brown. Ventral surface almost indistinguishable from dorsum but a little paler.

Skull not examined.

Remarks :

Moore and Tate (1965) treated *germaini* as a subspecies of *Callosciurus finlaysoni* (Horsfield) and made the following comment about the type-series :

Though the colour of the typical series appears at first jet black, a trace of brown mixed with the black of the chin, neck and underparts could be distinguished in good light when examined in 1951. Possibly this is due to fading, as the specimens were collected nearly 90 years ago. In the type specimen there is also a tiny patch of hairs with whitish tips asymmetrically placed on the left on the lumber region. Hands, feet and tail are perfectly black.

Due to lack of additional specimens comments on the status of this species is kept reserved.

Distribution :

Cochin China, Kampuchia.

Callosciurus hippurus (I. Geoffroy)

Sciurus hippurus 1. Geoffroy, 1831, in Belanger, *Voy. Indes Orient. Zool.*, 2 : 149. (Malacca, Malaysia),

Diagnosis :

General colour somewhat blackish. Tail extremely bushy, Frontal relatively narrow and less than one-third of the occipitonasal length. Incisors generally more proodont. Presence of a short sagittal crest is a normal feature of skull. Baculum compound, specialised, being broad-bladed.

Callosciurus hippurus hippurus (I. Geoffroy)

(Fig. 18A, B)

Sciurus hippurus I. Geoffroy, 1831, in Belangar, *Voy. Indes Orient. Zool.*, 2 : 149.
(Malacca, Malaysia).

Sciurus rufogaster Gray, 1842, *Ann. Mag. nat. Hist.*, 10 : 263. (Malacca, Malaysia).

Material :

1 ♂	Bukit Tanga, Negri Sembilan, Malaysia.	Apr.
1 unsexed	Malacca, Malaysia.	—

Measurements :

External : 1 ♂ ; Head and body 235 , Tail 275 ; Hindfoot 60.

Cranial : 1 ♂ , 1 unsexed ; Occipitonasal 56, 57.7 ; Palate 29, 30.3 ;
Nasal 17.2, 18.1 ; Frontal 18.3, 18.8 , Orbit 18.7, 19.6.

Description :

Back grizzled black and brown. Limb, thigh and head grizzled black and white. Hairs on the proximal part of tail finely ringed with gray, white and light brown bands ; distal part of tail entirely dark brown. Ventral surface poorly haired, reddish in one and chestnut in other.

Palate long, more than half of the accipitanasal length.

Distribution :

Malaysia : Malay Peninsula.

Callosciurus hippurus borneensis (Gray)

Macroxus rufogaster var. *borneensis* Gray, 1867, *Ann. Mag. nat. Hist.*, (3) 20 : 283.
(Sarawak).

Sciurus hippurus grayi Bonhate, 1901, *Ann. Mag. nat. Hist.* (7) 7 : 171. (Sarawak).

Material :

1 unsexed	Sarawak	—
-----------	---------	---

Description :

A distinct mid-dorsal stripe extends from the neck to some distance about (40 mm.) on the tail. Hairs on either side of this stripe ringed with gray, light brown and brown bands. Underparts reddish.

Callosciurus ferrugineus (F. Cuvier)

(Fig. 18C, D)

Sciurus ferrugineus F. Cuvier, 1829, *Hist. nat. Mamm.*, 3 : 238. (Pegu, Burma).*Sciurus keraudreni* Lesson, 1830, *Cent. Zool.*, 11 : Pl. 1. (Burma).*Material :*

2 ♂, 2 ♀	48 to 58 km. north of Toungoo, Burma	Apr., Jun., Aug., Dec.
1 ♂	Mount Popa, c 1600 m, Myingyan, Burma	Sep.
1 ♀	Theme, Prome, Burma	Oct.
1 ♂, 4 ♀	Pegu, Burma	Jan., Apr., May, 2 undated.
1 unsexed	Rangoon, Burma	—
4 unsexed	Burma	—

Measurements :

External : Head and body 198-227 (mean=212, s=7.8, n=8) ; Tail 211-254 (mean=225.5, s=12.5, n=8) ; Hindfoot 50.5-55 (mean=52, s=1.4, n=8) ; Ear 20-23 (mean=21, s=1, n=8).

Cranial : Occipitonasal 51.4-53.5 (mean=52.5, s=0.5, n=5) ; Palate 25.1-26.8 (mean=25.9, s=0.6, n=5) ; Nasal 15.3-17.2 (mean=16.3, s=0.6, n=5) ; Frontal 18.7-20.4 (mean=19.8, s=0.6, n=5) ; Orbit 16.2-17 (mean 16.5, s=0.31, n=5).

Description :

Except feet and tail-tip dorsal pelage glossy, dark red ; feet blackish ; tail tip white. Underparts light red.

Skull and baculum similar to that of *C. e. erythraeus*.

Remarks :

Ellerman (1963) treated *ferrugineus* as a subspecies of the wholly red squirrel, *C. finlaysoni* (Horsfield). Moore and Tate (1965) treated *ferrugineus* as a distinct species as the present ranges of *finlaysoni* and *ferrugineus* are some 320 km. apart and separated from each other by a great barrier, the Salween. According to them *ferrugineus* has originated separately from all other red squirrels. From the geological point of view the treatment of Moore and Tate (1965) appears to be most convincing. They also opined that *keraudreni* may prove to occur west of lower Irrawaddy and to be a good subspecies on the basis of the following consideration :

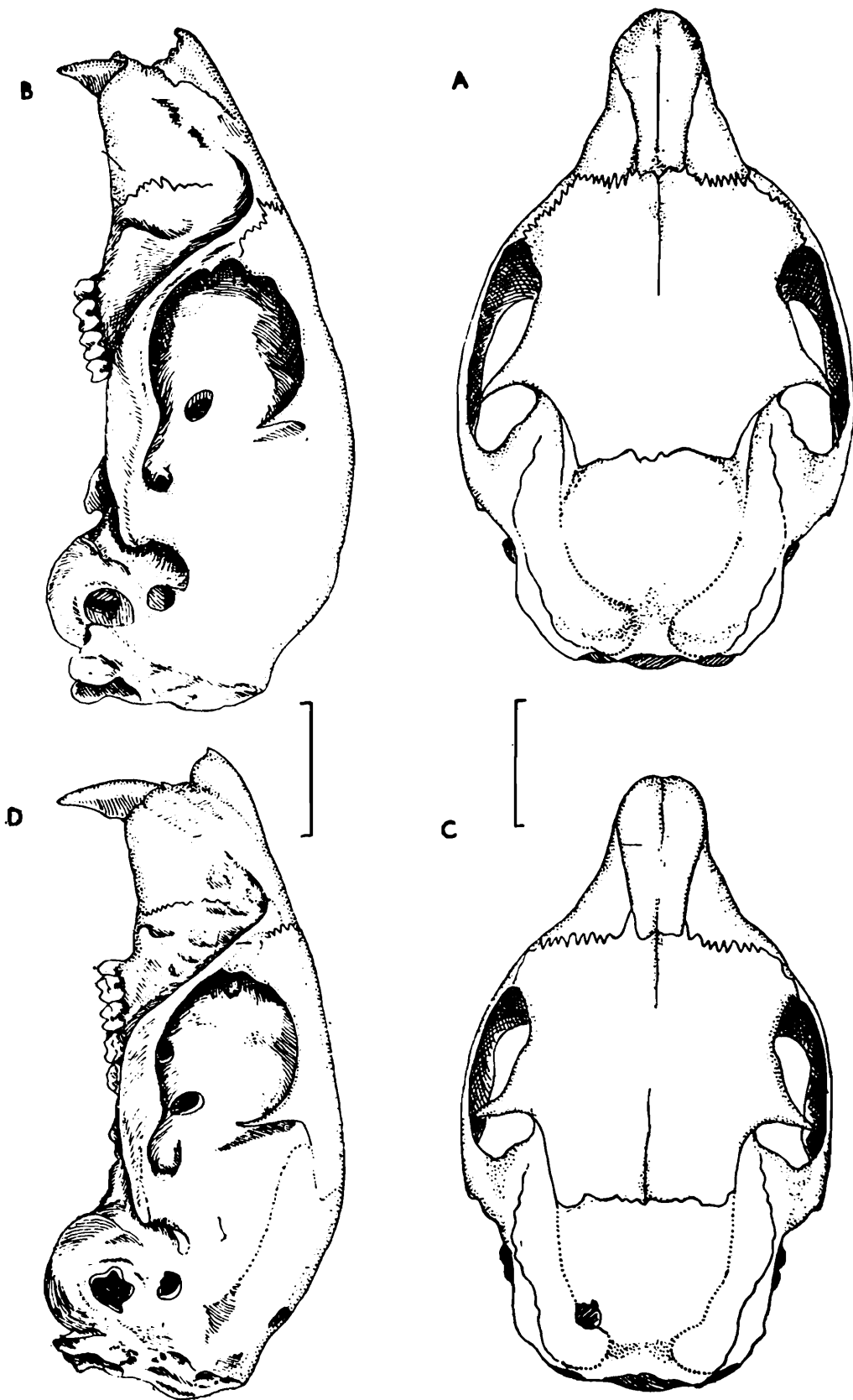


Fig. 18

- A. Dorsal view of skull of *Callosciurus hippurus hippurus*
- B. Lateral view of skull of *C. h. hippurus*
- C. Dorsal view of skull of *Callosciurus ferrugineus*
- D. Lateral view of skull of *C. ferrugineus*

‘Lessen’s plate of *keraudreni* indicates a much greater length of the white tail tip than is the case in *ferrugineus*. There is in the British Museum a specimen,.....which is labelled “*keraudreni*” It is from Arakan in west Burma.....Almost two inches of the tip of its tail are white. It thus agrees substantially with Lesson’s plate and differs somewhat from true *ferrugineus* in which the white tip is very much smaller’

Distribution :

Burma : Principally between the Sittang Valley and lower Irrawaddy.

SUMMARY

Detailed study on the taxonomy and distribution of 10 species and 54 subspecies of the genus *Callosciurus* from Indochinese and Malaysian subregions of the Oriental region have been made. Several species and subspecies, namely, *Macroxus punctatissimus*, *Sciurus hyperythrus*, *Sciurus blanfordi*, *Sciurus caniceps adangensis*, *S. c. fallax*, *Sciurus lokroides mearsi*, *Tomeutes mearsi virgo*, *Sciurus melanops*, *Sciurus vittatus plasticus*, and *S. v. perhentiani* have not been accepted as valid. Many other subspecies, namely, *Callosciurus erythraeus crotalius*, *C. e. kinneari*, *Callosciurus caniceps lancavensis*, *C. c. samuiensis*, *C. c. sullivanus* and *C. c. crumpi* have been revived. Taxonomic status of *Sciurus atrodorsalis*, *Sciurus gordonii* and *Sciurus atrodorsalis shanicus* have been discussed and revised. External and cranial characters including individual and seasonal colour variation of different subspecies have been discussed. External and cranial measurements of different subspecies have been statistically analysed to find out their significance. Diagnostic features of different species and keys to the identification of their subspecies have been provided.

Table 1. External and cranial measurements of the different subspecies of *Callosciurus erythraeus* (Pallas) with range, mean of samples in parentheses, number of measurements (n) and the standard deviation (s). Measurements given by Ellerman (1963) are also included.

Name	Head and body	Tail	Hindfoot	Ear	Occipitonasal	Palate	Nasal	Orbit	Frontal
<i>C. e. erythraeus</i>	212-290 (239) n=35 s=14	202-275 (234) n=35 s=17	48.57 (52.5) n=33 s=2.08	12-25 (20) n=34 s=3.85	54-57.5 (56.2) n=15 s=1.03	26.1-28.3 (27) n=14 s=0.57	16-18 (16.95) n=14 s=3.56	16.4-18.1 (17) n=14 s=0.43	18.5-21.5 (20.5) n=15 s=1.1
<i>C. e. erythrogaster</i>	207-282 (232) n=34 s=15	152-275 (232) n=35 s=25	43-58 (53) n=35 s=3.7	19-25 (21) n=33 s=1.3	52.5-58.5 (55.4) n=30 s=1.58	25.1-28.5 (27) n=32 s=0.92	15.1-18.9 (17.3) n=32 s=1.07	16.1-18.2 (17.1) n=32 s=0.57	17.5-22.3 (19.8) n=32 s=1.27
<i>C. e. atrodorsalis</i>	188-215 (204.5) n=10 s=9	155-217 (186) n=10 s=24.5	47-54 (51) n=10 s=2	19-22 (20) n=10 s=0.83	47.2-52.6 (40.7) n=14 s=1.41	22.8-25.3 (24) n=14 s=0.58	14.7-16.6 (15.4) n=13 s=0.62	15.4-16.8 (16) n=13 s=0.37	17.5-19.7 (18.6) n=14 s=0.54
<i>C. e. kinneari</i>	196-240 (220) n=14 s=14	210-239 (225) n=14 s=8	54-58.5 (56) n=14 s=1.46	20-22 (21) n=14 s=0.6	50.1-56.2 (53.6) n=10 s=2.06	23.9-28 (26) n=8 s=1.18	14.8-18 (16.8) n=10 s=1	15.6-17.2 (16.5) n=9 s=0.41	17.1-21.5 (19.1) n=9 s=1.15

Contd.

Table 1 (Contd.)

<i>C. e. crotalius</i>	208-248 (235) n=32 s=9	148-244 (277) n=32 s=19	52-58 (56) n=32 s=1.14	20-22.5 (21.5) n=27 s=0.74	53.1-55.9 (54.9) n=15 s=0.64	25.6-27 (26.3) n=11 s=0.49	16.3-18.2 (17.2) n=15 s=0.48	16.3-17.1 (16.8) n=12 s=0.25	17.8-21 (19.8) n=14 s=0.73
<i>C. e. intermedius</i>	198-250 (221) n=23 s=13.5	176-239 (213) n=22 s=17	39-51 (47) n=23 s=3.2	20-23 (21) n=23 s=0.82	50-54.6 (53) n=26 s=1.37	24.2-26.4 (25.45) n=26 s=0.62	15-17.3 (16.1) n=26 s=0.61	15.2-17 (16.4) n=26 s=0.48	17.2-20 (18.85) n=26 s=0.7
<i>C. e. bhutanensis</i>	213-233 (220) n=4	182-222 (201) n=4	46-55 (50) n=4	19-22 (20) n=4	54.3,54.8 n=2	26.2-26.7 (26.4) n=3	16.8,17.8 n=2	17.2-17.3 (17.24) n=3	19.1-19.5 (19.3) n=3
<i>C. e. gordonii</i>	176,250 n=2	119,220 n=2	44,50 n=2	12,21 n=9	49.1-51.8 (50.3) n=9 s=0.80	23.9-25.3 (24.3) n=8 s=0.47	14.5-16 (15.3) n=9 s=0.56	15.1-16.9 (15.7) n=9 s=0.51	16.2-18.4 (17.3) n=9 s=0.65

Table 2. External and cranial measurements of different subspecies of *Callosciurus flavimanus* (I. Geoffroy) with range, mean of sample in parentheses, number of measurements (n) and the standard deviation (s). Measurements given by Ellerman (1963) are also included.

Name	Head and body	Tail	Hindfoot	Ear	Occipitonasal	Palate	Nasal	Orbit	Frontol
<i>C. f. shortridgei</i>	216-249 (238) n=21 s=7.5	208-285 (264) n=21 s=22	55-60 (58) n=21 s=1.5	21-23 (22) n=21 s=0.7	54.9-57 (55.8) n=15 s=0.6	25.8-27.6 (26.3) n=15 s=0.5	15.8-17.8 (16.9) n=15 s=0.4	16.3-18 (16.9) n=15 s=0.5	19.1-21.5 (20.4) n=13 s=0.7
<i>C. f. sladeni</i>	207-250 (232.5) n=20 s=10.5	236-270 (247) n=20 s=9.5	46-58.5 (55) n=19 s=3	14-22 (20) n=20 s=2	54-58.1 (55.9) n=14 s=1.1	25.3-27.5 (26.5) n=14 s=0.6	16-18 (17.4) n=14 s=0.7	16.4-17.3 (16.7) n=14 s=0.3	19.4-21.5 (20.3) n=14 s=0.5
<i>C. f. phayrei</i>	192-250 (228) n=27 s=16	208-268 (240) n=26 s=14	41-58 (49) n=27 s=1.4	19-24 (21) n=26 s=1.5	50.7-57.5 (54.8) n=23 s=2.4	23.7-29.2 (26.4) n=23 s=1.5	15.1-18.5 (16.9) n=22 s=0.8	15.7-18.5 (16.9) n=23 s=0.7	17.2-21.2 (19) n=22 s=0.9
<i>C. f. blanfordi</i>	207-223 (215) n=6 s=6.4	202-235 (221) n=5 s=11	45-51 (49) n=6 s=2	19-22 (21) n=6 s=0.9	51-54.1 (51.9) n=7 s=1	23.7-25.8 (24.9) n=5 s=0.8	14.7-16 (15.5) n=7 s=0.8	15.5-18.1 (16.3) n=7 s=0.8	17.4-17.8 (17.6) n=6 n=0.2
<i>C. f. rubex</i>	183-227 (214) n=11 s=10.5	183-277 (224) n=10 s=24	53-58.5 (54) n=11 s=1.5	19-22 (20) n=11 s=0.9	51-54.9 (52.8) n=7 s=1.1	24.3-26 (25.3) n=6 s=0.6	15.3-17.8 (16.3) n=7 s=1.1	16-17 (16.4) n=7 s=0.3	18.5-19.5 (18.8) n=6 s=0.3
<i>C. f. haringtoni</i>	231-260 (244) n=20 s=7.5	234-286 (260) n=19 s=17	56-59.5 (58) n=19 s=1	21-26 (22.5) n=20 s=1	54.2-57.7 (55.9) n=15 s=1	25.4-27.6 (26.5) n=14 s=0.6	15.6-17.9 (17) n=14 s=0.7	16.4-17.6 (17) n=15 s=0.4	19.4-21.8 (20.4) n=13 s=0.7

Table 3. Degree of development of flank patch in *Callosciurus flavimanus phayrei*.

Month	Poorly developed	Moderately developed	Well-developed
January	one	two	two
February	absent	one	absent
March	absent	two	one
April	one	one	one
May	absent	two	one
July	one	absent	absent
August	one	absent	absent
September	absent	absent	one
November	absent	one	absent
December	absent	absent	one
Undated	one	one	two

Table 4. External and cranial measurements of different subspecies of *Callosciurus caniceps* (Gray) with range, mean of sample in parentheses, number of measurements (n) and the standard deviation (s). Measurements given by Ellerman (1963) are also included.

Name	Head and body	Tail	Hindfoot	Ear	Occipitonasal	Palate	Nasal	Orbit	Frontal
<i>C. c. caniceps</i>	200-232 (219) n=3	227-244 (234) n=3	52-55 (53.3) n=3	21-22 (21.6) n=3	52.5-56.9 (54.6) n=11 s=1.4	25.2-27.2 (26) n=11 s=0.5	15.4-18.4 (16.5) n=11 s=0.8	16.6-20.4 (17.9) n=10 s=1.2	16.8-21.1 (19.2) n=9 s=1.45
<i>C. c. shanicus</i>	183-218 (206) n=19 s=10	165-209 (185) n=17 s=12.5	41.5-50 (47) n=18 s=2.2	18-22 (20) n=20 s=1	47.2-51.7 (49.5) n=17 s=1.2	21.6-24.5 (23.3) n=14 s=0.7	13.6-16.5 (14.9) n=16 s=0.8	14.7-16.4 (15.5) n=14 s=0.5	14.7-18.8 (17) n=15 s=0.9
<i>C. c. sullivanus</i>	210-240 (224) n=5 s=10	185-230 (205) n=5 s=17	41-47 (45.6) n=5 s=2	17-20 (18.4) n=5 s=1	52.3-54.2 (53.3) n=6 s=0.6	25-27 (25.7) n=6 s=0.7	15.3-17 (16.2) n=6 s=0.6	16-17.6 (16.6) n=6 s=0.7	19-20.4 (19.3) n=6 s=0.5
<i>C. c. crumpi</i>	199-213 (206) n=7 s=4	191-223 (202) n=7 s=10	47-51 (49.5) n=7 s=1.4	19-22 (20.6) n=7 s=1	52-55 (53) n=6 s=1	24-26 (25) n=6 s=0.1	14.7-17.6 (16) n=6 s=0.9	16-17 (16.4) n=6 s=0.4	18.3-20 (19) n=6 s=0.5

Contd.

Table 4. (Contd.)

<i>C. c. concolor</i>	192-220 (205) n=10 s=7	178-225 (199) n=10 s=16.5	41-46 (44) n=10 s=1.5	16.5-20 (18) n=10 s=1	48.7-53.1 (50.5) n=5 s=1.6	23.4-26.2 (24.9) n=6 s=0.9	14.5-15.3 (14.8) n=3	15.8-18.2 (17) n=6 s=0.8	16.8-18 (17.4) n=6 s=0.5
<i>C. c. bimaculatus</i>	202-250 (232) n=57 s=10	180-240 (219) n=57 s=13	40-54.5 (48.5) n=57 s=3.5	17-29 (20) n=57 s=1.5	53-58.1 (55.6) n=34 s=1.2	25-27.8 (26.5) n=34 s=0.7	15.1-18.3 (16.9) n=34 s=0.7	16.1-19.9 (17) n=34 s=0.6	18-21.6 (19.4) n=34 s=0.9
<i>C. c. lancavensis</i>	222,230 n=2	200,200 n=2	44,45 n=2	10(?),19 n=2	52.8-54 n=2	25.9,25.9 n=2	15.5,16.9 n=2	16.1,16.8 n=2	18.5,18.9 n=2
<i>C. c. samuensis</i>	225,229 n=2	210,223 n=2	55.49.5 n=2	19.5,20 n=2	53.4 n=1	25.6 n=1	16.8 n=1	16.7,17 n=2	18.3,19.1 n=2

Table 5. External and cranial measurements of different subspecies of *Callosciurus pygerythrus* (I. Geoffroy) with range, mean of sample in parentheses, number of measurements (n) and the standard deviation (s). Measurements given by Ellerman (1963) are also included.

Name	Head and body	Tail	Hindfoot	Ear	Occipitonasal	Palate	Nasal	Orbit	Frontal
<i>C. p. pygerythrus</i>	158-192	152-189	40.5-46	17-21	43-47.5	20.8-23.2	12.2-14	14.3-15.8	14-15.5
	(179)	(175)	(43)	(18.4)	(45.8)	(22.3)	(13.5)	(14.95)	(14.95)
	n=16	n=16	n=16	n=16	n=11	n=11	n=11	n=11	n=11
	s=9	s=10	s=2	s=1	s=1.3	s=0.6	s=0.5	s=0.4	s=0.6
<i>C. p. lokroides</i>	158-222	132-205	36-47	13.5-22	43.7-50.7	20.8-24.3	12.3-16.6	14-16.3	14.4-18.1
	(185)	(180)	(41)	(18)	(48.2)	(23.2)	(14.5)	(15.2)	(16.2)
	n=57	n=56	n=57	n=57	n=32	n=30	n=32	n=31	n=32
	s=14	s=13	s=2.5	s=2	s=1.4	s=0.83	s=0.8	s=0.54	s=0.8
<i>C. p. janetta</i>	164-205	145-200	39-49	17-22	42.8-47.6	20.1-22.7	11.7-14.2	14.2-15.8	13.3-15.7
	(189)	(179)	(43.5)	(20)	(45.8)	(21.7)	(13)	(15)	(14.8)
	n=36	n=36	n=36	n=35	n=25	n=25	n=26	n=26	n=26
	s=10	s=12	s=2.5	s=1	s=1.1	s=0.6	s=0.7	s=0.4	s=0.5
<i>C. p. blythi</i>	145-210	142-217	34-49	15-24	44.6-49.4	21.5-24.5	12.4-16.6	14.1-16.7	13.7-16.9
	(187)	(183)	(42)	(19)	(47.5)	(22.9)	(13.7)	(15.2)	(15)
	n=82	n=78	n=82	n=79	n=34	n=34	n=34	n=34	n=33
	s=12.6	s=14.7	s=2.7	s=1.5	s=1.2	s=0.8	s=0.7	s=0.5	s=0.9
<i>C. p. stevensi</i>	176,185, 198	188,192 192	41,47.5,48	19,20,20	47.5-49.7 (48.6)	22.8-24 (23.6)	13.5-15.8 (14.7)	15.2-17.1 (16.2)	14.9-15.7 (15.2)
	n=3	n=3	n=3	n=3	n=6	n=6	n=6	n=7	n=7
					s=0.7	s=0.5	s=0.75	s=0.6	s=0.2
<i>C. p. bellona</i>	154-192	158-189	35-45	15-19.5	44.6-47.2	21.6-23.2	13.2-14.6	14.1-15.3	14.6-15.5
	(179)	(176)	(43)	(17.2)	(46)	(22.3)	(13.7)	(14.8)	(15)
	n=16	n=15	n=16	n=15	n=5	n=5	n=5	n=5	n=5
	s=8.5	s=7.2	s=2.2	s=1.8	s=0.8	s=0.5	s=0.5	s=0.4	s=0.3

Table 6. External and cranial measurements of different subspecies of *Callosciurus prevosti* (Desmarest) with range, mean of sample in parentheses and number of measurements (n)

Head and body	Tail	Hindfoot	Ear	Occipitonasal	Palate	Nasal	Orbit	Frontal
				Name : <i>C. p. prevosti</i>				
244 n=1	253 n=1	50 n=1	16 n=1	56,57.4 n=2	25-27.8 (26.7) n=3	17-18.7 n=3	16.3-17.5 (16.9) n=3	23.4-24.5 (23.8) n=3
				Name : <i>C. p. humei</i>				
266 n=1	228 n=1	58 n=1	21 n=1	56.6 n=1	26.8 n=1	17.8 n=1	17.5 n=1	23.6 n=1
				Name : <i>C. p. wrayi</i>				
254 n=1	252 n=1	58 n=1	29 (?) n=1	60.5 n=1	27.2 n=1	18.8 n=1	18.2 n=1	26.6 n=1
				Name : <i>C. p. rafflesi</i>				
—	—	—	—	54.7-58.3 (56.6) n=4	25.3-29.1 (26.8) n=4	16-20 (17.8) n=4	16.5-17.4 (16.9) n=4	21.6-23.9 (22.7) n=3
				Name : <i>C. p. pluto</i>				
—	—	—	—	53.5 n=1	25 n=1	16.4 n=1	16.6 n=1	21.3 n=1
				Name : <i>C. p. atricapillus</i>				
225 n=1	193 n=1	49 n=1	22 n=1	52 n=1	25.6 n=1	15.7 n=1	17.4 n=1	22.3 n=1
				Name : <i>C. p. carimonensis</i>				
205 n=1	237 n=1	53 n=1	20 n=1	—	—	—	—	—

Table 7. External and cranial measurements of different subspecies of *Callosuciurus vittatus* (Raffles) with range, mean of sample in parentheses and number of measurements (n).

Name	Head and body	Tail	Hindfoot	Ear	Occipitonasal	Palate	Nasal	Orbit	Frontal
<i>C. v. dulitensis</i>	195,196 n=2	172,196 n=2	45,46 n=2	15,16 n=2	47.5 n=1	—	15.8 n=1	15.3 n=1	19.3 n=1
<i>C. v. tenuirostris</i>	195 n=1	185 n=1	42.5 n=1	17.5 n=1	51.4 n=1	24.4 n=1	15.3 n=1	16.5 n=1	18.5 n=1
<i>C. v. miniatus</i>	190-209 (198) n=4	154-204 (187) n=4	31-44 (41) n=4	15-19 (17) n=4	49.52 (50.4) n=4	23.1-24.9 (24) n=4	14.5-15 (14.8) n=4	15.8-16.3 (16) n=4	17.2-19.4 (18.3) n=4
<i>C. v. scott</i> with <i>'plasticus'</i> and <i>'perhentiani'</i>	138-188 (168) n=3	168-187 (180) n=3	42.5-43.5 (43.2) n=3	16.5,17 n=2	44.2-44.8 (44.4) n=3	21.7-22.7 (22.3) n=3	11.2,12.6 n=2	14.5-15.2 (14.9) n=3	15.6-16.4 (16) n=3
<i>C. v. proteus</i>	182 n=1	168 n=1	40 n=1	15 n=1	46.3 n=1	22.8 n=1	14.8 n=1	14.5 n=1	16.3 n=1
<i>C. v. subluteus</i>	213 n=1	183 n=1	47 n=1	16 n=1	49.1 n=1	24.3 n=1	12,4 n=1	15.8 n=1	19.3 n=1

Table 8. Showing combined breadth of nasals in two subspecies of *Callosciurus vittatus* (Raffles).

Name	Combined breadth of nasals at the anterior margin	Combined breadth of nasals at the posterior margin
<i>C. v. vittatus</i>	*8	*5
<i>C. v. tenuirostris</i>	7.2,5.1	3.4,3.4

* From Bonhote (1901).

Table 9. Showing the greatest length of skull in three subspecies of *Callosciurus vittatus* (Raffles).

Name	Greatest length of skull
<i>C. v. scotti</i>	*45
<i>C. v. plasticus</i>	44.3,44.8
<i>C. v. perhentiani</i>	44

* From Kloss (1911b).

Table 10. External and cranial measurements of different subspecies of *Callosciurus nigrovittatus* (Horsefield) with range, mean of sample in parentheses and number of measurements (n).

Name	Head and body	tail	Hindfoot	Ear	Occipitonasal	Palate	Nasal	Orbit	Frontal
<i>C. n. nigrovittatus</i>	181,183 n=2	160,164 n=2	42,43 n=2	14,15 n=2	46.5 n=1	22.1 n=1	13,6 n=1	14.7 n=1	17.9 n=1
<i>C. n. bilimitatus</i>	223 n=1	160 n=1	45 n=1	19 n=1	47.5 n=1	23.4 n=1	14.8 n=1	15.6 n=1	19.2 n=1
<i>C. n. microrhynchus</i>	182 n=1	153 n=1	35 n=1	16 n=1	—	—	—	—	—
<i>C. n. johorensis</i>	—	—	—	—	48.4,48.5 n=2	23.3-23.4, (23.33) n=3	12.4-15.2 (13.7) n=3	15.3,15.5 n=2	18-19.3 (18.4) n=3
<i>C. n. bocki</i>	174,177 n=2	140,154 n=2	38.5,39.5 n=2	15,16 n=2	42.3,43 n=2	19.7,19.8 n=2	11.8,12.7 n=2	14,14.2 n=2	16.1,16.3 n=2

Table 11. Showing the length of upper tooth row and maximum breadth of combined nasals in three subspecies of *Callosciurus nigrovittatus* (Horsefield).

Name	Maximum breadth of combined nasals	Length of upper tooth row
<i>C. n. bilimitatus</i>	7.1	9.1
<i>C. n. microrhynchus</i>	*6.75,7	9
<i>C. n. johorensis</i>	7,8	3.4,9.3,**10

* From Kloss (1908)

** From Robinson and Wroughton (1911)

REFERENCES

- AGRAWAL, V C. and BHATTACHARYYA, T P. 1979. Taxonomic status of *Macroxus punctatissimus* Gray (Rodentia : Sciuridae). *Proc. zool. Soc., Calcutta*, 30 : 57-59.
- ALLEN, G. M. 1925. Squirrels collected by the American Museum Asiatic Expedition. *Am. Mus. Novit.*, 163 : 1-16.
- ALLEN, G. M. 1940. The mammals of China and Mongolia. Natural History of Central Asia, 11, pt. 2 (Rodentia Ungulates and Sirenians). New York, American Museum of Natural History.
- ANDERSON, J. 1871. On three species of squirrels from Upper Burmah and Kakhyen Hills between Burmah and Yunnan. *Proc. zool. Soc. Lond.*, pp. 139-142.
- ANDERSON, J. 1879 (1878). Anatomical and Zoological researches : Comprising an account of the two expeditions to Western Yunnan in 1868 and 1875 ; and a monograph of the two cetacean genera, *Platanista* and *Orcella*. Vol. 1. London.
- ANTHONY, H. E. 1941. Mammals collected by the Vernay-Cutting Burma Expedition. *Publs. Field Mus. nat. Hist.*, 27 : 37-125.
- ASKINS, R. A. 1977. Family Sciuridae [in Mammals of Thailand by B. Lekagul and J. A. McNeely]. pp. 337-387.
- BLANFORD, W T 1891. The fauna of British India, Mammalia. Taylor and Francis, London.
- BLYTH, E. 1847. Supplementary report by the Curator, Zoological Department. *J. Asiat. Soc. Beng.*, 16 : 864-878.
- BLYTH, E. 1849. Notes on the *Sciuri* inhabiting Ceylon, and those of Tennasserim provinces. *J. Asiat. Soc. Beng.*, 18 : 600-603.
- BLYTH, E. 1855. A discussion of the smaller squirrels of eastern Asia. *J. Asiat. Soc. Beng.*, 24 : 472-477.
- BONHOTE, J. L. 1901a. On the squirrels of the *Sciurus erythraeus* group. *Ann. Mag. nat. Hist.*, (7) 7 : 160-167.
- BONHOTE, J. L. 1901b. On the squirrels of the *Sciurus prevosti* group. *Ann. Mag. nat. Hist.*, (7) 7 : 167-177.
- BONHOTE, J. L. 1901c. On *Sciurus caniceps* and allied species. *Ann. Mag. nat. Hist.*, (7) 7 : 270-275.
- BONHOTE, J. L. 1901d. On *Sciurus notatus* and allied species. *Ann. Mag. nat. Hist.*, (7) 7 : 444-455.

- BONHOTE, J. L. 1908. Report on the Gunong Tahan Expedition, Mammals. *J. Fed. Malay St. Mus.*, 3 : 1-3.
- CARTER, T. D. 1943. The mammals of the Vernay-Hopwood Chindwin Expedition, northern Burma. *Bull. Am. Mus. nat. Hist.*, 82 : 99-113.
- CHAKRABORTY, S. 1975. On a collection of mammals from Bhutan. *Rec. zool. Surv. India*, 68 : 1-20.
- CHASEN, F. N. 1940. A handlist of Malaysian mammals. A systematic list of the Malay peninsula, Sumatra, Borneo and Java, including the adjacent small Islands. *Bull. Raffles Mus.*, 15 : 1-209.
- DICE, H. H. and LERAAS, H. J. 1936. A graphic method of comparing several sets of measurements. *Contr. Lab. vertebr. Genet. Univ. Mich.*, No. 3 : 1-3.
- ELLERMAN, J. R. 1947. A key to the Rodentia inhabiting India, Ceylon and Burma, based on collection in the British Museum. *J. Mammal*, 28 : 249-279, 357-387.
- ELLERMAN, J. R. 1963 (1961). The fauna of India including Pakistan, Burma and Ceylon. Vol. 3 (Rodentia). Govt. of India, Delhi.
- ELLERMAN, J. R. and MORRISON-SCOTT, T. C. S. 1951. Checklist of Palaeartic and Indian Mammals. *Brit. Mus. Nat. Hist.*, London.
- GRAY, J. E. 1842. Descriptions of some new genera and fifty unrecorded species of Mammalia. *Ann. Mag. nat. Hist.*, 10 : 255-267
- GRAY, J. E. 1967. Synopsis of the Asiatic squirrels (Sciuridae) in the collection of the British Museum, describing one new genus and and some new species. *Ann. Mag. nat. Hist.*, 20 : 270-286.
- GYLDENSTOLPE, N. 1914. Mammals collected or observed by the Swedish Zoological Expedition to Siam, 1911-1912. *Ark. Zool.*, 8 (23) : 1-36.
- HUBS, C. L. and PERLMUTTER, A. 1942. Biometric comparison of several samples with particular references to racial investigations. *Am. Nat.*, 76 : 582-592.
- KLOSS, C. B. 1908. New mammals from Malay Peninsula region. *J. Fed. Malay St. Mus.*, 22 : 143-147.
- KLOSS, C. B. 1911a. New mammals and birds from the low lands of Pahang. *J. Fed. Malay St. Mus.*, 4 : 144-166.
- KLOSS, C. B. 1911b. Diagnosis of new mammals from Trengganu Archipelago, east coast of Malay Peninsula. *Ann. Mag. nat. Hist.*, (8) 7 : 115-119.
- KLOSS, C. B. 1916. Diagnosis of four new squirrels from Siam. *J. nat. Hist. Soc. Siam.*, 2 : 178.

- KLOSS, C. B. 1921. A new squirrel from North Sarawak. *J. Straits Brch R. Asiat. Soc.*, 83 : 151-152.
- LYON, M. W. 1907a. Description of a new squirrel of the *Sciurus prevosstii* group from Pulo Temaju, West coast of Borneo. *Smithson Misc. Collns*, 48 : 275-276.
- LYON, M. W. 1907b. The squirrels of the *Sciurus vittatus* group in Sumatra. *Smithson. Misc. Collns*, 48 : 277-283.
- LYON, M. W. 1907c. Notes on some squirrels of the *Sciurus hippurus* group, with description of two new species. *Smithson. Misc. Collns*, 50 : 24-29.
- MEDWAY, L. 1969. The wild mammals of Malaya. Oxford Univ. Press, Kuala Lumpur. 127. pp.
- MEDWAY, L. 1978. The wild mammals of Malaya (Peninsular Malaysia) and Singapore 2nd ed. Oxford Univ. Press, Kuala Lumpur.
- MILLER, G. S. 1900a. Description of two new squirrels from Trang, Lower Siam. *Proc. Acad. Sci. Wash.*, 2 : 79-81.
- MILLER, G. S. 1900b. Mammals collected by Dr. W. L. Abbott on islands in the N. China Sea. *Proc. Acad. Sci. Wash.*, 2 : 203-246.
- MILLER, G. S. 1902. Mammals collected by Dr. W. L. Abbott in the region of Indragiri river, Sumatra. *Proc. Acad. nat. Sci. Philad.*, 54 : 143-159.
- MILLER, G. S. 1903a. Mammals collected by Dr. Abbott on the coast and islands of N. W. Sumatra. *Proc. U. S. natn. Mus.*, 26 : 437-484.
- MILLER, G. S. 1903b. Seventy new Malayan mammals. *Smithson. Misc. Collns*, 45 : 1-73.
- MILLER, G. S. 1906. The mammals collected by Dr. W. L. Abbott in the Rhino-Lingga Archipelago. *Proc. U. S. natn. Mus.*, 31 : 247-276.
- MOORE, J. C. 1959. Relationships among the living squirrels of the Sciurinae. *Bull. Am. Mus. nat. Hist.*, 118 : 152-206.
- MOORE, J. C. 1960. Squirrel geography of the Indian subregion. *Syst. Zool.*, 9 : 9-17.
- MOORE, J. C. 1961. Geographic variation in some reproductive characteristics of diurnal squirrels. *Bull. Am. Mus. nat. Hist.*, 122 : 1-32.
- MOORE, J. C. and TATE, G. H. H. 1965. A study of the diurnal squirrels, Sciurinae, of the Indian and Indochinese subregions. *Fieldiana, Zool.*, 48 : 1-351.

- OSGOOD, W. H. 1932. On the mammals of Indochina. *Publs. Field Mus. nat. Hist.*, 18 : 193-339.
- RIDGWAY, R. 1886. Nomenclature of colors. Boston, Little Brown.
- ROBINSON, H. C. 1912. On new mammals from the islands of Johore Archipelago, South China Sea. *Ann. Mag. nat. Hist.*, (8) 10 : 589-595.
- ROBINSON, H. C. 1913. Zoological results of the Abor Expedition 1911-1913. Mammals. *Rec. Indian Mus.*, 8 : 85-98.
- ROBINSON, H. C. 1916a. A collection of mammals and birds from Pulau Panjong or Pulau Mapor, Rhio-Lingga Archipelago. *J. Fed. Malay St. Mus.*, 7 : 59-69.
- ROBINSON, H. C. 1916b. A new race of *Callosciurus vittatus* (Raffles) from Singapur Island. *J. Fed. Malay St. Mus.*, 7 : 73-74.
- ROBINSON, H. C. and KLOSS, C. B. 1914. On new mammals, mainly from Bandon and adjacent islands, East coast of the Malay Peninsula. *Ann. Mag. nat. Hist.*, (8) 13 : 223-224.
- ROBINSON, H. C. and KLOSS, C. B. 1915a. On a collection of mammals, from the Siamese Province of Bandon, N. E. Malay Peninsula. *J. Fed. Malay St. Mus.*, 5 : 111-127.
- ROBINSON, H. C. and KLOSS, C. B. 1915b. The Zoology of Koh Samui and Koh Pennan. Part 2. Mammals. *J. Fed. Malay St. Mus.*, 5 : 130-139.
- ROBINSON, H. C. and KLOSS, C. B. 1918. A nominal list of the Sciuridae of the Oriental region with a list of specimens in the collection of the Zoological Survey of India. *Rec. Indian Mus.*, 15 : 171-254.
- ROBINSON, H. C. and KLOSS, C. B. 1922. New mammals from French Indo-China and Siam. *Ann. Mag. nat. Hist.*, (9) 9 : 87-98.
- ROBINSON, H. C. and WROUGHTON, R. C. 1911. Notes on Indo-Malayan squirrels. *J. Fed. Malay St. Mus.*, 4 : 166-168.
- ROBINSON, H. C. and WROUGHTON, R. C. 1916. On a new race of *Callosciurus atrodorsalis* (Gray) from North Siam. *J. Fed. Malay St. Mus.*, 7 : 91.
- BOONWAL, M. L. 1950. Contribution to the fauna of Manipur State, Assam. Part 3. *Rec. Indian Mus.*, 47 : 1-64.
- RYLEY, K. V. 1914. Scientific Results from the Mammal Survey. No. 6E, *J. Bombay nat. Hist. Soc.*, 22 : 662-663.

- SCLATER, W. L. 1891. Catalogue of Mammalia in the Indian Museum, Calcutta. Part 2. Indian Museum, Calcutta.
- SODY, H. J. V. 1928. Over *Callosciurus notatus* Bodd. met beschrijving van 2 nieuwe subspecies. *Natuurk. Tijdschr. Ned.—Indië*, 88 : 325-332.
- SODY, H. J. V. 1929. Naamlijst van de zoogdieren van Java (met Korte beschrijvingen van twee nieuwe subspecies) [*Callosciurus*, *Rattus*]. *Natuurk Tijdschr. Ned.—Indië*, 89 160-166.
- STONE, W. and REHN, J. A. G. 1902. A collection of mammals from Sumatra, with a review of the genera *Nycticebus* and *Tragulus*. *Proc. Acad. nat. Sci. Philad.*, 54 127-142.
- TATE, G. H.H. 1947. Mammals of eastern Ania. New York.
- THOMAS, O. 1905. On a new squirrel from Burma. *Proc. zool. Soc. Lond.*, 2 : 314-315.
- THOMAS, O. 1914. Scientific Results from the Mammal Survey. No. 8. *J. Bombay nat. Hist. Soc.*, 23 : 197-205.
- THOMAS, O. 1915. The penis bone or 'baculum' as a guide to the classification of certain squirrels. *Ann. Mag. nat. Hist.*, (8) : 15 : 383-387.
- THOMAS, O. 1929 (1928). The Delacour exploration of French Indo-China. Mammals. III. Mammals collected during the winter of 1927-28. *Proc. zool. Soc. Lond.*, pp. 831-841
- THOMAS, O. and ROBINSON, H. C. 1921. Some new insular squirrels of the *Callosciurus caniceps-concolor* group from Peninsular Siam. *Ann. Mag. nat. Hist.* (9) 7 : 118-123.
- THOMAS, O. and WROUGHTON, R. C. 1909a. Diagnosis of new mammals collected by Mr. H. C. Robinson in the Malay Peninsula and Rhio Archipelago. *Ann. Mag. nat. Hist.*, (8) 3 : 439-441.
- THOMAS, O. and WROUGHTON, R. C. 1909b. Diagnosis of new mammals collected by Mr. H. C. Robinson in the islands of the straits of Malacca. *Ann. Mag. nat. Hist.*, (8) 4 : 534-536.
- THOMAS, O. and WROUGHTON, R. C. 1916. Scientific Results from the Mammal Survey. Nos. XXIIA, XIIID. *J. Bombay nat. Hist. Soc.*, 24 : 224-239, 419-422.
- WROUGHTON, R. C. 1908. A new squirrel from Burmah. *Ann. Mag. nat. Hist.*, (2) 2 : 491.

WROUGHTON, R. C. 1916. Scientific Results from the Mammal Survey No. XIIIIGI. *J. Bombay nat. Hist. Soc.* 24 : 424-425.

WROUGHTON, R. C. 1919. Summary of the results from the Indian Mammal Survey of Bombay Natural History Society, Part 3. *J. Bombay nat. Hist. Soc.*, 26 : 338-379.

WROUGHTON, R. C. 1921. Scientific Results from the Mammal Survey, No. XXVIC, XXVII. *J. Bombay nat. Hist. Soc.* 27 : 601, 773-777.