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by

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WITH AN APPENDIX BY

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Subfamily (d) MURINAE

Muridae in which the upper molars are laminate, the laminae pressed closely together, and in which the cusps, when present, are arranged in three longitudinal rows. The cheekteeth are rooted, and 3/3 in number. The skull and external appearance are almost always without extreme specialization and the jaw muscle structure is typical for the family; the infraorbital foramen is normally modified into a wider upper portion for muscle transmission and a lower, narrower one for nerve transmission, and the zygomatic plate is broadened and tilted upwards. The lower jaw is without abnormality, except that occasionally the lower incisor root may form a knob on its outside. The frontals are nearly always constricted. The bullae vary greatly in size; even within the genus *Rattus* they may be as low as 9% of the occipitonasal length, or in certain Australian forms like *R. sordidus*, as high as 25%; intermediates connect these two extremes. The palate length varies from over 60% of the occipitonasal length in fossorial genera like *Nesokia* to about 42% in the Bornean species *Rattus baeodon*. The palatal foramina are usually long, but may be as low as one-tenth of the occipitonasal length in *Nesokia*. With one exception (*Hapalomys*) the genera have only two functional rows of cusps in the lower molars. Externally the form is usually generalized and essentially mouse-like or rat-like, but may be specialized towards arboreal life, and a few genera have the great toe clawless and apparently opposable. The tail in the present group is usually naked and scaly, but *Crateromys* from the Philippine Islands has it as bushy as a squirrel. Fifteen genera worthy of retention occur in Indian territory. On the mainland of Asia there are only two more, *Pithecheir* (Malay States, Sumatra and Java), which most resembles *Hapalomys* in cranial details but is quite different dentally as it lacks the third row of cusps in the lower molars

which is characteristic of the latter; and *Arvicanthis* (Arabia and the greater part of Africa except the south), which is not easy to distinguish from *Rattus* and may be retained only on a combination of characters. Many more genera belonging to this group occur in the Malay Islands, Australia, New Guinea and Africa. The natural distribution of the Murinae is absolutely throughout the Old World (if one accepts the Madagascar genus *Eliurus* as a member of this subfamily, and it seems to belong here), and the three commensal species *Rattus rattus*, *Rattus norvegicus* and *Mus musculus* are world-wide.

Blanford recognized only seven genera in this subfamily, *Hapalomys*, *Vandeleuria*, *Chiropodomys* (which are three of the four Indian genera with opposable hallux), *Acomys*, *Golunda*, *Nesokia* and *Mus*. *Nesokia* contained the fossorial bandicoot-rats, which have subsequently been split into three genera, one of which is not valid but the other, *Bandicota*, may be reasonably retained. *Mus* was subsequently restricted, first by the separation of mice in which the posterointernal cusp of the upper molars is retained, as *Micromys* (harvest-mice) and *Apodemus* (field-mice), secondly, by restricting *Mus* on dental details to be house-mice and their immediate allies (as by Miller, 1912, and subsequent authors), referring the house-rats and numerous allied groups to *Rattus*, which is the largest genus of all mammalia (see Simpson, 1945) in species and named forms. A fourth genus with appposable hallux but with simpler teeth than the three named genera above, *Chiromyscus*, was more recently set up.

Thomas separated the species *humei* (from *Mus*) as *Hadromys* and discovered two more genera, *Dacnomys* and *Diomys*, in the collections of the Indian Mammal Survey; the latter had an interesting history, as it was described from one broken skull only, and living animals were not collected until nearly thirty years later, when Mr. Frost obtained many in Manipur during a collection made in connection with the present work. Other generic names adopted by Wroughton and Thomas seem unnecessary. It must be borne in mind that any worker on this subfamily is dealing with enormous numbers of specimens and a great deal too many named subspecies.

Key to the Indian genera of Murinae

1	(8) The hallux is clawless and apparently fully appposable .	2
2	(3) First and second upper molars lack the posterointernal cusp.	<i>Chiromyscus</i>

- 3 (2) First and second upper molars with a clear posterointernal cusp, which is retained until the dental pattern wears out. . . 4
- 4 (5) First and second lower molars with three rows of approximately equal-sized cusps. Occipitonasal length (in Indian race) is more than 37 mm. Toothrow, proportionately longer, exceeds 7 mm. Bullae proportionately larger, 7.7 mm. and more *Hapalomys*
- 5 (4) First and second lower molars normal, with two functional rows of cusps. Occipitonasal length (in Indian races) not reaching 30 mm. Toothrow, proportionately shorter in Indian races, is less than 4 mm. in length. Bullae, proportionately smaller, less than 4.5 mm. in length . . 6
- 6 (7) Width of the frontal bones exceeds 4 mm. (usually over 18% of the occipitonasal length). Fifth finger and toe with claw (normal) . . *Chiropodomys*
- 7 (6) Width of the frontal bones less than 4 mm. (usually 15% of the occipitonasal length or less). Fifth finger and toe lack a claw. *Vandeleuria*
- 8 (1) The hallux is clawed and not fully appposable.
- 9 (10) Upper incisors clearly and prominently grooved. Molars exceptionally heavily cuspidate, the centre and inner rows of cusps much raised up and thickened. M. 3 large, with no outer row of cusps. (No posterointernal cusp in M. 1 and M. 2) *Golunda*
- 10 (9) Upper incisors normally not grooved. Molars never as just described for *Golunda* and much less abnormal. 11
- 11 (16) Incisors proodont, or base of skull so lengthened that the condylobasal length is normally equal to the occipitonasal length (*Diomys*) or exceeds it always in *Nesokia* and *Bandicota bengalensis*; about eleven exceptions in *Bandicota indica* in about sixty-two skulls (*B. indica* may be distinguished from *Rattus* and genera below by its very long palate). 12
- 12 (15) Occipitonasal length is not less than 34.6 mm. Palate length is at

least 58% of the occipitonasal on average, often over 60%. Lower incisor root forms prominent knob on outer side of lower jaw. Palatal foramina proportionately shorter. (The bullae are enlarged, varying between 15% and 22% of the occipitonasal length). Molars tending to become plain straight laminate.

13

- 13 (14) The palatal foramina are not reduced and normally exceed 7 mm. in length; most often exceeding 18% of the occipitonasal length. M. 2 usually retains some traces of the original front lamina. Tail usually more than three-quarters of head and body length.

Bandicota

- 14 (13) The palatal foramina strongly shortened, not reaching 7 mm. in length; about 14% of the occipitonasal length or less on average. M. 2 lacks traces of the original front lamina. Tail usually less than three-quarters of head and body length.

Nesokia

- 15 (12) Occipitonasal length not exceeding 33.2 mm. Palate proportionately shorter, approximating to 55-56% of the occipitonasal. Palatal foramina proportionately longer, approximating to 23% of the occipitonasal length. Lower incisor root forms only a weak knob on outer side of lower jaw. (Bullae about 19% of the occipitonasal). Molars not tending to become plain laminate.

Diomys

- 16 (11) The condylobasal length is normally less than the occipitonasal length. The lower incisor root forms a much less prominent process on the outer side of the lower jaw than in *Nesokia* and *Bandicota*. Usually the molars are more normally cuspidate than in these genera. The above characters, either for *Diomys* or for *Nesokia* and *Bandicota*, are never combined.

17

- 17 (18) The foremost space between the pterygoid bones is roofed in by bone. Fur densely spiny. (No posterointernal cusp in M. 1 and M. 2).

Acomys

- 18 (17) The foremost space between the pterygoid bones is not roofed in by bone. 19
- 19 (22) A well developed posterointernal cusp is present in M. 1 and M. 2 and retained until the whole dental pattern wears out. 20
- 20 (21) Pygmy species, the occipitonasal length does not exceed 19.5 mm. Rostrum shortened, the diastema approximates to 20-21% of the occipitonasal length only. So far as is known, the tail is prehensile. *Micromys*
- 21 (20) The occipitonasal length is at least 22 mm. The rostrum is less shortened, the diastema proportionately longer. The tail is not prehensile. *Apodemus*
- 22 (19) No clear posterointernal cusp is present in the first and second upper molars. 23
- 23 (28) Upper tooththrow not specialized by enlargement of M. 1 so that it is normally over half length of the tooththrow, combined with distortion inwards of the anterointernal cusp, combined with strong to extreme reduction of M. 3. 24
- 24 (25) The zygomatic plate has the anterior border concave. (M. 3 relatively large; incisors heavy; fifth finger short, and outer digits of hindfoot shortened) *Hadromys*
- 25 (24) The zygomatic plate has the anterior border normally not concave. 26
- 26 (27) Upper tooththrow very long, approximating to one-fifth of the occipitonasal length. (Large rats, occipitonasal length exceeding 50 mm., bullae only about one-tenth of occipitonasal length or slightly more)... .. *Dacnomys*
- 27 (26) Upper tooththrow is less than one-fifth of the occipitonasal length.. *Rattus*
- 28 (23) Upper tooththrow specialized by enlargement of M. 1 so that it is normally more than half the length of the tooththrow, combined with distortion inwards of the anterointernal cusp, combined with strong to extreme reduction of M. 3. *Mus*

In my previous work on Indian rodents I retained the genus *Millardia* distinct from *Rattus*. More recently I have

worked in detail through the South African species of *Rattus*, and it becomes clear that some of them are so close to *Millardia* that the last named will have to be referred as a subgenus to *Rattus*.

Genus 31. *Apodemus* Kaup

1829. *Apodemus* Kaup, *Skizz. Europ. Thierwelt*, 1, 154.
1924. *Sylvaemus* Ognev, *Faun. Vert. Gouv. Voronesh*, 143. (*Mus sylvaticus* Linnaeus.)
1924. *Nemomys* Thomas, *J. Bombay nat. Hist. Soc.*, 29, 4, 889. (*Mus sylvaticus* Linnaeus.)

Type-species.—*Mus agrarius* Pallas, from Russia.

Range.—Throughout the Palaearctic region. The approximate southern boundary for the genus is Algeria and Morocco in North Africa; Israel, Persia, Afghanistan, KASHMIR, PUNJAB, NEPAL, NORTH ASSAM, NORTH BURMA, Yunnan, Fukien, Formosa. The northern limits are Scandinavia, Russia and Siberia, but not within Arctic regions, and east to west the genus ranges from Japan to Ireland and Iceland.

Probably the commonest genus of rodent in the Palaearctic region, this genus was referred to *Mus* in Blanford's day, but Miller and Thomas later very properly regarded the retention of the posterointernal cusp in the first and second upper molars as of generic value and revived the name.

The genus may be roughly defined as essentially generalized mice in which the posterointernal cusp is retained and strong in M. 1 and M. 2, and otherwise with no special peculiarities or specializations cranially, dentally or externally.

According to the classification adopted here, the forms of *Apodemus* named from India, which are few in number, may be referred to two species, both of which are recognized as occurring together throughout the greater part of Europe and some parts of Western Asia, and which I suggest really may be regarded as occurring more or less together throughout Palaearctic Asia. They differ from each other merely in size, and only on average at that, but nevertheless it seems to me reasonable and indeed necessary to retain them although on account of the enormous number of specimens available it is quite impossible to draw a sharp line between them. The first species to be named in the genus is *A. sylvaticus*, of Linnaeus, 1758; to this Glover Allen has already referred some of the Chinese races, and in this I follow him; one of them occurs in Assam. The third species to be named in the genus was *A. flavicollis* Melchior, 1834, to which some of the Kashmir races are already referred, and it seems to me that

if one follows Glover Allen in referring the smaller Chinese races to *sylvaticus*, there is no reason why one should not refer the larger Chinese races to *A. flavicollis*. One of these occurs in North Burma, and another Nepalese form, *gurkha*, seems to me to be referable to *flavicollis* as well. The type, *A. agrarius* Pallas, 1771, was the second species to be named. I do not think it occurs in Indian territory, but have little doubt that it may be found in East Burma, as it is very common in West Yunnan. Asiatic *agrarius* is definable as follows: M. 3 has two inner lobes; the skull always has supra-orbital ridges; except in the Szechuan race there is a mid-dorsal dark stripe on the back. (Usually the size of the skull is smaller than in *flavicollis* and agrees with *sylvaticus*). Against these characters, *A. sylvaticus* and *A. flavicollis* in Asia have M. 3 with three inner lobes normally; no mid-dorsal stripe; and the skull most often, but by no means always, lacks supraorbital ridges.

Besides these three species, I recognize two other species of *Apodemus* which occur in Asia; both are nearer *sylvaticus* and *flavicollis* than they are to *agrarius*; both, on average, are larger in skull size than *A. flavicollis*; these two species are: *A. mystacinus*, which occurs in Asia Minor, Syria, Israel, Greece and Yugoslavia, which has the tail averaging longer than the head and body, and in which the skull lacks supraorbital ridges (and it has wider molars than in *sylvaticus* and *flavicollis*, with both of which it occurs); and *A. speciosus*, Japan, tail shorter than head and body on average, skull usually with supraorbital ridges.

Key to the species of Apodemus occurring in India

1	(2) In the majority of specimens, the length of the occipitonasal is less than 27 mm.. . . .	<i>Apodemus sylvaticus</i>
2	(1) In the majority of specimens, the length of the occipitonasal is more than 27 mm.. . . .	<i>Apodemus flavicollis</i>

As indicated above, the difference between these two species is average, not absolute, but they occur together over an enormously wide area.

I have measured approximately five hundred skulls for the former species, forty-five approximately of which reach 27 mm. in occipitonasal length; and I have measured about one hundred and ninety specimens of *flavicollis*, about forty-six of which do not reach 27 mm. (some of these may be not fully adult). In dealing with numbers of specimens as large

as this, however, not very much more can be done by way of definitions. Dental characters are, with the exception of the one pointed out by Glover Allen to distinguish these two species from *A. agrarius*, mostly inconstant, and presence or absence of frontal ridges in the various Asiatic and some European races for these two species proves hopelessly inconstant when detailed work is done.

69. *Apodemus flavicollis* (Melchior)

The Larger Long-tailed Field-Mouse

1834. *Mus flavicollis* Melchior, *Danske Staats og Norges Pattedyr*, 99.

Type-locality.—Sielland, Denmark.

Distribution.—As here understood; in Europe, France, Switzerland, England (the Shetlands included), Norway and Sweden, Germany, Hungary, Yugoslavia, Rumania, Greece, Finland, Estonia, and parts of European Russia, including the Caucasus. In Asia, KASHMIR, PUNJAB, KUMAON, NEPAL, NORTH BURMA, Yunnan, Szechuan, South Tibet, Kansu, Shensi and Shansi, Chihli, Korea. Perhaps Syria. Afghanistan.

Apodemus races in which M. 3 has, at least in Asiatic forms (probably always), three inner lobes traceable when the pattern is not worn out; in which there is no mid-dorsal stripe on the back; and in which the skull is large, the length of the occipitonasal being in the majority of specimens more than 27 mm.

External characters.—Soft furred rather large-eared mice in which the tail is usually a little longer than head and body, *A. f. wardi* excepted. It is naked but with a certain growth of hair throughout. Hand with four functional fingers bearing claws, the outer one the shortest; foot with five toes, all clawed, the hallux shorter than D. 5 which is shorter than the central three. Apparently 6 plantar pads. Mammae 1-2 = 6, *wardi* (1 skin), *rusiges* (several skins). 8 in *gurkha*, according to Thomas.

Colour.—*Rusiges* and *latronum*; these two races do not differ very much from each other in colour. The colour of the back is dark brown. Often in *rusiges* there is in the centre of the back a line of particularly dark hairs, suggesting almost a mid-dorsal line, such as is present in *Apodemus agrarius*, though not so well marked as in that. Some specimens of *rusiges* are moderately light brown, but on the whole the race tends to be rather dark. Feet whitish or pale

as a rule. Underparts whitish grey in *rusiges*, tending to be more silvery grey or averaging darker in *latronum*. But intermediate and indistinguishable specimens occur in both races. Tail clearly bicolor, dark above, whitish below in *rusiges*; varying from about clearly bicolor to poorly so and sometimes nearly all dark in *latronum*.

A. f. wardi. Although there are some individual exceptions which are indistinguishable from *rusiges*, the back tends to be paler in colour; quite light brown, sometimes almost fawn. Feet white; belly lightish grey to near whitish. A few specimens have a dark mid-dorsal area suggested.

A. s. gorkha seems to stand rather apart from the others in having the back cold grey in colour, described by Thomas as 'dark smoky or bluish grey, nearest to "deep mouse-gray" of Ridgway'. This colour is constant in the series examined. Sometimes a specimen with this colour may be found in either of the other races, but they are exceptional. Possibly they are immature and it is conceivable that *gorkha* is a race which retains the duller, greyer coat of the young specimens, even in the adults. Belly more or less silvery grey or bluish grey, lighter than back. Tail bicolor. Feet light.

External measurements.—As in Table 57, below.

TABLE 57.—*External measurements of the Indian races of Apodemus flavicollis*

	Head and body	Tail	Hind- foot	Ear
<i>Apodemus flavicollis rusiges</i>				
F. Phurkia, Kumaon	93	115	23	16
				Mammae 6
F. Phurkia	100	?	23	16
				Mammae 6
M. Phurkia	98	110	22	17
M. Phurkia	101	116	22	15
Phurkia	86	91	22	15
F. Phurkia	100	110	23	17
				Mammae 6
F. Phurkia	102	?	21	16
M. Phurkia	95	111	23	15
M. Murree, Punjab	86	94	21	15½
M. Murree	90	95	21	16
M. Murree	97	?	21	17
M. Murree	97	101	21	16
F. Murree	90	92	20½	16½
				Mammae 1-2 = 6
M. Murree	95	96	21	15½
M. Murree	94	?	21	16
M. Murree	95	115	21	17

TABLE 57.—*External measurements of Apodemus flavicollis (contd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Apodemus flavicollis rusiges</i> (concl'd.)				
M. Murree	101	106	21	16
M. Kyelang, Lahul	100	117	23	18
M. Rahla, Lahul	107	110	23	18
F. Gondla, Lahul	99	110	23	18
M. Rahla, Lahul	100	117	24	19
F. Rahla, Lahul	103	115	23	17½
M. Rahla, Lahul	103	115	23	18
F. Kothi, Kulu Valley, Lahul.	107	117	23	19½
M. Rahla, Lahul	105	114	23	18
M. Rahla, Lahul	107	99	23	18
Rahla, Lahul	101	112	23	18
M. Rahla, Lahul	107	120	23	18
M. Kyelang, Lahul	94	111	23	18
M. Pahlgahm, Kashmir	98	96	22	17½
F. Murree, Punjab	93	98	21	16
			Mammæ 1-2 = 6	
F. Sardalla, Kashmir	77	95	24	17
M. Sardalla	78	85	23	18
F. Sardalla	85	96	24	17
F. Sardalla	83	112	24	17
M. Sardalla	89	?	24	17
M. Sardalla	90	98	24	17
M. Doosoo, Kashmir	199	105	23	17
M. Aru, Kashmir	98	100	23	17
M. Aru	84	91	21½	16
F. Pahlgahm, Kashmir	113	104	23	15
R. Kagan Valley, N.W.F. Province	112	112	23	17
			Mammæ 1-2 = 6	

Other specimens from Chandawara, Surez and Noogali, Kashmir.

Apodemus flavicollis gorkha

F. Laprak, Gorkha, Nepal	94	110	22	17
F. Laprak	88	111	22	16
M. Laprak	96	119	23	17
F. Laprak	85	99	21	16
M. Barpak, Gorkha	90	98	23	17
F. Laprak	95	112	22	17
F. Apoon Sottidanda, Gorkha	87	112	24	17
Laprak, type	102	118	24	16

Apodemus flavicollis wardi

M. Leh, Ladak	104	100	23	17
M. Durgu Village, Ladak	94	97	21	15
F. Leh, Ladak	98	96	20	15
M. Leh, Ladak	107	81	22	18

TABLE 57.—*External measurements of Apodemus flavicollis (concl'd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Apodemus flavicollis wardi</i> (concl'd.)					
F.	Kharchar, Ladak	102	99	21	16½
	Kharchar, Ladak	93	99	19	15
F.	Leh, Ladak	100	104	21	16
M.	Rupal, Astor	100	109	22	18
F.	Gugga Nullah, Kashmir	93	90	21	17
M.	Gugga Nullah	104	99	23	17
M.	Gugga Nullah	96	113	22	16
F.	Gugga Nullah	92	94	23	17
				Mammæ 1-2 = 6	
M.	Gugga Nullah	94	93	21	17
M.	Gugga Nullah	104	96	23	17
	Gugga Nullah	105	81	24	19
M.	Gugga Nullah	111	109	20	14
	Arthroothoo Nullah, Kashmir	86	75	18	15
F.	Chichoti, Kashmir	97	101	22	17
M.	Dangail, Kishtwar	111	124	24	18
M.	Moonlan, Kashmir	108	?	22	17

Apodemus flavicollis latronum

M.	Adung Valley, North Burma	85	108	23	18
	Adung Valley	90	100	23	17
F.	Adung Valley	77	90	23	18
M.	Adung Valley	86	100	23	18
F.	Adung Valley	94	110	23	17
M.	Adung Valley	97	105	25	17
M.	Adung Valley	83	98	24	17
M.	Adung Valley	98	120	23	17
M.	Adung Valley	91	104	23	17
M.	Adung Valley	84	100	23	17
M.	Adung Valley	98	112	23	17
	Adung Valley	85	115	22	17
	Adung Valley	101	114	24	17
M.	Adung Valley	91	107	24	19
M.	Adung Valley	86	106	25	19
M.	Adung Valley	106	117	26	22
	Adung Valley	93	110	23	19
	Adung Valley	90	108	22	17
M.	Adung Valley	84	100	22	18
F.	Adung Valley	94	98	23	16
M.	Adung Valley	98	115	24	19
M.	Adung Valley	95	110	23	16
M.	Adung Valley	86	96	22	17
M.	Adung Valley	93	117	24	18
F.	Adung Valley	79	100	23	19
F.	Adung Valley, 28·10° N., 97·40° E,	90	115	24	17

Notes from skins.—

- A. f. rusiges*: Doosoo, Kashmir, 6,500 ft.; trapped under roots of tree.
 Phurkia, Kumaon; weight $1\frac{1}{4}$ oz. and 1 oz.;
 mammae 6; $1\frac{1}{8}$ oz. and $\frac{3}{4}$ oz.
 Kagan Valley; 'had the cheek to sit up on top of a cake within 2 ft. of me, and start nibbling at it! No others seen' (Whitehead collection).
 Murree, 7,000 ft.; mammae 6; 3 foetuses.
 Kothi, Lahul, 8,400 ft.; contained 5 foetuses.
- A. f. wardi*: Dangail, Kishtwar, 10,000 ft.; trapped in scrub jungle.
 Gugga Nullah, 8,000 to 9,000 ft.; river bank beneath root of pine-tree, 5 young in uterus. And mammae 6; 7 in uterus.
 Leh, Ladak, 11,500 ft.; trapped in wall of residency compound.
 Durgu Village, Ladak, 13,500 ft.; trapped by river.
 Moonlan, 9,000 ft.; trapped in a Goojar's hut.
 Leh; trapped in house, majority of species only come into house in winter, according to local report. And 'near dwellings'
 Arthroothoo Nullah, Kashmir, 8,000 to 9,000 ft.; trapped in open. Leh, 'trapped in compound, tail rather stumpy but had elongated hairs at end. Old and mangy specimen'
- A. f. latronum*:
 Adung Valley; trapped in bracken, common; trapped in hut, very common; trapped in tree roots, common; caught by day in camp; caught at night in jungle, very common; trapped in jungle, common; caught by hand in the hut, 7 p.m., daylight; trapped on open bracken-covered land.

Cranial characters.—The skull has rather long nasals and pointed rostrum, and moderately constricted frontals. Supra-orbital ridges may or may not be developed, but are not strong as a rule. In *latronum* they are most often traceable; in *wardi* and *rusiges* they are most often absent, but there is individual variation in this respect in the latter two races. In *gurkha* they appear very faintly traceable. The brain-case is quite wide and the interparietal is well developed. Occiput rather low and weak. The bullae are of

TABLE 58.—*Cranial measurements of Apodemus flavicollis (contd.)*

		Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Frontals width
<i>Apodemus flavicollis latronum</i> (concl'd.)							
M.	32.11.1.132	29.8	14.7	6.3	4.4	4.0	4.9
	Adung Valley						
M.	32.11.1.134	26.0	12.5	5.4	4.5	3.7	4.3
	Adung Valley. Rather young						
M.	32.11.1.137	27.8	13.7	5.5	4.7	4.2	4.3
	Adung Valley						
M.	32.11.1.138	27.7	13.9	5.5	4.4	4.1	4.6
	Adung Valley						
M.	32.11.1.141	25.7	12.6	5.2	4.1	4.0	4.6
	Adung Valley						
M.	32.11.1.143	25.8	12.5	5.1	4.2	4.0	4.6
	Adung Valley						
M.	32.11.1.144	25.3	12.5	5.1	4.1	4.0	4.6
	Adung Valley						
M.	32.11.1.145	27.0	13.1	5.5	4.4	3.9	4.6
	Adung Valley						
M.	32.11.1.146	28.2	13.7	5.9	c. 3.8	4.0	4.7
	Adung Valley						
M.	32.11.1.147	27.6	13.6	5.6	4.2	4.1	4.8
	Adung Valley						
M.	32.11.1.148	25.7	12.5	5.0	4.2	4.1	4.6
	Adung Valley. Rather young						
F.	32.11.1.155 c.	27.7	13.8	5.6	4.5	3.9	4.6
	Adung Valley						
F.	32.11.1.159	27.6	13.7	5.6	4.4	4.1	4.6
	Adung Valley						
F.	32.11.1.161	27.0	13.1	5.6	4.3	3.9	4.4
	Adung Valley						
M.	32.11.1.150	27.3	c. 13.1	5.8	4.3	4.1	4.4
	Adung Valley						
<i>Apodemus flavicollis gorkha</i>							
F.	23.11.5.45	29.2	14.7	5.7	4.2	4.2	c. 4.5
	Laprak, Gorkha, Nepal						
M.	23.11.5.47	27.7	14.3	5.8	4.3	4.1	4.5
	Barpak, Gorkha, Nepal						
M.	23.11.5.44	28.5	14.6	5.9	c. 4.4	4.2	4.6
	Laprak, Gorkha, type						
<i>Apodemus flavicollis wardi</i>							
	10.1.18	27.8	14.5	5.9	4.5	4.1	3.9
	Sugga Nullah, Kashmir						
F.	5.10.3.6	25.8	12.7	4.8	4.1	3.6	4.1
	Leh, Ladak						
F.	6.12.3.17	26.0	12.6	5.0	4.4	3.8	4.2
	Kharchar, Ladak						

TABLE 58.—*Cranial measurements of Apodemus flavicollis (concl'd.)*

		Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Frontals width
<i>Apodemus flavicollis wardi</i> (concl'd.)							
F.	7.12.16.3	27.3	13.1	5.5	4.2	3.8	4.3
	Leh, Ladak						
	10.1.18.49	27.1	14.1	5.5	4.4	3.9	4.2
	Sugga Nullah, Kashmir.	Foramina measurement represents longer side					
M.	10.1.18.50	27.3	13.8	5.1	4.5	4.0	4.3
	Kashmir						
F.	10.1.18.52	27.3	13.9	5.3	4.5	3.7	3.9
	Sugga Nullah						
	96.11.2.1	28.3	14.3	5.7	4.3	3.8	3.8
	Gulmerg, Kashmir						

The type has the occipitonasal about 27 mm. in length.

Apodemus flavicollis rusiges

M.	5.10.8.4	25.5	12.5	5.3	4.3	3.9	4.0
	Skardu, Baltistan.	Youngish					
F.	6.12.3.13	26.0	13.5	5.1	4.2	3.7	4.0
	Pahlgam, Kashmir						
M.	6.12.3.15	24.9	12.5	5.1	4.4	3.7	4.3
	Aru, Kashmir.	Rather young					
M.	7.12.16.5	28.6	14.4	5.8	4.8	4.0	4.2
	Pahlgam, Kashmir						
F.	9.11.26.3	27.5	14.2	5.6	c. 4.6	4.0	4.3
	Kagan Valley, NW. Frontier Province						
M.	14.7.10.202	27.9	13.6	5.5	4.7	4.0	4.2
	Phurkia, Kumaon.	Old					
M.	14.7.10.205	26.7	13.3	5.4	4.6	3.9	4.2
	Phurkia						
F.	14.7.10.207	26.9	13.5	5.7	4.4	3.9	4.3
	Phurkia						
F.	14.7.10.208	27.8	13.7	5.8	4.6	4.0	4.3
	Phurkia						
M.	23.9.1.106	28.3	14.1	5.9	4.3	3.8	4.1
	Rahla, Lahul.	Foramina measurement represents longer side					
M.	23.9.1.107	27.7	13.5	5.7	4.5	3.7	4.0
	Rahla, Lahul.	Foramina measurement represents longer side					
M.	23.9.1.110	28.4	14.2	5.2	4.7	4.0	4.1
	Rahla, Lahul.	Foramina measurement represents longer side					
M.	23.9.1.111	27.8	13.8	5.4	4.7	3.8	4.3
	Rahla, Lahul						
M.	23.9.1.112	27.4	13.4	5.5	4.3	3.5	4.2
	Rahla, Lahul.	Old					

Dimensions of Apodemus flavicollis, including all races, in British Museum material.—The head and body length varies

between 77 and 122 mm. The tail between 75 and 127 mm. The hindfoot 18–26 mm. The occipitonasal length between 24·7 and 30·5 mm. Toothrow 3·5–4·8 mm.

The subspecies of Apodemus flavicollis in Asia.—

I am acquainted with five subspecies in Asia referable to this species. All except *A. f. peninsulæ*, which has a wide range in China, occur in some part of Indian territory. These Indian races can be keyed as follows:

1	(4) The palate long, usually more than half the length of the occipitonasal.	2
2	(3) Tail most often shorter than the head and body or individually only a little longer. Colour rather pale.	<i>A. f. wardi</i>
3	(2) Tail always much longer than head and body. (Colour rather dark). . . .	<i>A. f. gorkha</i>
4	(1) The palate shorter, usually less than half the length of the occipitonasal, or sometimes approximating to half this length.	5
5	(6) The ear proportionately larger, usually about 19% of the head and body.	<i>A. f. latronum</i>
6	(5) The ear proportionately smaller, rarely as much as 19% of the head and body.	<i>A. f. rusiges</i>

The form *A. f. peninsulæ* appears to have a long palate as in the first two races, but has a tail percentage on average longer than *wardi*, just longer than the head and body, but shorter than *gorkha*. European races seem to have the tail as a rule shorter than Asiatic ones, *wardi* excepted. Usually, also, the palate in these races is below half the occipitonasal length.

(i) *Apodemus flavicollis rusiges* (Miller)

1891. *Mus arianus* Blanford, *Fauna Brit. India, Mamm.*, **2**, 416.
Not of Blanford, 1881.
1894. *Mus arianus griseus* True, *Proc. U.S. nat. Mus.*, **17**, 8.
Not of Mina-Palumbo, 1868.
1913. *Apodemus flavicollis rusiges* Miller, *Proc. biol. Soc. Washington*, **26**, 81.

Type-locality.—Central Kashmir.

Range.—Specimens examined from KUMAON, Phurkia. PUNJAB: Gondla, Lahul, Kyelang, Lahul, Kothi, Lahul, Rahla, Lahul, Murree. KASHMIR: Ara, Chandawara, Doosoo, Noogali, Pahlgahm, Skardu in Baltistan, Surez, Sardalla, and Kagan Valley (N.W.F.P.).

A moderately dark race with no special peculiarities or specializations, tail averages longer than head and body.

(ii) **Apodemus flavicollis latronum** Thomas

1911. *Apodemus speciosus latronum* Thomas, *Abstr. Proc. zool. Soc. Lond.*, 49; *Proc. zool. Soc. Lond.*, 1912, 137.

Type-locality.—Ta-tsien-lu, West Szechuan.

Range.—Specimens examined from UPPER BURMA: Adung Valley. Yunnan: Atunsi, Chaotungfu, Likiang Range, Mekong-Salween Divide, Szechuan: Tatsienlu, and 23 miles south-east of it. SE. Tibet (presumably this race), 28°25' N., 97°55' E. and Zayul and Ata.

Similar to *rusiges* in most respects, but the ear averages proportionately a little larger.

(iii) **Apodemus flavicollis wardi** (Wroughton)

1908. *Micromys sylvaticus wardi* Wroughton, *J. Bombay nat. Hist. Soc.*, 18, 282.

Type-locality.—Saspul, Ladak.

Range.—Specimens examined from LADAK: Saspul, Durgu Village Kharchar, Leh, KASHMIR, etc. Arthroothoo Nullah, Chichoti, Dangail, Kishtwar, Gulmerg, Gugga Nullah, Moonlan, Moolbeck, Rupal, Astor.

Dorsal coloration averaging paler than in the last two races. Length of the palate usually exceeds half the occipito-nasal length, thereby differing from the majority of the last two races. Tail most often shorter than head and body.

(iv) **Apodemus flavicollis gorkha** Thomas

1924. *Apodemus gorkha* Thomas, *J. Bombay nat. Hist. Soc.*, 29, 4, 888.

Type-locality.—Laprak, Gorkha, Nepal, about 11,500 ft.

Range.—Specimens examined from NEPAL: Apoon Sottidanda, Barpak and Laprak, all Gorkha.

Dorsal coloration cold grey, rather different from the majority of specimens of the allied races. Length of the palate as in *wardi*, as a rule. Tail much longer than head and body.

70. *Apodemus sylvaticus* (Linnaeus)

The Common Long-tailed Field-Mouse

Text-fig. 35

1758. *Mus sylvaticus* Linnaeus, *Syst. nat.*, 10th ed., 1, 62.

Type-locality.—Uppsala, Sweden.

Distribution.—Practically as in the genus *Apodemus*. In India, it appears that the related *flavicollis* is the commoner of the two species, and it seems that *sylvaticus* is confined to the PUNJAB and NORTH ASSAM. NORTH BURMA.

An enormous number of named forms is referable to this species, from Europe and Asia. It seems, broadly speaking, that the European races may almost always be separated from the Asiatic races by the fact that the palatal foramina average less than one-fifth of the occipitonasal length in Asia, more than 20% of the occipitonasal in Europe. The only Asiatic race in material I have examined which agrees with the European races is *orestes*, one of the two occurring in India, which will be dealt with below.

The species is here defined as essentially like *A. flavicollis*, but occurring with it extensively and averaging smaller; in the majority of specimens the length of the occipitonasal does not reach 27 mm. (Perhaps the commonest species of rodent in Europe and Asia, I have measurements for well over four hundred skulls of this species).

External characters.—Thick-furred rather large-eared mice, with the tail either longer (*orestes*), or shorter (*pentax*) than head and body. The tail is naked, but especially in *pentax* with a certain growth of hair throughout its length. Four functional clawed fingers on the hand; foot with five toes, the hallux clawed as the other digits, considerably shorter than D. 5 which is shorter than the three central digits. Apparently 6 plantar pads. Colour above dark brown; many specimens of *orestes* are almost blackish brown, but others are not distinguishable from *pentax* in colour. Feet usually pale to whitish. Underparts whitish grey in *pentax*, nearly always darker, more silvery grey in *orestes*. Tail normally sharply bicolor, near black above, near white below, but varying individually in *orestes* to wholly dark in rare cases.

External measurements.—As in Table 59, below.

Notes from skins.—

A. s. orestes: Imaw Bum, west side; trapped by stream in mixed forests, 9,000 ft.

TABLE 59.—*External measurements of the Indian races of Apodemus sylvaticus*

	Head and body	Tail	Hind- foot	Ear
<i>Apodemus sylvaticus orestes</i>				
M. Dreyi, Mishmi	94	112	22	?
M. Dreyi	98	76	22	16
M. Dreyi	98	132	22	19
F. Wulaw Pass, Naunchaung Valley, North Burma	94	115	20½	16
F. Naunchaung Valley	95	98	22	17
M. Naunchaung Valley	98	119½	22	15½

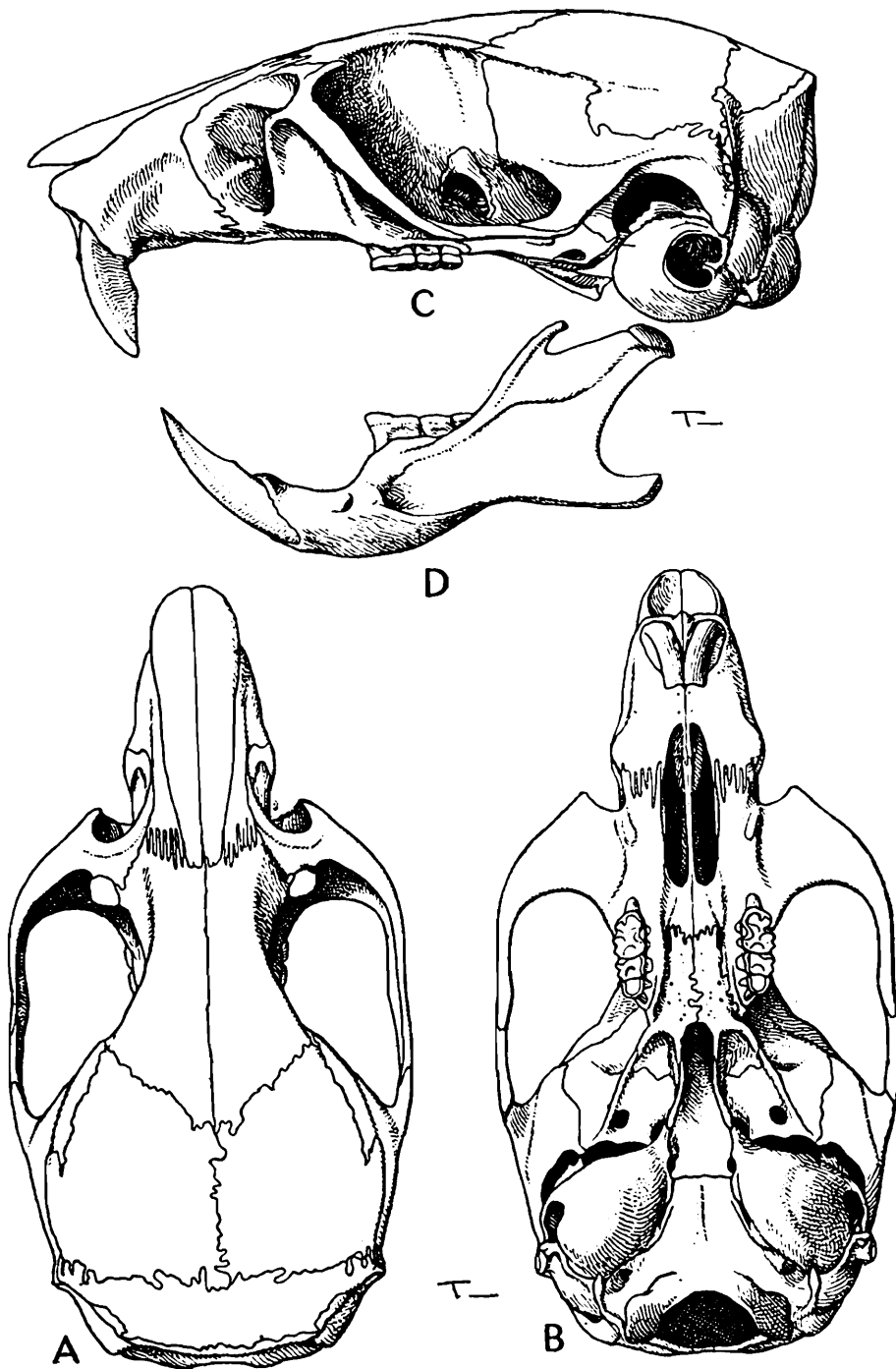
Other specimens from Mount Imaw Bum.

<i>Apodemus sylvaticus pentax</i>				
F. Thandiani, Hazara	105	96	23	16
F. Thandiani	100	90	23	15
M. Murree	88	93	21	16
F. Murree	89	91	23	13
M. Murree	90	91	23	15
M. Murree	103	87	20	15
M. Gharial, Punjab	92	85	20	14
M. Gharial	95	82	19	15
M. Gharial	91	83	21	15
M. Gharial	96	95	20	15
M. Thandiani, type	102	92	21½	16

A. s. pentax: Gharial; trapped in hole in open but not far from houses; and trapped in open ground in pine forest; and trapped in wood, root of tree, and trapped in bed of old watercourse. Murree; trapped at open burrow on hillside. Thandiani; trapped in hut, burrows outside, and trapped at burrow under roots of tree; pile of broken wild cherry or berry stones outside burrow.

Cranial characters.—Apart from average smaller size, essentially as in *flavicollis*, as described above. Supraorbital ridges most often absent, but traceable in some specimens of *orestes*. The length of the palate is less than half the occipitonasal length. Palatal foramina less than one-fifth of the occipitonasal in *pentax*, approximating to this measurement (or a little less or more individually) in *orestes*.

Dental characters.—Essentially as in the related species.



TEXT-FIG. 35. *Apodemus sylvaticus* (Linnaeus), ♂. A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. ($\times 3\frac{1}{2}$). (After Ellerman, 1941, p. 94.)

Cranial measurements.—As in Table 60, below.

Dimensions of Apodemus sylvaticus, including all races, in British Museum material.—The head and body length varies between 54 and 120 mm. The tail between 58 and 218 mm.

TABLE 60.—*Cranial measurements of the Indian races of Apodemus sylvaticus*

		Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Frontals width
<i>Apodemus sylvaticus pentax</i>							
M.	7.11.21.20	25.9	12.3	4.6	4.4	3.5	4.2
	Gharial, Punjab						
M.	7.11.21.21	26.0	12.4	5.0	4.3	4.0	4.1
	Gharial						
M.	7.11.21.23	25.4	12.5	4.5	4.5	3.6	4.0
	Gharial. Foramina measurement represents the longer side						
M.	10.8.1.55	26.6	13.3	4.9	4.3	3.7	4.3
	Murree, Punjab. Old						
M.	8.10.4.2	27.8	13.7	5.6	4.9	3.8	4.2
	Murree. Possibly this specimen represents <i>flavicollis</i> subspecies						

The type, an old specimen from Thandiani, Punjab, has the occipitonasal length about 27.2 mm.

<i>Apodemus sylvaticus orestes</i>							
M.	15.2.1.5	27.5	13.2	5.4	4.3	3.8	4.6
	Wulaw Pass, North Burma						
F.	15.2.1.6	26.2	12.6	5.4	4.3	3.8	4.6
	Wulaw Pass						
F.	12.2.1.7	26.8	13.3	5.5	4.2	3.9	4.7
	Hsipaw Pass, Naunchaung Valley, North Burma						
F.	20.8.7.11	26.3	12.8	5.2	4.5	3.9	4.6
	Imaw Bum, North Burma						
F.	20.8.7.12	24.7	12.0	4.8	4.3	3.8	4.2
	Imaw Bum. Rather young						
F.	20.8.7.13	26.0	12.8	5.8	4.3	4.0	4.4
	Imaw Bum						
M.	21.12.5.58	26.6	13.0	5.4	4.2	3.8	4.5
	Dreyi, Mishmi						
M.	21.12.5.59	27.4	13.4	5.5	4.4	3.9	4.4
	Dreyi. Old						
F.	21.12.5.60	24.8	11.9	5.2	4.1	3.9	4.1
	Dreyi						

The hindfoot 15–26 mm. Occipitonasal length varies between 22.0 and 28.6 mm. Toothrow 3.1–4.3 mm.

Key to the Indian races of Apodemus sylvaticus

- 1 (2) The palatal foramina normally 5 mm. and less, below one-fifth of the occipitonasal length. Tail most often shorter than head and body.

A. s. pentax

- 2 (1) The palatal foramina most often 5.2 mm. and more, and most often more than one-fifth of the occipito-nasal length. Tail usually much longer than head and body *A. s. orestes*

Compared with some of the better known races of *Apodemus sylvaticus* which antedate them, these two races may perhaps be characterized as follows. *A. s. orestes* is the only Asiatic race which has the relatively long palatal foramina of the European races and the North African race, but it stands quite apart from those on the character of its considerably longer tail. Assuming that *pentax* is not based merely on small specimens of one of the north-western Indian races of *A. flavicollis* (and it is not impossible that this is so), then its palate averages shorter than *A. s. giliacus* from Sakhalin; its skull averages larger than *A. s. geisha* and allied races from Japan; its tail seems to be shorter on average than *A. s. semotus* from Formosa; and its skull averages a little larger than the following races: *A. s. tokmak* from Semirechya (if I have identified British Museum specimens rightly), *A. s. arianus* from Persia, *A. s. tauricus* from Asia Minor, *A. s. tscherga* from the Altai (if I have identified British Museum specimens correctly), *A. s. draco* from Fukien and *A. s. pallipes* from the Samarkand region.

(i) ***Apodemus sylvaticus pentax* (Wroughton)**

1908. *Micromys sylvaticus pentax* Wroughton, *J. Bombay nat. Hist. Soc.*, 18, 283.

Type-locality.—Thandiani, Punjab.

Range.—Specimens examined from PUNJAB: Thandiani, Gharial and Murree.

Tail length 96 mm. and less. Length of palatal foramina as a rule 5 mm. and less. Underparts average lighter than the next.

(ii) ***Apodemus sylvaticus orestes* Thomas**

1911. *Apodemus speciosus orestes* Thomas, *Abstr. Proc. zool. Soc. Lond.*, 49; *Proc. zool. Soc. Lond.*, 1912, 136.

Type-locality.—Mount Omi-San, West Szechuan, China.

Range.—Specimens examined from MISHMI: Dreyi. UPPER BURMA: Naunchaung Valley; Wulaw Pass; Mount Imaw Bum. Szechuan: Omisan and Weichoe. Yunnan: Chuntien Plateau, Doker-la, Kagar-pu, etc.

Tail length in Indian specimens 98 mm. and more (when not broken), mostly over 100 mm. Palatal foramina length as a rule 5.2 mm. and more. Underparts average darker than the last.

Genus 32. *Micromys* Dehne

1841. *Micromys* Dehne, *Micromys agilis*, ein neues Säugethier der Fauna von Dresden, 1.

Type-species.—*Micromys agilis* Dehne = *Mus soricinus* Hermann, from Eastern France (one of the subspecies of *Mus minutus* Pallas).

Distribution.—Europe, from England, France, Switzerland, Italy, Germany, southwards to Rumania and Yugoslavia, parts of Russia, northwards, it is said, to the Leningrad district, Finland; southern Siberia, Yakutsk, Transbaikalia, Ussuri and perhaps other parts of eastern Siberia; Japan, Korea, Formosa, China known from the States of Shensi, Szechuan, Yunnan, and Fukien. NORTH ASSAM and NORTH BURMA. North Indo-China.

This widely ranging genus contains a single species for which the first name is *Micromys minutus* Pallas. The name *Micromys* was formerly for a short time used for this species and *Apodemus* as well, when Miller and Thomas gave generic rank to those Palaearctic mice in which the posterointernal cusp was retained in M. 1 and M. 2, but then *Apodemus* was discovered to be an earlier name, and *Micromys* was restricted to the harvest-mice.

These are pygmy mice, the occipitonasal length under 20 mm. in all specimens available, with the rostrum shortened, the diastema proportionately shorter than in *Apodemus*, and with the tail prehensile. The hallux is clawed and normal, thereby distinguishing this genus from *Vandeleuria*, to which it bears some resemblance in some ways.

Considering its wide range, there are surprisingly few specimens of this little mouse in the British Museum.

71. *Micromys minutus* (Pallas)

The Harvest-Mouse

1771. *Mus minutus* Pallas, *Reise Russ. Reichs.*, 1, 454.

Type-locality.—Simbirsk, banks of the Volga, Russia.

With the characters of the genus. I have never seen a typical specimen, from Russia. The second name in the genus appears to be the type, *M. m. soricinus* Hermann,

described from Strasbourg, and occurring variously in Europe, England included. This has, in our specimens, the tail shorter than the head and body. The first name for an Asiatic race appears to be the Indian one, *erythrotis*, which differs from the European races which I have seen in having the tail averaging considerably longer than the head and body.

External and cranial characters.—As in the subspecies *M. minutus erythrotis*, described below.

(i) **Micromys minutus erythrotis** (Blyth)

1855. *Mus erythrotis* Blyth, *J. Asiat. Soc. Beng.*, 24, 721.

1874. *Mus pygmaeus* Milne-Edwards, *Rech. Mamm.* 291. (Moupin, Szechuan, China.)

Type-locality.—Cherrapunji in Khasi Hills, Assam.

Range.—Specimens examined from TONKIN, Chapa and Ngai-tio. Fukien, Kuatun. Szechuan: 30 miles south-east of Ning-yuen-fu. Shensi: Shangchow district. ASSAM: Naga Hills, 5,000 ft.

Chinese specimens represent '*pygmaeus*' of Milne-Edwards, but I cannot see that they differ from Tonkin material which has been referred to *erythrotis*, the older name.

Differing from *soricinus* of Europe by having the tail longer than the head and the body. I have not been able to compare it with the typical race, from Russia, which I have never seen.

I do not know the difference between this and the typical race, as the latter is not represented in our collection, but as indicated above, it has a proportionately longer tail than in European races, which antedate it. It seems extremely improbable that '*pygmaeus*' from south China is anything but a synonym. But the Japanese and Ussuri races are, judging by our collection, more like *soricinus* of Europe. It is very difficult to divide this species into races in a satisfactory manner.

External characters of Micromys minutus erythrotis, based on specimens from Fukien, Szechuan, Shensi and Tonkin.—Very small mice, head and body 57–66 mm. Ear rather large, 9–11 mm. Fur soft. Tail not well haired, longer than head and body (60–90 mm.). Hand with four functional fingers, the fifth one clawed, but rather short. Hind-foot 14–16 mm. in length, narrow, with five digits, the outer one rather shorter than the central three, but longer than

the hallux, which bears a claw. The tail is prehensile in this genus, so far as known. Colour above dark brown or greyish, below silvery grey, or rarely pale fawn, or in one specimen whitish in part. Tail bicolor, dark above, pale below. The tail is bare above at the tip. Miller has described some interesting external characters of the ear and sole-pads for the European species in his Catalogue of Mammals of Western Europe. Whether these are constant throughout the genus I am not able at the moment to ascertain.

There is one specimen which I identify as *Micromys minutus erythrotis* in the Frost collection, from the Naga Hills, Assam, 5,000 ft. It is an old female, with an unusually long tail. The skull, unfortunately, is not accurately measurable, but it agrees well enough with *Micromys* skulls from Kuatun and Tonkin.

	Head and body	Tail	Hind- foot	Ear
Frost collection—				
F. 314	60	90	15	10
Naga Hills, 5,000 ft.				

Cranial characters of Micromys minutus erythrotis, as shown by skulls from Tonkin, Szechuan, and Fukien.—Skull very small, one of the smallest rodents found in Asia, the occipitonasal length not exceeding 19.5 mm., and in British Museum material for all races, European included, most often below 19 mm. Rostrum short, the diastema only about one-fifth of the occipitonasal length. The frontals are moderately constricted, their narrowest part being somewhat behind the anterior zygomatic roots; the braincase is large and broad. There are no supraorbital ridges. The interparietal is quite well developed. Bullae of medium size. Pterygoid fossae low and flat. The palate is usually less than half the length of the occipitonasal. Palatal foramina long and well developed (approximating to 18% of the occipitonasal length, but skulls as small as these are not easy to measure accurately). Zygoma narrow. The zygomatic plate is nearly straight anteriorly. Coronoid process of mandible moderately well developed. The angular portion is slightly drawn backwards.

Dental characters.—Upper incisors narrow, yellow and plain. First upper molar considerably the dominant tooth, and third upper molar rather small. The first upper molar has three laminae, each bearing three cusps, so that there are nine cusps in all, the posterointernal one retained and clear,

Second upper molar with the second and third lamina resembling those of the tooth in front of it, but as usual the front lamina is much reduced, and seems only to have the inner cusp retained. Third upper molar reduced, a small antero-external cusp, and the last two laminae not very clear and somewhat interfused on the outer side. Traces of the anteroexternal cusp can be present in M. 2. Lower molars with two functional rows of cusps; three laminae on M. 1 which is larger than the other teeth which each have two laminae.

It should perhaps be noted that in British Museum material, *Micromys minutus erythrotis* averages a fraction larger in size of skull than all other races. The occipitonasal length for this race varies between 18.2 and 19.5 mm. in our material. Toothrow 2.7–3.1 mm. (for *erythrotis*).

Dimensions of the species *Micromys minutus*, in *British Museum material, all races included*.—The occipitonasal length varies between 16.9 and 19.5 mm. Toothrow 2.6–3.1 mm. The head and body length varies between 51 and 71 mm. Tail between 42 and 90 mm. Hindfoot 13–17 mm.

Genus 33. *Chiropodomys* Peters

1868. *Chiropodomys* Peters, *Mber. Preuss. Akad. Wiss.*, 448.

Type-species.—*Chiropodomys penicillatus* Peters = *Mus gliroides* Blyth.

Range.—ASSAM, BURMA, Indo-China, Siam, Malay States, Sumatra, Java, Borneo, Busanga Island in Philippines, and perhaps Kwangsi in South China.

This genus contains specialized arboreal mice with the following characters: the posterointernal cusp is present and retained in the first and second upper molars; the hallux is clawless and fully opposable. This opposability of hallux is a rare character and is met with in only *Platacanthomys* and five genera of Indo-Malayan Murinae in the Order Rodentia. Four of the Murinae occur in India (the fifth one is *Pithecheir*, from Malaya, Sumatra, Java). *Chiropodomys* is in some ways the most generalized of the climbing mice with the clawless hallux peculiarity. From *Vandeleuria*, its nearest ally, it differs in having proportionately wider frontals, and in having the fifth finger and toe normal, with a claw. There are at least three species in this genus and some authors recognize more. But only one occurs on the mainland of Asia, the type. The other two which are

retainable, *C. pusillus* and *C. major*, neither very well known, are confined to Borneo.

72. *Chiropodomys gliroides* (Blyth)

The Penicillate-tailed Tree-Mouse

1856. *Mus gliroides* Blyth, *J. Asiat. Soc. Beng.*, 24, 721.

Type-locality.—Cherrapunji, Khasi Hills, Assam.

Occipitonasal length varying between 22·4 and 27·2 mm. (smaller than *C. major*, larger than *C. pusillus*). Generic characters as above. Tail much longer than head and body.

Distribution, as here understood.—Mainland range of the genus, and in all probability represented in Java by *C. g. anna* Thomas, and in Borneo by *C. g. pictor* Thomas. Perhaps in Sumatra also.

External characters.—Relatively small climbing mice, head and body length nearly always under 100 mm. Tail long, most often over 130% of the head and body, moderately well haired throughout its length (although the scales are visible) and tufted terminally. Manus with four functional fingers, all bearing claws including the outer one. Foot with four toes bearing claws, and the hallux opposable, broadened at end, and clawless. The fifth toe rather long. 4 mammae. The fur is soft in this species and the ear rather large. Colour brown above, underparts white or dirty white. Tail wholly dark in colour; feet usually light. Vibrissae black and long.

External measurements.—As in Table 61, below.

TABLE 61.—*External measurements of Chiropodomys gliroides gliroides*

	Head and body	Tail	Hind- foot	Ear
F. Khonshnong, Jaintia Hills, Assam	90	125	20	19
			2 pairs of mammae	
F. Nam Tamai Valley, North Burma	92	125	17	18

Chiropodomys gliroides gliroides ('peguensis')

M. Bankachon, Tenasserim	94	139	20·25	16·75
M. Bankachon	93	131	20·5	16
M. Bankachon	103	148	20·5	17·5
F. Bankachon	77	107	19	16
F. Bankachon	80	122	21	16·25
M. Bankachon	77	111	19	15
F. Bankachon	88	113	19·5	16

TABLE 61.—*External measurements of Chiropodomys gliroides gliroides (concl'd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Chiropodomys gliroides gliroides</i> (' <i>peguensis</i> ') (concl'd.)				
F. Bankachon	88	133	20	16
F. Bankachon	92.5	123	19.5	16
F. Bankachon	88	127	20.5	17
F. Bankachon	86	116	19.25	16
M. Bankachon	76	100	18.5	16
M. Bankachon	89	116	19.5	15.5
M. Bankachon	92	116	20	16
M. Bankachon	95	121	20	17
F. Bankachon	86.5	125	20	16.5

Notes from skins.—Khonshnong, Jaintia Hills; weight 1 oz. Mammae 2 pairs inguinal. Bankachon, Tenasserim; weight $\frac{5}{8}$ oz.

Cranial characters.—The skull is of the type found in arboreal mice, with short rostrum, and heavy widened braincase; the frontals little constricted, their narrowest width about 19-20% of the occipitonasal length, their outer sides prominently ridged, the ridges extending backwards over the forepart of the parietals. The braincase slants downwards posteriorly and the interparietal is very wide and large. Bullae rather small and flat, on average about 15% of the occipitonasal length. The pterygoid fossae rather shallow. The palate length is less than half of the occipitonasal length, as a rule, and the palatal foramina are short, averaging roughly 15% of the occipitonasal length. The toothrow is rather short. Zygomatic plate about straight anteriorly; zygoma rather narrow. Mandible with very low coronoid process.

Dental characters.—M.1 originally with ten cusp spaces, including the posterointernal cusp, all the other usual cusps, and a very small posteroexternal cusp. M.2 seems to be like M.1 except that as usual the front lamina lacks its centre cusp, and the anteroexternal cusp is more reduced. M.3 narrowed, considerably narrower than M.2, apparently trilaminate and with three clear inner cusps. Originally the pattern is complexly cuspidate, but there is a tendency among the specimens seen for the teeth to become indistinct with wear. Lower molars with the usual two rows of cusps and the usual number of laminae per tooth (three in M.1, two on the others); but with unusually clear indications of the vestigial outer row.

Cranial measurements.—As in Table 62, below.

TABLE 62.—*Cranial measurements of Chiropodomys gliroides gliroides*

		Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Frontals width
F.	21.1.6.78 Khonshnong, Jaintia Hills, Assam	24.7	12.2	4.0	4.1	3.8	4.6
F.	32.11.1.163 c. Nam Tamai, North Burma	25.4	12.9	3.9	?	3.9	4.4
The following probably represent <i>C. g.</i> ' <i>peguensis</i> '.							
M.	14.12.8.150 Bankachon, Tenasserim	24.9	12.2	4.0	?	3.5	4.8
M.	14.12.8.151 Bankachon	22.4	10.6	3.3	?	3.5	4.7
M.	14.12.8.154 Bankachon	25.8	12.5	4.2	3.5	3.6	5.2
M.	14.12.8.155 Bankachon	24.4	12.4	4.0	3.2	3.5	4.9
F.	14.12.8.157 Bankachon	24.3	11.7	3.6	c. 3.7	3.7	5.0
F.	14.12.8.159 Bankachon	24.3	12.0	4.0	3.8	3.7	5.0
F.	14.12.8.160 Bankachon	25.0	12.3	4.1	3.6	3.7	4.7
M.	88.12.1.46 Tenasserim	25.8	12.5	4.0	3.7	3.8	5.0
F.	14.12.8.156 Bankachon	24.6	12.0	4.0	3.6	3.7	4.9

Dimensions of Chiropodomys gliroides, in British Museum material, all races included.—Head and body length varying between 75 and 103 mm. (only once over 100 mm.). Tail between 97 and 148 mm. (only once under 100 mm.). Hind-foot 15–21 mm. Occipitonasal length varies between 22.6 and 27.2 mm. Toothrow 3.3–4.2 mm.

I cannot see that there is any racial difference between northern and southern specimens, though recently Chasen and Osgood have recognized *peguensis* as a valid race.

(i) *Chiropodomys gliroides gliroides* (Blyth)

1856. *Mus gliroides* Blyth, *J. Asiat. Soc. Beng.*, 24, 721.

1859. *Mus peguensis* Blyth, *J. Asiat. Soc. Beng.*, 28, 295.
(Schwegyin, southern Burma.)

Type-locality.—Cherrapunji in Khasi Hills, Assam.

Range.—Specimens examined from ASSAM: Khonshnong in Jaintia Hills. UPPER BURMA: Nam Tamai. TENASSERIM:

Bankachon. Annam, Dakto. SW. Siam, no exact locality. Pahang, Telom River.

Genus 34. **Vandeleuria** Gray

1842. *Vandeleuria* Gray, *Ann. Mag. nat. Hist.*, **10**, 265.

Type-species.—*Mus oleraceus* Bennett.

Distribution.—CEYLON, PENINSULA OF INDIA northwards to KUMAON, thence eastwards to NEPAL, ASSAM, BURMA, Indo-China and Siam. Its occurrence in South China (Yunnan) seems not conclusively proved.

This genus contains, in my opinion, one species, which is common in India. Its generic characters are: posterointernal cusp retained in first and second upper molars; hallux clawless, and apparently opposable; fifth finger and toe also clawless. The latter divides it specially from *Chiropodomys*, and it also differs from *Chiropodomys* in having the frontals relatively narrowed. From *Micromys* it differs, besides in its clawless hallux, in normally larger size; it is rare in this genus for the occipitonasal length to be under 20 mm.; also presumably in the fact that the tail is not prehensile. I revert to Blanford's classification and regard all named forms as belonging to one species.

Many authors have stated that the incisors in this genus are grooved. It is necessary to state that this is not normal for the genus. Any genus of rodent may have occasional specimens with grooved incisors, but in this genus these are very much in the minority, not the average nor the majority.

73. **Vandeleuria oleracea** (Bennett)

The Indian Long-tailed Tree-Mouse

1832. *Mus oleraceus* Bennett, *Proc. zool. Soc.*, 121.

Vernacular names (from Blanford).—Marad ilei, *Can.* Meina Yelka, *T'el.* of *Yanadis*.

Type-locality.—The Deccan.

With the characters of the genus. Rather small mice, occipitonasal length rarely under 20 mm., rarely reaching 25 mm.

External characters.—Very small mice, head and body only once reaching 100 mm., tail much longer than the head and body, in some races over half as long again. Fur soft. Tail not very well haired. 8 mammae. Feet with abnormal and peculiar digits, as regards development or absence of claws.

The hand has four fingers, the three main ones with claws, but the fifth (outer) finger is short, stumpy, and clawless. In one specimen, Bhutan Duars, the third and fourth fingers lack claws apparently, and in one, Bhutan Duars, the second finger seems to lack a claw on one side. These are doubtless abnormalities. Another specimen, Bhutan Duars, lacks a claw on the second finger one side, not the other. Foot with five toes. The hallux is apparently apposable, blunt at end, and clawless; the outer (fifth) toe is also clawless. The three middle toes bear claws as usual. D. 5 shorter than the middle three, longer than hallux. About seventy skins examined for these characters.

Colour.—Above varying from light reddish brown (*dumetica*, most specimens), to dull brown, or near fawn, as in the majority of specimens of most of the other races; unusually pale, almost sandy, in *spadicea* (one specimen); unusually dark, brown in two skins for *nolthenii*. Fur of back dark grey basally. Feet pale. Tail usually wholly dark, occasionally poorly bicolor. Underparts white, except in *nolthenii*, which differs very sharply from the other races in having them more or less blue grey.

External measurements.—As in Table 63, below.

TABLE 63.—*External measurements of the Indian races of Vandeleuria oleracea*

	Head and body	Tail	Hind- foot	Ear
<i>Vandeleuria oleracea oleracea</i>				
M. Lohra, Hazaribagh, Bihar	76	123	18	16
M. Dadhivara, Surat district	70	107	19	16
M. Locality ?	73	108	18	14
				'wroughtoni'
M. Dadhivara, Surat	76	100	17	15
F. Khatkia, Gwalior	81	115	19	18
M. Gwalior	90	138	19	16
F. Rothiai, Gwalior	83	114	18	14
M. Agra Malwa, Gwalior	88	116	19	17
M. Moz	72	106	17	?
M. Chandgarh, Nimar	72	105	17	16
M. Chandgarh, Nimar	71	100	18	15
F. Sonawahnee, Balaghat	72	115	17	15
				mammae 8
M. Sheura Dangs	69	92	18	15
				'wroughtoni'
M. Dharwar	62	99	18	14
F. Junagadh, Kathiawar	68	105	19	13
				mammae 8
M. Poona	73	110	19	15

TABLE 63.—*External measurements of Vandeleuria oleracea (contd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Vandeleuria oleracea oleracea</i> (concl'd.)					
F.	Poona district	64	96	16	14
M.	Sehore, Central India	75	104	17	14
M.	Surat district, type of 'wroughtoni'	71	103	18	14
<i>Vandeleuria oleracea nilagirica</i>					
M.	Konkan	80	112	?	13
F.	Konkan	75	121	16	17
F.	Kolaba district, Konkan	95	109	15	19
M.	Konkan	83	115	20	16
F.	Kutta, South Coorg	105	142	21	16½
F.	Shevaroy Hill	74	120	20	17
					mammæ 8
F.	Kutta, South Coorg (Huvinakadu Estate)	89	120	18½	14½
M.	Kodura, Balapalli Range	71	116	18	15
M.	Coonoor, Nilgiris	69	110	20	16
M.	Mousekande, Gammaduwa, Ceylon	78	109	17	15
M.	Mousekande	83	111	19	15
<i>Vandeleuria oleracea nolthenii</i>					
M.	West Haputale, Ohiya, Ceylon	87	122	20	14
F.	West Haputale	85	125	20	14
M.	West Haputale, type	84	123	21	13
<i>Vandeleuria oleracea spadicea</i>					
M.	Lunwa, Palanpur	83	104	18	15
M.	Lunwa, type	85	117	19	16
<i>Vandeleuria oleracea rubida</i>					
F.	Bageswar, Kumaon, type	78	124	18½	15
<i>Vandeleuria oleracea modesta</i>					
F.	Ramnagar, Kumaon	70	113	18½	14
F.	Ramnagar, Kumaon	65	100	18	14
M.	Ramnagar, Kumaon	72	126	18½	15
F.	Ramnagar, Kumaon	72	109	19	15
M.	Ramnagar, type	72	102	19	14
<i>Vandeleuria oleracea dumeticola</i> ('marica')					
F.	Koira, Chaibassa, Orissa	69	116	18	14½
					mammæ 8
F.	Koira, Chaibassa	74	118	17	14

TABLE 63.—*External measurements of Vandeleuria oleracea (contd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Vandeleuria oleracea dumeticola</i> ('morica') (concl'd.)					
F.	Koira, Chaibassa	74	121	18	14
					mammæ 8
F.	Koira, Chaibassa	74	121	18	14
					mammæ 8
F.	Koira, type	79	120	18	15
<i>Vandeleuria oleracea dumeticola</i>					
M.	Nmai Valley, 27° N., Burma	77½	119	17	13½
M.	Mount Poppa, Burma	81	105	19	14
M.	65 miles west of Kindat, Chin Hills, Burma	71	104	17	14
M.	40 miles west of Kindat	72	112	17	13½
	Hasimara, Bhutan Duars	69	108	17	13
M.	Hasimara	65	118	18	15
F.	Hasimara	60	105	17	15
F.	Hasimara	60	110	17	15
M.	Hasimara	65	104	19	13
F.	Hasimara	60	110	18	15
	Hasimara	70	114	18	14
M.	Bharnabhari, Bhutan Duars	62	102	16	14
M.	Bharnabhari	63	108	18	14
M.	Bharnabhari	60	105	16	14
F.	Angarakhata, North Kamrup	62	100	17	13½
M.	Angarakhata	70	118	18	14
M.	Angarakhata	56	101	18	14
F.	Angarakhata	75	115	18	14
M.	Angarakhata	60	93	17	14
F.	Khonshnong, Jaintia Hills, Assam	75	114	19	15
				mammæ 2-2 = 8	
F.	Shangpung, Jaintia Hills	80	115	17	14
F.	Pashok, Sikkim	69	129	19	11
Also seen from Manipur.					
Frost collections—					
M.	220 Naga Hills, Assam	78	103	17	13
M.	221 Naga Hills	65	104	18	14
M.	256 Naga Hills	65	110	15	15
F.	257 Naga Hills, 500 ft.	65	115	15	15
M.	— Naga Hills	65	105	16	15
M.	259 Naga Hills	60	95	15	13
M.	260 Naga Hills	65	105	15	14

TABLE 63.—*External measurements of Vandeleuria oleracea (concl'd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Vandeleuria oleracea dumeticola (concl'd.)</i>					
M.	267	60	95	15	15
	Naga Hills				
M.	268	60	95	15	14
	Naga Hills				
M.	269	62	95	15	13
	Naga Hills				
F.	290	70	102	15	14
	Naga Hills				
M.	335	68	111	16	12
	Naga Hills				
M.	338	75	110	17	15
	Naga Hills				
F.	339	70	110	17	14
	Naga Hills				
F.	340	65	110	16	13
	Naga Hills				
F.	352	75	115	16	14
	Naga Hills				
M.	358	65	105	17	14
	Naga Hills				
M.	359	70	105	15	13
	Naga Hills				
M.	360	70	110	15	14
	Naga Hills				
M.	361	65	108	17	14
	Naga Hills				
F.	461	85	115	15	14
	Bishampur, Manipur				

Notes from skins.—

V. o. dumeticola: 40 miles west of Kindat, 'house mouse'

Shangpung; builds a small cup-shaped nest in bamboos.

'marica', Koira, Chaibassa; mammae 8; weight $\frac{1}{2}$ oz. or $\frac{3}{8}$ oz.

Khonshnong; mammae 2-2 = 8; weight 0.40 oz.

Angarakhata; weight 0.25 oz.

V. o. oleracea: Chandgarh; trapped under low hedge and trapped in tree; weight $\frac{1}{2}$ oz.

Junagadh; mammae 8; weight $\frac{1}{2}$ oz.

Lohra, Hazaribagh; weight $\frac{5}{8}$ oz. Poona; caught in banyan tree.

Ramnagar; weight $\frac{3}{8}$ oz. (*modesta*) and $\frac{1}{2}$ oz.

Sheura Dangs; border of 600 sq. miles of almost continuous forest. Poona; caught with cheese on ground in garden. Strong '*Mus*' scent.

Dadhivara; killed in tent. Sonawahnee; mammae 8; weight $\frac{1}{2}$ oz.

V. o. nilagirica: Nilgiris; trapped in hotel garden.

Shevaroy Hill. Mammae 8. Mousekande, Ceylon; found dead by a stable; and caught in a hollow tree. Kutta, Coorg; weight $\frac{5}{8}$ oz.

V. o. nolthenii: West Haputale; caught in the guttering of bungalow.

V. o. spadicea: Lunwa; weight $\frac{3}{4}$ oz.

Cranial characters.—Small mice; the frontals considerably constricted, very much more so than in the related *Chirodomys*. Supraorbital ridges normally absent, or very weak. Braincase rather large, and wide; parietals considerably wider than frontals, interparietal prominent and well developed. Rostrum rather short, but measurements I have taken indicate that the diastema is proportionately longer than in *Micromys*. The skull of this genus bears some resemblance to *Micromys*, apart from larger size and longer diastema, and is more superficially like that genus than it is like *Chirodomys*, which seems considerably more specialized cranially. Palate less than half the length of the occipitonasal, normally. Palatal foramina quite long (roughly 16–18% of the occipitonasal length). The bullae are quite large (roughly the same size as the length of the foramina, or a little more or less). Pterygoid fossae rather shallow. Coronoid process of mandible quite well developed.

Dental characters.—Upper incisors narrow, yellow, and normally plain. Occasionally very faint traces of grooving may be seen with a microscope, but these are the exception (perhaps five in fifty) rather than the rule, and seem mostly present in *dumeticola*. M. 1 and M. 2 retain the postero-internal cusp; there are nine cusps in M. 1, eight in M. 2, apparently (the centre front cusp of M. 2 absent as usual). M. 3 reduced, but apparently trilaminar originally. M. 1 apparently 4-rooted. Lower molars about normal, without extreme peculiarity, the subsidiary outer row of cusps not very strongly marked.

Cranial measurements.—As in Table 64, below.

Dimensions of Vandeleuria oleracea, in British Museum material.—The head and body length varies between 52 and 105 mm. (only once over 100). Tail between 92 and 142 mm.

TABLE 64.—*Cranial measurements of the Indian races of Vandeleuria oleracea*

		Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Frontals width
<i>Vandeleuria oleracea oleracea</i>							
F.	13.8.8.90	20.5	9.7	3.5	3.9	3.2	3.1
	Junagadh, Kathiawar.		4 roots	M. 1			
M.	15.4.3.106	21.9	10.4	3.9	3.9	3.3	3.0
	Hazaribagh						
M.	19.6.3.57	21.6	10.0	3.6	3.7	3.2	3.2
	Poona						
F.	19.6.3.58	19.5	9.0	3.1	?	3.1	3.0
	Poona						
M.	80.11.11.32	20.9	9.6	3.5	3.8	3.2	3.0
	Ahmednagar						
M.	91.11.1.16	22.1	10.6	4.1	3.9	3.2	2.9
	Fategarh.	The foramina measurement represents longer side					
	91.11.1.17	20.6	10.0	3.5	3.5	3.2	2.8
	Fategarh						
F.	97.3.9.8	21.6	10.7	3.6	3.9	3.4	3.3
	Moz.—?						
M.	98.5.5.19	19.7	9.3	3.3	—	3.2	3.0
	Dangs, Bombay						
M.	98.4.2.30	21.0	9.8	3.8	3.7	3.3	3.0
	Bombay						
M.	98.4.3.32	21.4	10.3	3.7	c. 3.8	3.4	3.1
	Dadhivara, Surat district						
M.	98.4.2.33	20.3	9.7	3.7	3.8	3.2	2.9
	Dadhivara						

Type, from the Deccan, has the occipitonasal about 21.2 mm.
Type of '*wroughtoni*' Patal has the occipitonasal 20.4 mm.

Vandeleuria oleracea rubida

F.	14.12.1.3	23.3	11.0	4.1	3.9	3.4	3.3
	Bageswar, Kumaon, type						

Vandeleuria oleracea nilagirica

M.	35.10.6.9	23.0	c. 11.2	4.0	3.8	3.4	3.4
	Mousekande, Ceylon						
	90.11.12.2	23.4	11.1	4.3	3.4	3.4	3.4
	Ceylon						
M.	7.11.22.1	23.1	10.9	4.0	3.7	3.5	3.3
	Kolaba district						
F.	7.11.22.2	22.9	11.0	3.5	4.0	3.5	3.6
	Kolaba district						
M.	7.11.22.3	22.8	11.2	4.0	4.0	3.5	3.3
	Kolaba district						
F.	7.11.22.4	23.8	11.4	3.9	3.9	3.4	3.5
	Kolaba district						
F.	7.11.22.5	22.4	10.9	4.1	4.1	3.5	3.5
	Kolaba district						

Hindfoot 15–21 mm. Occipitonasal length varies between 19·2 and 25·3 mm. Toothrow 3·0–3·7 mm.

*Provisional key to the subspecies of
Vandeleuria oleracea*

1	(6) The tail very long, on average more than 150% of the head and body length....	2
2	(5) Colour of the back generally brighter, red.	3
3	(4) Occipitonasal not reaching 23 mm..	<i>V. o. dumeticola</i>
4	(3) Occipitonasal length (of the type) over 23 mm..	<i>V. o. rubida</i>
5	(2) Colour of the back paler; brown.	<i>V. o. modesta</i>
6	(1) The tail more moderate, most often less than 150% of the head and body length....	7
7	(8) Back unusually dark. Occipitonasal length 24 mm. and more. Underparts bluish grey.	<i>V. o. nolthenii</i>
8	(7) Back less dark. Occipitonasal below 24 mm. Underparts white. .	9
9	(10) Usually smaller; occipitonasal length only once reaching 22 mm. (in about fourteen specimens) ..	<i>V. o. oleracea</i>
10	(9) Usually larger; occipitonasal length exceeds 22 mm.	11
11	(12) Colour unusually pale.....	<i>V. o. spadicea</i>
12	(11) Colour not unusually pale	<i>V. o. nilagirica</i>

Some of these races are very little known, but in the present state of our knowledge, all appear retainable except 'marica' which I am not able to distinguish on colour from *dumeticola*, when all specimens for both are compared.

I restrict *rubida* to Nepal, its type-locality. Perhaps it is merely a large specimen of *dumeticola*, but I have thirty skulls for that, and none of them reaches the measurement of *rubida*. *Modesta*, *nolthenii*, and *spadicea* are very little known.

(i) **Vandeleuria oleracea oleracea** (Bennett)

1832. *Mus oleraceus* Bennett, *Proc. zool. Soc. Lond.*, 121.
1914. *Vandeleuria wroughtoni* Ryley, *J. Bombay nat. Hist. Soc.*, 22, 658. (Patal, Surat district, India.)

Type-locality.—'Dukhun', India. (Deccan.)

Range.—Specimens examined from DHARWAR; AHMED-NAGAR; Dadhivara, SURAT district; POONA; Hazaribagh, BIHAR; Chandgarh, NIMAR; Sonawahnee, BALAGHAT; Sehore,

CENTRAL INDIA: Agarmalwa, Khatkia, and Rothiai, all GWALIOR: Junagadh, KATHIAWAR. Patal, SURAT district. Also Fategarh, Sheura Dangs, and Moz.

Small race; occipitonasal length (14 skulls) 19·5–22·1 mm. Head and body 62–90 mm. Tail usually less than half as long again as head and body. Colour usually, but not always, less red than in *dumeticola*.

(ii) **Vandeleuria oleracea nilagirica** (Jerdon)

1867. *Mus nilagiricus* Jerdon, *Mamm. India*, 203.

Type-locality.—Ootacamund, South India.

Range.—Specimens examined from KONKAN, Kolaba district; CUDDAPAH: Kodura, Balapalli Range; EASTERN GHATS: Shevaroy Hill. South Mahratta. COORG, Kutta. Coonoor in NILGIRIS. CEYLON: Mousekande.

Averaging larger than the last. Occipitonasal length (8 skulls) 22·4–23·9 mm. Head and body 69–105 mm. Hindfoot usually larger than in the typical race, 21 mm. at maximum (as against 19 mm. maximum for *oleracea*). Tail usually below 150% of head and body length. Colour of back usually less red than *dumeticola*.

Specimens from Ceylon which have been identified as *rubida* have a much shorter tail than the type of that, and appear to me most likely to represent *nilagirica*.

(iii) **Vandeleuria oleracea spadicea** Ryley

1914. *Vandeleuria oleracea spadicea* Ryley, *J. Bombay nat. Hist. Soc.*, **22**, 659.

Type-locality.—Lunwa, Palanpur, Gujerat.

Range.—Specimens examined from GUJERAT: Lunwa.

Like *nilagirica*, but the colour of the body is unusually pale above. Occipitonasal length about 23·4 mm. (one skull). Head and body 83–85 mm. Tail less than 150% of head and body.

This is a doubtful race. The type specimen is not so pale as the one duplicate available for examination.

(iv) **Vandeleuria oleracea nolthenii** Phillips

1929. *Vandeleuria nilagirica nolthenii* Phillips, *Ceylon J. Sci.*, Sec. B. **15**, 165.

Type-locality.—West Haputale, Ohiya, Ceylon.

Range.—Specimens examined from CEYLON: West Haputale.

Largest race. Colour unusually dark above. Occipito-nasal length 24–25·3 mm. (three skulls). Head and body 84–87 mm. Tail less than half as long again as head and body.

(v) **Vandeleuria oleracea dumeticola** (Hodgson)

1845. *Mus dumeticola* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 268.
 1841. *Mus domecolus* Hodgson, *J. Asiat. Soc. Beng.*, **10**, 915, *nom. nud.*
 1845. *Mus povensis* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 269. (Nepal.)
 1859. *Mus badius* Blyth, *J. Asiat. Soc. Beng.*, **28**, 295. (Tenas-serim Province.)
 1915. *Vandeleuria oleracea marica* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 54. (Koirā, Chaibassa, 800 ft., Orissa.)

Type-locality.—Nepal.

Range.—Specimens examined from NEPAL: Katmandu. SIKKIM: Pashok. BHUTAN DUARS: Hasimara and Bharnabhari. KAMRUP: Angarakhata. ASSAM, Khonshnong in Jaintia Hills, and Shangpung, Naga Hills. MANIPUR: Booribazar, Bishenpur. BURMA: (West) 40–65 miles west of Kindat. (North) Nmai Valley, 27° N. (Southern) Mount Poppa, and north of Toungoo. CHAIBASSA, Koirā ('*marica*').

Small race, with very long tail, on average over 150% of head and body length. Typically, but not always individually, bright red in colour. Occipitonasal length 19·2–22·7 mm. Head and body 56–85 mm.

(vi) **Vandeleuria oleracea rubida** Thomas

1914. *Vandeleuria rubida* Thomas, *J. Bombay nat. Hist. Soc.*, **23**, 202.

Type-locality.—Bageswar, 3,200 ft., Kumaon.

Range.—Specimens examined from KUMAON; Bageswar.

Restricted to the type specimen; apparently very like *dumeticola* but larger; occipitonasal length about 23·3 mm. Head and body 78 mm. Tail over half as long again as head and body.

(vii) **Vandeleuria oleracea modesta** Thomas

1914. *Vandeleuria oleracea modesta* Thomas, *J. Bombay nat. Hist. Soc.*, **23**, 202.

Type-locality.—Ramnagar, 1,100 ft., Kumaon.

Range.—Essentially like *dumeticola*, but just distinguishable by the colour of the back being brown (not reddish). It is

possible to pick out these specimens on colour, when mixed up with the whole series for *dumeticola*, so I retain this race. But this, and the last, are very near *dumeticola*, and might well be merged with it. Occipitonasal length 21.1–21.9 mm. Head and body 65–72 mm. Tail usually half as long again as head and body or more. (3 skulls measurable.)

Genus 35. **Hapalomys** Blyth

1859. *Hapalomys* Blyth, *J. Asiat. Soc. Beng.*, **28**, 296.

Type-species.—*Hapalomys longicaudatus* Blyth.

Distribution.—TENASSERIM, Indo-China, Siam, Malay States, and said also to occur in Hainan.

This genus, which contains probably one valid species only, is entirely distinct from all other Murinae in the fact that the first and second lower molars have three rows of approximately equal-sized cusps, a most unusual character. Superficially, otherwise, it resembles *Chiropodomys* and *Vandeleuria*, in having the hallux clawless and opposable, and in retaining the posterointernal cusp in the first and second upper molars. It is a larger animal than the last two named genera, a 'rat' rather than a 'mouse', and also it has a longer toothrow and usually larger bullae than in the two smaller genera. In this it is near *Pithecheir*, of the Malay States, Sumatra, and Java, but the dentition of that genus is quite normal, totally different from the present genus. The tail is considerably longer than the head and body. The incisors are broadened and powerful, and the frontals well ridged. The first and second upper molars are similar in pattern to the first and second lower molars (i.e. the rows of cusps are approximately equal-sized), and the original front lamina of M. 2 appears to be entirely suppressed.

74. **Hapalomys longicaudatus** Blyth

Berdmore's Tree-Rat

1859. *Hapalomys longicaudatus* Blyth, *J. Asiat. Soc. Beng.*, **28**, 296.

With the characters as indicated for the genus, above. Only the typical race occurs in India. A smaller, shorter tailed race with smaller bullae and shorter teeth, *H. l. delacouri*, inhabits Indo-China (Annam).

External characters.—Moderate sized climbing rats, head and body about 147 mm. in the one measured skin available.

Ear small, less than one-tenth of head and body length. Fur thick and soft. Tail much longer than head and body, not well haired but faintly tufted terminally. Hand with four functional digits, bearing remarkably small claws in the two skins examined, each apparently with a digit pad below the claw which seems larger than the claw. Foot short and broad; hallux clawless, widely opposable, its end very thickened. Fifth toe shorter than the central three; claws well developed on these toes, and each with a large digit pad under the claw. The digit pads are grooved in the centre. Blanford states there are 8 mammae.

Colour.—Brownish (dull) above, and dull white below. Tail apparently wholly brown. Blanford states that the 'foot pads are large, peculiarly marked with irregular concentric lines; both metatarsal pads elongate, the hindmost greatly so and much curved'.

External measurements of Hapalomys longicaudatus longicaudatus.—

	Head and body	Tail	Hind- foot	Ear
M. Bankachon, Tenasserim	147	203	30	13

Cranial characters.—Skull of medium size, occipitonasal length about 37–40 mm. It is well ridged, and of the type found in climbing Muridae. The rostrum is rather short, the frontals not much constricted, and in both specimens seen somewhat depressed between the powerful ridges; the braincase is broad, and the ridges are rather widely divergent backwards over the frontals and parietals; the latter are very wide, and nearly straight in their suture with the frontals. The interparietal is very broad, extending right across the width of the back of the skull, and the braincase tends to be depressed posteriorly. Occiput low, paroccipital process rather prominent. Bullae strongly enlarged, nearly one-fifth of the occipitonasal length. The pterygoid fossae are deep, and the palate is raised up over the general level of the back of the skull. The toothrow is very long, roughly 19% of the occipitonasal length, and the molars are wide, width of M. 1 about 2.2.1 mm. The palate is more than half the length of the occipitonasal, and the palatal foramina are rather short, about 15% of the occipitonasal length. (The percentage figures given here refer to the typical race only). Zygomatic plate nearly straight in front; jugal short; zygoma rather powerful. Coronoid process of mandible moderate. The angular portion is rather pulled inwards below by powerful ridges.

Dental characters.—Upper incisors thick and powerful, plain, and yellow in colour. Upper molars most peculiar; M. 1 with three laminae, each bearing three cusps of almost exactly equal size, so that there are nine cusps in all, including a strong posterointernal one; second molar with all traces of the front lamina apparently suppressed, its second and third laminae exactly resembling the second and third laminae of M. 1, the large posterointernal cusp included; M. 3 reduced, with only two laminae, the front one bearing apparently two cusps, and the last one bearing one cusp only. The cusps of the teeth are peculiarly raised up and symmetrical, and perhaps indicate a specialized diet. First and second lower molars with three rows of almost equal-sized cusps, the outer row (which is normally suppressed or vestigial in Murinae) being only a little smaller than the centre and inner ones; eight cusps in M. 1 (only two on the front lamina, the antero-external one suppressed); six cusps in M. 2; M. 3 has two laminae each bearing two cusps, making four in all for that tooth. The lower molar pattern of this genus appears quite unique in Murinae.

Cranial measurements of Hapalomys longicaudatus longicaudatus.—

		Occipito- nasal	Palate	Palatal foramina.	Bullae	Toothrow	Frontals width
M.	14.12.8.147	37.7	19.3	6.0	c. 8.0	7.5	5.6
	Bankachon, Tenasserim						
F.	90.10.1.1	40.3	20.9	6.0	7.7	7.6	5.5
	Mita, Tavoy, Tenasserim						

(i) **Hapalomys longicaudatus longicaudatus** Blyth

1859. *Hapalomys longicaudatus* Blyth, *J. Asiat. Soc. Beng.*, 28, 296.

Type-locality.—Sitang River, Tenasserim.

Range.—Specimens examined from TENASSERIM: Bankachon; Mita, Tavoy. Siam: SW. Siam, no locality.

Bankachon; weight $3\frac{1}{4}$ oz. 'Found among bamboos, with *Chiropodomys*.'

Dimensions of Hapalomys longicaudatus, in British Museum material, including Indo-Chinese specimens, but not including juvenile specimens.—Head and body length varies between 115 and 147 mm. Tail 140–203 mm. Hindfoot $19\frac{1}{2}$ –30 mm. The occipitonasal length varies between 34.1 and 40.3 mm. Toothrow 5.9–7.6 mm.

Genus 36. **Chiromyscus** Thomas

1925. *Chiromyscus* Thomas, *Proc. zool. Soc. Lond.*, 503.

Type-species.—*Mus chiropus* Thomas.

Distribution.—Originally named from SE. LOWER BURMA, this genus is better known from specimens more recently collected in Indo-China (Tonkin, Annam, and Laos).

The genus contains one rather uncommon species, which agrees with *Hapalomys*, *Vandeleuria*, and *Chiropodomys* in the unusual peculiarity of having the hallux clawless and fully opposable, but differs from them in having the postero-internal cusp of the first and second upper molars suppressed, so that it might well be described as 'like *Rattus* but with an opposable great toe'

75. **Chiromyscus chiropus** (Thomas)

Fea's Tree-Rat

1891. *Mus chiropus* Thomas, *Ann. Mus. Civ. Stor. nat. Genova*, 10, 884.

1920. *Haeromys chiropus* Wroughton, *J. Bombay nat. Hist. Soc.*, 26, 4, 964.

Type-locality.—Karin Hills, Burma.

Range.—Specimens examined from Indo-China: Tonkin, Baoha; Annam, Dakto; Laos, Xieng-khouang.

The type of this species is not in the British Museum, and I have no Indian skulls. Apparently the species was named on a single specimen, and was not subsequently collected until about 1925, when specimens came to hand from Indo-China, and the genus *Chiromyscus* was set up to receive the species. Wroughton provisionally referred it, in 1920, to *Haeromys*, a Bornean genus with which it has little in common.

External characters.—Based on specimens from Indo-China. Head and body length, three specimens, 160, 150 and 147 mm. Tail of these specimens, 226 (?), 206 and 200 mm. Hindfoot of these specimens, respectively, 27, 28 and 29 mm. Ear 20, 19 and 19 mm. The ear is thus less reduced than in *Hapalomys*, and is more than one-tenth of the head and body length. The fur is bristly to the touch, in part; several very weak spines are mixed with the fur. Tail much longer than head and body, moderately well haired for a rat, but the scales clearly visible. Hand with four functional fingers, claws rather small. Foot with five toes, the hallux flat, broad, clawless and opposable. The other

toes bear well developed claws; the fifth is shorter than the central three. There appear to be six plantar pads.

Colour.—Above reddish brown, with a suggestion of blackish in the centre of the back; face light brown, including cheeks; feet also light brown. Belly white; a sharp line of demarcations along the sides. Tail poorly bicolor (darker above, pale below), whitish at tip in one specimen.

External measurements.—Thomas gave the dimensions of the type as head and body 125 mm., tail 198 mm., hindfoot 30 mm.

Cranial characters.—As indicated by skulls from Indo-China. Skull of medium size, the occipitonasal length roughly 38 mm. The rostrum is rather long, the nasals tending to be slightly broadened in front. Frontals very powerfully ridged, their combined narrowest width about 6.5 mm. They are much wider posteriorly, and the ridges almost form a postorbital knob where they join the frontoparietal suture. Parietals wide, the frontal ridges continued over about half their length on either side; interparietal very large and wide. Occiput rather weak. Bullae small and reduced, roughly 11% only of the occipitonasal length, and rather flat. Pterygoid fossae somewhat shallow. Length of the palate is less than half the occipitonasal length. Palatal foramina large and well open, about 18% of the occipitonasal length. Zygomatic plate nearly straight anteriorly, zygoma rather narrow. Mandible with well marked coronoid process, and without special peculiarity.

Dental characters.—Upper incisors of medium width, yellow and plain. Upper molars of *Rattus* type; no posterointernal cusp in M. 1 and M. 2; M. 1 with eight cusps, or cusp spaces (three on the front lamina, three on the second, two on the third); M. 2 with six (the front lamina represented only by the anterointernal cusp, the second and third laminae like those of M. 1); M. 3 reduced, with an anterointernal cusp representing the original front lamina, and the two laminae behind it somewhat interfused and indistinct. Lower molars with two rows of cusps, the laminae three on M. 1, two on the other teeth, M. 3 small and reduced, and with a well marked terminal heel or central cusp in M. 1 and M. 2, posteriorly.

Dimensions of Chiromyscus chiropus, in British Museum material.—Occipitonasal length 38.4–38.7 mm. Toothrow 6.4–6.7 mm. The head and body length varies between 147 and 160 mm. Tail between 200 and ? 226 mm. Hindfoot 27–29 mm. (See above for Thomas's measurements of the type, which is smaller than these specimens, hindfoot excluded.)

Genus 37. **Rattus** Fischer

1803. *Rattus* Fischer, *National Mus. nat. Paris*, **2**, 128. (Misprinted *Ruttus*).
1881. *Epimys* Trouessart, *Bull. Soc. Etudes Sci. Angers*, **10**, 117. (*Mus rattus* Linnaeus.)
1903. *Lenothrix* Miller, *Proc. U.S. nat. Mus.*, **26**, 466. *Lenothrix canus* Miller, from Pulau Tuangku, off Sumatra. Valid as a subgenus.
1910. *Stenomys* Thomas, *Ann. Mag. nat. Hist.*, **6**, 507. *Mus verecundus*, from New Guinea. Valid as a subgenus.
1911. *Millardia* Thomas, *J. Bombay nat. Hist. Soc.*, **20**, 4, 998. *Golunda meltada* Gray. Valid as a subgenus.
1911. *Grypomys* Thomas, *J. Bombay nat. Hist. Soc.*, **20**, 4, 999. *Mus gleadowi* Murray.
1912. *Cremnomys* Wroughton, *J. Bombay nat. Hist. Soc.*, **21**, 340. *Cremnomys cutchicus* Wroughton. Valid as a subgenus.
1917. *Guyia* Thomas, *J. Bombay nat. Hist. Soc.*, **25**, 2, 201. *Millardia kathleenae* Thomas.
1936. *Maxomys* Sody, *Nat. Tijds. Ned. Ind.*, **96**, 55. *Mus bartelsi* Jentink, from Java. Valid as a subgenus.
1941. *Madromys* Sody, *Treubia*, **18**, 2, 260. *Mus blanfordi* Thomas.
1941. *Millardomys* Sody, *Treubia*, **18**, 2, 261. *Millardia kathleenae* Thomas.
1947. *Leopoldamys* Ellerman, *Proc. Zool. Soc.*, **177**, 1, 261, 267. *Mus sabanus* Thomas, from Borneo. Valid as a subgenus.
1947. *Berylmys* Ellerman, *Proc. zool. Soc. Lond.*, **117**, 1, 261, 267. *Epimys manipulus* Thomas. Valid as a subgenus.

Type-species.—*Mus decumanus* Pallas = *Mus norvegicus* Berkenhout.

Distribution.—Wild species occur through much of the Old World except Madagascar, Europe and northern Asia. Two species, *Rattus rattus* and *R. norvegicus*, are now world-wide in distribution owing to accidental human introduction, and a third, *R. exulans*, has a wide range in the Pacific region as a commensal.

This is the largest mammalian genus, with more than sixty valid species in Asia and Australia alone, and well over five hundred named forms. Formerly it was included in *Mus* as were most of the Murinae which occur in the Palaearctic region. Miller and Thomas separated those forms which retain the posterointernal cusp in the first and second upper molars and later Miller restricted the genus *Mus* to the small species with enlarged first upper molar and reduced third upper molar, and *Rattus* (originally under the antedated name '*Epimys*') came into use for the majority of species from Asia, Africa and Australia which lack the posterointernal cusp in the upper molars and have no very special peculiarities.

There are some very distinct groups retained within this genus, but intermediate species seem to connect all of them and it does not seem good classification to subdivide the genus into anything but subgenera. I have elsewhere offered a classification which divides this genus into about eight or nine subgenera in Asia (and about half-a-dozen more in Africa). This seems convenient and reasonable. In my former work on Rodents I retained *Millardia* (together with its synonyms '*Grypomys*' and '*Guyia*') as a valid genus. Recently I have done further work on the African species of *Rattus* and it appears that some of them are so closely allied to *Millardia* that the retention of that group becomes more than doubtful. It is here referred to *Rattus* as a subgenus.

My revision of *Rattus* and its division into subgenera is based on measurements of over fifteen hundred skulls from Asia, Europe and Australia.

Key to the subgenera of Rattus inhabiting India

1	(4) Palatal foramina long, normally on average 22% or more of the occipitonasal length...	2
2	(3) Palate long, exceeds half the occipitonasal length; plantar pads, so far as is known, less than 6 in number; fifth hindtoe shortened...	<i>Millardia</i>
3	(2) Palate short, less than half the occipitonasal length; plantar pads 6; fifth hindtoe rather noticeably long....	<i>Cremnomys</i>
4	(1) Palatal foramina shorter, not reaching 22% of the occipitonasal length. (Species with the longest palatal foramina have proportionately larger bullae than the subgenus <i>Cremnomys</i> ; their palatal foramina always shorter than <i>Millardia</i>).	5
5	(6) Bullae very small, one-tenth of occipitonasal length at most, usually less. Large species, occipitonasal length exceeds 50 mm.; length of upper tooththrow more than 8 mm.	<i>Leopoldamys</i>
6	(5) Bullae normally proportionately larger. In the species with the smallest bullae (<i>R. rajah</i>), the occipitonasal length is normally below 50 mm. (always so in Indian material available), and the length of the upper tooththrow is normally less than 7 mm.	7

7	(8)	The palate is short, less than half the occipitonasal length; the bullae are small, less than 15% of the occipitonasal length; and the palatal foramina are short, at most 15% of the occipitonasal length.	<i>Lenothrix</i>	
8	(7)	Never combining the characters of shortened palate, reduced bullae and shortened palatal foramina..		9
9	(10)	Incisors proodont, the diastema long, up to one-third of the occipitonasal length, and normally at least 31% of it.....	<i>Berylmys</i>	
10	(9)	Diastema proportionately shorter, normally less than 30% of the occipitonasal length....		11
11	(14)	The bullae are reduced, on average less than 15% of the occipitonasal length.		12
12	(13)	The palate is long, well over half the occipitonasal length.....	<i>Stenomys</i>	
13	(12)	The palate is short, less than half the occipitonasal length. (Palatal foramina long, on average at least 16% of occipitonasal length).....	<i>Maxomys</i>	
14	(11)	Normally the bullae are large, on average over 15% of the occipitonasal length.	<i>Rattus*</i>	

Further details of the various subgenera will be given below.

Subgenus (a) **Rattus** Fischer

The typical subgenus is here restricted primarily to those species which have the bullae enlarged (15–25% of the occipitonasal length on average). Both the world-wide house-rats, *Rattus rattus* and *Rattus norvegicus*, belong to this group. A very few forms, one of which occurs in India, appear to have the bullae a little too small for this group, but are so like allied forms with normally large bullae that it is wisest to retain them in this subgenus.

The distribution of this subgenus is world-wide, owing to the accidental human introduction of the two above-mentioned species to nearly all parts of the world. Another species, *Rattus exulans*, which ranges from Burma eastwards

* The little known form *R. nitidus obsoletus* has, in the material examined, the bullae just too small to be normal for the subgenus. Compared with *R. (Stenomys) muelleri* with which it on this account requires comparison, it is smaller, below 46 mm. in occipitonasal length; Indian specimens of *R. muelleri* exceed 50 mm.

to the Pacific Islands, must also surely be in part accidentally introduced by man.

Besides these, there are more than twenty species in the Indo-Malayan and Australian regions. Several of these are Australian only; some more are confined to the Philippines or Celebes.

In general the rats which are referred to here have the palate long or very long, well over half the occipitonasal length. The Indian *Rattus blanfordi* is, however, an exception to this and there are a few more. The palatal foramina are normally long in the typical subgenus.

The main species in this subgenus is *Rattus rattus* which is very common throughout the Indo-Malayan region. This species appears to occur in two forms which might be described as colour varieties, the one, thought to be wild, with a white belly, and the other, presumably commensal, with a dull belly. Both forms occur together extensively in India. A very few species which are closely allied to *R. rattus*, but which occur with it and can be distinguished specifically, can be admitted, such as *Rattus nitidus* and *Rattus rattoides*. The former is Himalayan (Nepal eastwards to South China), the latter ranges from Sikkim and Nepal westwards to Afghanistan and Russian Turkestan. The small *Rattus exulans* (*R. e. concolor*), which differs markedly in size where it occurs with *Rattus rattus* at least on the mainland of Asia, is a Burmese species, so far as India is concerned. And *Rattus blanfordi*, a much more distinct species, which makes an approach towards subgenus *Cremnomys* owing to its long palatal foramina, combined most often with a short palate (with enormous bullae, compare *Cremnomys*), is confined to the Peninsula of India and Ceylon.

Provisional key to the species of typical subgenus Rattus which are native to India.—(Not including *R. norvegicus* which seems an introduced form.)

- 1 (2) The length of the palate is in most specimens less than half the occipitonasal length (very rarely exceeding half this length). Combined with long palatal foramina, on average about 20% of the occipitonasal length, large bullae which average 18% of the occipitonasal length. The tail is of two colours, as a rule wholly dark basally, wholly pale terminally. . . *Rattus blanfordi*
- 2 (1) The length of the palate is normally clearly more than half of the

	occipitonasal length. Not combining the characters described above.	3
3	(4) Length of the occipitonasal in Indian specimens does not exceed 32.5 mm.	
	<i>Rattus exulans</i>	
4	(3) Length of the occipitonasal length exceeds 35 mm.	5
5	(10) The tail is normally of one colour, wholly dark	6
6	(7) Molars with the cusps unusually angular and prominent. (Nasals relatively shorter than in <i>R. nitidus</i> . Bullae smaller than is usual in <i>R. rattus</i>)	
	<i>Rattus montanus</i>	
7	(6) Molars without the peculiarities of the last species.	8
8	(9) The nasals long, usually exceeding 40% of the occipitonasal length.	
	<i>Rattus nitidus</i>	
9	(8) The nasals shorter, normally less than 40% of the occipitonasal length.	
	<i>Rattus rattus</i>	
10	(5) The tail is normally of two colours, or if it tends to be unicolorous, then it is wholly pale.	
	<i>Rattus rattoides</i>	

Possibly *R. rattoides* could be regarded as a colour phase of *R. rattus*. It seems to occur with it extensively. *R. montanus* is not well known and could also, taking a wide view, be regarded as a form of *R. rattus* although its dental characters are not normal. *R. nitidus* looks like a commensal form of *R. rattus*, but I am inclined to regard it as a valid species on account of its peculiarly long nasals. I have seen much material from India for *nitidus*, but very little from China where it is also supposed to occur.

76. *Rattus rattus* (Linnaeus)

The Common Indian Rat

1758. *Mus rattus* Linnaeus, *Syst. Nat.*, 10th ed., 1, 61. From Uppsala, Sweden.

Vernacular names (Blanford).—*Chuha*, *Musa*, H.; *Gachua-indur*, Beng.; *Kart velli*, Tam.; *Ghasmivo*, Cing.

Distribution.—World-wide, owing to accidental human introduction. Throughout Indian territory (except perhaps the extreme west Palaearctic portion) and in southern China and in most of the Malay region and larger Islands (in fact, throughout the Indo-Malay region), there appear to be two varieties of this species occurring together, the one,

white-bellied, being wild, as far as is known, the other, dark-bellied, being commensal. It is, of course, the commensal variety or type which occurs throughout Europe and the Palaearctic region.

This is the commonest Indian rodent. The Indian specimens have been worked out in very great detail by Hinton (1918).

I propose to follow Hinton where possible in dealing with this enormous species. I have, however, given certain cranial measurements here (as I do for the other species), mainly in order to show the place of this species in my keys.

The tail percentages given by Hinton for the various races do not always agree exactly with results of skins here listed. Mr. Hinton writes me that the reason for this is that in his figures only adult material is shown, whereas in my lists there are apparently certain rather younger specimens. I propose to follow his results.

The status of the better known Western commensal forms as *rattus*, *alexandrinus* and *frugivorus*, and the fact that the Indian white-bellied forms appear to be wild, the dark-bellied ones mainly house-dwelling or commensal, is well illustrated by Hinton.

Rattus rattus may be summed up as a medium sized species, with the tail normally wholly dark in colour, and normally longer than the head and body (though not always so, in some of the Malay Island subspecies); the skull with a very long palate, considerably more than half the occipitonasal length as a rule; the palatal foramina long but not excessively so, and the bullae large and well inflated. Mammæ 10 or 12.

The common commensal rat of West India is *R. r. rufescens*, and extralimital Eastern forms which take its place, in my opinion, as commensals in China and Japan are such forms as *flavipectus* Milne-Edwards and *tanezumî* Temminck.

The species *Rattus rattus* is so large in the Indo-Malayan region that it almost defies classification and one wonders if much useful purpose is served by attempting to divide it into races.

Hinton (1918) has shown that the three earliest commensal names *R. r. rattus*, named from Sweden, *R. r. alexandrinus*, originally named from Egypt, and *R. r. frugivorus*, named from Sicily, are 'nothing but colour phases of one and the same species'. I believe that *rattus* and *alexandrinus* types may occur in the same litter. Typical *rattus* is probably melanistic, 'dorsal parts black, ventral parts dusky'; the other two have 'dorsal parts brown'; in *alexandrinus* the 'ventral parts are not usually conspicuously lighter than the

flanks, the ventral hairs with slaty bases'; *frugivorus* has the 'ventral parts light, sharply contrasted with the flanks, the ventral hairs pure white or lemon coloured to their bases'. The white-bellied Indian races have all been given separate names from *frugivorus*; whether that form is supposed to occur in India I do not know. It is probably best regarded as a colour variety of the species from Europe and elsewhere. The form *alexandrinus* is identified by Hinton from Sind and the Punjab, and we have specimens bearing this name from Baluchistan. To me they seem barely or not distinguishable from *rufescens*, which is the common commensal form of western India and is said to differ from *rattus* and *alexandrinus* in having the 'dorsal colour rufous, hairs of the belly with a rusty tinge' (cf. Hinton's key) as against 'dorsal colour rarely rufous, bellies without rusty tinge' for *alexandrinus*. Hinton has divided the white-bellied Indian forms into about fifteen races; with the exception of *R. r. satarae* all are very closely allied, and antedated by many extralimital named forms. An interesting point which emerged from the numerous measurements which I took is that western Indian races have a shorter toothrow than Nepalese and Burmese forms (*satarae* excepted). This applies alike to commensal and wild races. *R. r. sladeni* Anderson, 1879, from western Yunnan was recorded from northern Burma by Anthony. I do not know its characters, but it requires comparison with *brunneusculus*, an Indian name which antedates it. The form *R. r. jalorensis* Bonhote, 1903, occurs in Siam and the Malay States; I have not seen much material for this race, but their skulls seem rather small (only once reaching 40 mm.), their tails average proportionately smaller than the western Indian races, but they seem to agree with the Western races in having rather short teeth. The form *andamanensis* from the Andaman Islands is so poorly represented in London that apart from stating that it is a race of *R. rattus* (we possess a co-type) little can be done as regards giving characters to distinguish it from the other races. I regard the Indian forms *brunneus*, *tistae* and *kelaarti* as commensals.

External characters, colour and notes from skins for Rattus rattus.—There is such an unusually large number of specimens for this species that I propose, in dealing with this heading, to divide the Indian specimens into six groups of races.

A. Short-toothed commensal races, from western India and Ceylon: *alexandrinus*, *ceylonus*, *rufescens*, *kelaarti*. (Underparts mainly dark.)

The fur is rather thick in *kelaarti*, which is a high mountain form, apparently, definitely short in the others just mentioned as a general rule, except in some specimens of *rufescens* from Hoshangabad and Kumaon. Tail dark, always averaging longer than head and body in Indian subspecies. (But in certain Malayan races it may average slightly shorter.) Mammae 10 or 12. Hindfoot with 5 toes, all clawed; normally 6 plantar pads; the fifth hindtoe longer than the hallux, shorter than the central three. Hand with 4 clawed fingers.

Notes from skins.—*R. r. kelaarti*: Pattipola, trapped on edge of bungalow compound; West Haputale, jungle, caught with coconut. Ambawla, trapped in tea by stream. Roof of bungalow. West Haputale, in garden.

R. r. ceylonus: Kandy, trapped in plantain garden; in native house; Trinco, in town. Hambantota, in village. Mannar, from 'an old Dutch house' and trapped on tree in compound.

R. r. rufescens: Seringapatam, $3\frac{7}{8}$ oz., $4\frac{3}{8}$ oz. Rajkot, $3\frac{3}{4}$ oz. Bhuj, Cutch, mammae 5 pairs: $4\frac{3}{4}$ oz., $5\frac{1}{4}$ oz. and 5 oz.; mammae 10: $4\frac{1}{2}$ oz., $5\frac{3}{4}$ oz. Bangalore, $4\frac{5}{8}$ oz., 4 oz. Gersoppa, Kanara, $5\frac{3}{8}$ oz., 7 oz. Jerna, Ramnagar, $6\frac{1}{2}$ oz., 6 oz.; mammae 10: 5 oz. Dela, Ramnagar, mammae 12: 6 oz. Gwalior, caught in village, in native house, $6\frac{1}{2}$ oz., $4\frac{1}{2}$ oz., $6\frac{3}{4}$ oz. Sonawahnee, Balaghat, in field, 4 oz. Rawalpindi, Punjab, trapped in servant's house. Palanpur, 6 oz., $5\frac{1}{2}$ oz.; mammae 10. Sonawahnee, mammae 10: $4\frac{3}{4}$ oz. Village Keshod, Junagadh, mammae 12: $5\frac{1}{2}$ oz., 4 oz.; mammae 10: $4\frac{1}{2}$ oz. Rajkot, $5\frac{1}{4}$ oz. Danta, Gujerat, $5\frac{1}{2}$ oz. Mt. Abu, Rajputana, 6 oz. Bori, Hoshangabad, in hut, $4\frac{1}{4}$ oz. Ganoor, Nimar, in hut, 4 oz. Chichpalli, Chanda, 5 oz.; in hut, $3\frac{3}{4}$ oz.; mammae 10: $4\frac{1}{4}$ oz. Helwak, Satara, $4\frac{3}{4}$ oz. Dhain, Hoshangabad, in hut, $3\frac{3}{4}$ oz. Lohagpur, Hoshangabad, trapped in hedge, $5\frac{1}{2}$ oz. Sakot, 3 oz., trapped in hedge. Pilibhit, Rohilkund, mammae 12: $4\frac{3}{4}$ oz.; mammae 10: $7\frac{1}{2}$ oz., $5\frac{3}{4}$ oz. Asirgarh, Nimar, $4\frac{1}{4}$ oz., trapped on bank. Chandgarh, mammae 10: $4\frac{3}{4}$ oz. Bhadgaon, Khandesh, $7\frac{3}{4}$ oz., trapped in hut. Ghodesgaon, on bank near river. Pili, Sipna, 4 oz., trapped on bank. Ganoor, trapped on bank, 3 oz. Gersoppa, Kanara, $5\frac{5}{8}$ oz. Harisel, Berar, $3\frac{1}{2}$ oz., trapped in bungalow. Rawalpindi, trapped in stable. Sakot, Hoshangabad, in hut, mammae 10: $5\frac{1}{4}$ oz.

The back is brown, darker or paler, sometimes with a rufous tinge and sometimes with a slightly darkened mid-dorsal area. Feet usually dark, occasionally with whitish or white toes. Tail wholly dark. Underparts grey, slaty or dusky, not very much paler often than the back, with the

possible exception of *kelaarti*, in which the ventral parts as a rule have deep slaty bases, and white tips, about 5 specimens (from West Haputale) out of about 18 examined, skins being quite white-bellied.

B. Long-toothed ? commensal dull-bellied races, from Nepal to Assam: *brunneus* and *tistae*. In *brunneus* the fur appears rather short, but in *tistae* it is usually rather soft. Main external characters, as outlined above, for *rufescens* and allies.

Notes from skins.—*R. r. tistae*: Gangtok, Sikkim, weight 5½ oz. Rongli, Sikkim, 4½ oz., mammae 10. Angarakhata, Kamrup, 3.25 oz. Golohat, Nagas, 2.25 oz. Batasia, 5 oz. Cherrapunji, mammae 10: 4.75 oz. Narbong, mammae 10: 4 oz. Margherita, Nagas, mammae 12. Rongli, 4 oz. Angarakhata, 6 oz., and mammae 10. Tura, Garo Hills, 5 oz. Batasia, mammae 10: 4 oz.

The main dorsal coloration in both races under discussion is brown. The feet appear to be mainly dark. Tail wholly dark. The underparts are in *brunneus* mainly dark, yellowish or buffy. A very few specimens (3 in 13) have the belly white. Hinton regards these as 'wild coloured' individuals, or intermediates between *brunneus* and *brunneusculus*, the white-bellied form of Nepal. It is not impossible, however, that they really represent *brunneusculus*. The underparts in *tistae* seem mainly dull, slaty-based, with white tips or slaty and white hairs mixed, giving in general a dull effect. About 15 out of 60 seem to have the belly quite white. Of these, 10 are from Gopaldhara, received in 1921, and I have no skulls for them. On skins alone I would have identified them as '*sikkimensis*' = *brunneusculus*. They seem not to be mentioned in Mr. Hinton's paper. Other near-white-bellied skins are 17.7.2.12, Pashok; 15.9.1.144, Gangtok; 15.9.1.148, Pashok; 15.9.1.142, Rongli; 20.6.7.40, Lohit Valley, Sadiya; 15.9.1.141, Rongli. But taking into account that *tistae* occurs with *sikkimensis*, which seems always to be white-bellied, I think there is ground for regarding *tistae* as a normally dull-bellied type, taking the place of *rufescens* (which is dark-bellied and occurs with normally white-bellied types). The condition of the ventral coloration of *tistae* seems to me to be about as in *R. r. kelaarti*, of Ceylon. In these forms it becomes slightly difficult to draw a line between 'dark-bellied' and 'whitish-bellied' rats. In *tistae* only about 9 skulls in about 32 reach 40 mm. in occipitonasal length, which distinguishes it fairly well from *tikos*, another race with 'intermediate' belly colour, which has the occipitonasal length only once under 40 mm. in the series examined.

C. Relatively short-toothed, mainly white-bellied, rats from western India and Ceylon: *kandianus*, *arboreus*, *narbadae*, '*girensis*' and *wroughtoni*.

The fur is short and harsh in these races, and rarely, as sometimes in *wroughtoni*, may incline to be bristly. Essential external characters as outlined above under *rufescens* and allies.

Notes from skins.—*narbadae* and *girensis*: Sasan, Kathiawar, $4\frac{3}{4}$ oz.; trapped in hut, $3\frac{1}{2}$ oz.; trapped in hedge, 4 oz. Dhain, $3\frac{1}{2}$ oz., trapped in hut; 10 mammae: 4 oz., $4\frac{1}{2}$ oz. Chichpalli, Chanda, caught in hut, $4\frac{1}{2}$ oz.; mammae 10: 5 oz., 4 oz. Rorighat, Hoshangabad, in hedge, $4\frac{3}{4}$ oz.; mammae 10. Sonawahnee, Balaghat, in garden; mammae 10: $3\frac{1}{4}$ oz., $3\frac{3}{4}$ oz. Sasan, mammae 10: $3\frac{1}{4}$ oz., 5 oz. Chanda, 4 foetus; mammae 10: $5\frac{1}{2}$ oz., caught in field.

R. r. arboreus: Paresnath, $5\frac{1}{2}$ oz. Singar, Gaya, mammae 10: $5\frac{3}{4}$ oz., $5\frac{1}{4}$ oz., $6\frac{1}{2}$ oz. Daltongunj, $5\frac{1}{2}$ oz.; mammae 10. Paresnath, $6\frac{3}{4}$ oz. Gajhundi, $5\frac{1}{4}$ oz.; mammae 10. Gajhundi, mammae 10: $5\frac{1}{2}$ oz. Cawnpore, mammae 10. Paresnath, 10 mammae. Jalpaiguri, Bengal, 10 mammae: 5 oz.

R. r. wroughtoni: Kardibetta Forest, $3\frac{3}{4}$ oz.; in small open patch, close to thick bamboo jungle, near a seldom-used forest bungalow, $5\frac{3}{8}$ oz. Sagar, Mysore, near houses, $2\frac{5}{8}$ oz. Kotengady Estate, common, occurs in houses. Poumudi, trapped in wood, very common. Coonoor, in hotel garden. Bangalore, $4\frac{7}{8}$ oz. Gersoppa, Kanara, $5\frac{1}{2}$ oz. Trivandrum, trapped in public gardens. Kardibetta Forest, in thick bamboo jungle, not near any house, $4\frac{7}{8}$ oz. Coonoor, among big rocks, evergreen jungle, mammae 3 inguinal, 1 axilla.

R. r. kandianus: Valaichenai, trapped in native hut. Hambantota, trapped in jungle. Wellawaya, trapped alive in bazaar. Udugama, trapped in bungalow. Kandy, in Horton jungles. Maha-oya, in jungle, alive in native shop. Hambantota, on hill by sea. Anasigalla, caught in bungalow. Mankeni, trapped in native compound. Urugalla, in paddy field. Kumbukkan, edge of jungle. Urugalla, native garden, in a tree. Anasigalla, in bungalow kitchen.

Dorsal coloration brown mostly, sometimes with rufous tinge, or in *narbadae* and *girensis* sometimes more grey. Feet sometimes dark, but more often tending to be pale. Tail wholly dark. Underparts very generally white, occasionally greyish or dirty white. In *narbadae* ('*girensis*' included, as I can detect no constant colour difference between the two in material seen) about one-third of the specimens have rather dull bellies. In *wroughtoni*, a considerable

number tend to have a certain admixture of grey rather than white hairs ventrally and a few have quite dark bellies. I should think 25.10.1.36, Perumal, with a dark belly, is probably a specimen of *rufescens*, and other darkish-bellied skins include 13.4.11.90, Kolar, Mysore; 13.8.22.72, Haleri, Coorg; 7.11.22.35, Dharwar; 13.4.11.97, Seringapatam, etc. Whitish-bellied specimens definitely are in the majority.

D. Long-toothed exceptionally long-tailed western Indian race: *R. r. satarae*. The fur tends to be moderately thick. The essential external characters are as indicated above for *rufescens*, etc., but the tail is longer than in other subspecies. The feet appear somewhat arboreal in formation. Colour of the back golden brown, usually much darkened by the intermixed black hairs. Feet usually rather dark. Tail wholly dark. Underparts usually white but obscurely so in two skins out of ten.

E. Relatively long-toothed, relatively long-tailed, mainly white-bellied, types, Punjab to North Burma: *R. r. brunneusculus* (with '*sikkimensis*'), *bhotia*, *macmillani* and *gangutrianus*. Fur short and somewhat bristly in *macmillani*, usually thick and soft in the other races now under discussion, or medium in texture in some specimens. Essential external characters as noted above for *rufescens* and allies.

Notes from skins.—'*sikkimensis*': Darabanda, Garo Hills, weight 5 oz., mammae 10. Dening, Mishmi, mammae 12, Tura, Garo Hills, weight 4.25 oz., mammae 10. Rongli, Sikkim, mammae 12: 6 oz. Tura, weight 4.5 oz. Singhik, Sikkim, 12 mammae. Tura, 6 oz. Ringin, 4 oz.

R. r. gangutrianus: Ramnagar, Kumaon, 5½ oz., 4½ oz., mammae 10. Khati, mammae 12: 5¼ oz., 5 oz., 4 oz. Lohaghat, 5¼ oz., 5 oz. Sitabani, 6¾ oz. and 5½ oz., mammae 10: 4½ oz. Ranibagh, 6¼ oz. Takula, 6½ oz. Lwarkhet, 6 oz. Ratighat, 4½ oz.

Dorsal coloration brown to grey brown, occasionally with darkened mid-dorsal portion and occasionally with a rufous tinge: tending to be slightly darker in *macmillani*, but not always distinguishable from the others. (The colour distinctions given in Hinton's key between *gangutrianus*, *macmillani* and *sikkimensis*, 1918, p. 61, seem to me average rather than absolute.) Feet usually tending to be pale, perhaps excepting *bhotia*. Tail normally wholly dark. A few specimens of *gangutrianus*, however, seem to have the tail tending towards the *Rattus rattoides* pale type, as Nos. 14.7.10.129, 126 and 128, from Kumaon. Underparts white almost without exception in *sikkimensis*, *bhotia*, *macmillani*. Two skins labelled *brunneusculus*, Nagarcot and Gorkha, Nepal,

seem to have the belly nearly the dull colour that is more usual in commensal types, and in *gangutrianus*, there appear to be 5 dull-bellied specimens out of about 34. Most of these seem to be from the Punjab. Some of the other specimens have rather dirty white underparts, but the majority seems to be white in colour.

F. Similar to the last races, but with relatively shorter tail, and often rather dull underparts. From Burma and Tenasserim: *khyensis* (with '*tatkonensis*') and *tikos*.

R. r. tikos: Victoria Point, 4 $\frac{7}{8}$ oz. Tenasserim Town, 6 oz. Victoria Island, 5 $\frac{1}{4}$ oz. Victoria Point, 3 $\frac{7}{8}$ oz. and 5 $\frac{1}{8}$ oz.

R. r. khyensis: Pyaunggaung, 6 $\frac{3}{4}$ oz., 5 $\frac{1}{4}$ oz. NW of Toungoo, trapped in jungle bungalow, mammae 10. NW. of Kindat, caught in house in jungle, 5 oz., mammae 12: 3 $\frac{1}{2}$ oz. Six miles west of Kindat, caught drowned in a bath in a jungle rest house, said to live in holes, 4 oz. Shwebo district, caught in thick jungle.

The fur is short in these races and often, particularly in *tikos*, has a certain mixture of bristles or weak spines. Essential external characters as in the other races. Colour above brown, lighter or darker. The feet tend to be pale. The tail is normally wholly dark. Underparts usually white or dirty white in *khyensis*, though in many specimens there is an admixture of slaty hairs on the belly and a few specimens have quite dull bellies. The underparts in *tikos* are usually dirty white or white mixed with slaty, sometimes with a mid-ventral patch, which is slaty. There is a large percentage of *tistae*-like dull-bellied specimens in this race. Specimens from Hastings, Criddles, Tavoy and particularly Hayes Island (the latter might be *rufescens* if it were not for their short tails) tend to be dull-bellied. Perhaps I am dealing with more than one race here and the matter is further complicated by the fact that Miller has named some races from the Islands of the Mergui Archipelago, which antedate *tikos*. *R. r. dentatus* Miller, 1913, was named from Hastings Island and we have specimens from that locality. They appear to me to be somewhat dull-bellied and possibly this name should be used for our Mergui Island specimens, which seem, on the average, to be duller-bellied than the mainland specimens.

External measurements.—As in Table 65, below.

Cranial characters of Rattus rattus.—The extremes of length of occipitonasal measurements in my possession for this species vary between about 36 mm. and about 49 mm. This takes into account all the Asiatic white-bellied wild races, but does not include European commensal forms.

TABLE 65.—*External body measurements of the Indian races of Rattus rattus*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus brunneusculus</i>					
F.	Patibaghan, Nepal	203	233	32	22
M.	Nagarcot, Nepal	165	214	33	24
M.	Sipuri, Nepal	177	230	36	25
	Mircourt, Gorkha	147	195	34	23
	Bouzini, Nepal	140	190	32	24
	Nagarcot, Nepal	177	202	37	27
	Kakani, Nepal	160	180	33	22
	Nanglepany, Gorkha	146	190	33	23
M.	Changli, Nepal	176	?	35	25
F.	Nagarcot	167	197	31	25
M.	Chalna Khall, Nepal	165	210	35	25
	Sunachurn, Nepal	185	202	35	23
M.	Deosali, Gorkha	147	222	34	23
M.	Nagarcot	140	178	33	23
<i>Rattus rattus 'sikkimensis' = brunneusculus</i>					
	Dening, Mishmi	190	208	35	24
M.	Ringin, Sikkim	159	188	34	23
M.	Tura, Garo Hills	180	200	33	24
M.	Gopaldhara, Darjeeling	190	237	34	?
F.	Gopaldhara	166	210	33	25
F.	Gopaldhara	151	194	29	22
M.	Gopaldhara	175	231	35	22
F.	Gopaldhara	143	189	32	23
	Gopaldhara	169	208	32	23
F.	Pashok, Sikkim	170	215	32	23
M.	Rongli, Sikkim	177	230	36	25
	Rongli, Sikkim	162	203	34	23
					Mammae 12
	Singhik, Sikkim	168	188	32	24
					Mammae 12
M.	Pashok	146	190	33	23
M.	Pashok	160	208	31	22
M.	Tura, Garo Hills	205	221	31	26
F.	Tura, Garo Hills	167	216	33	25
					Mammae 10
F.	Dening, Mishmi	198	222	32½	25
					Mammae 12
M.	Dreyi, Mishmi	203	230	36	25½
M.	Dening, Mishmi	220	216	35	25
M.	Dreyi	191	231	34	24
F.	Dara Banda, Garo Hills	167	225	30	25
					Mammae 10 ; a white tail tip
F.	Nagarcot, Nepal	176	167	33	27
	Pashok, Sikkim	174	217	32	24

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus arboreus</i>				
F. Gajhundi, Hazaribagh	166	233	32	24
				Mammae 10
F. Cawnpore City	169	216	33	22
				Mammae 10
M. Jalpaiguri, Bengal	166	204	33	21
F. Jalpaiguri	167	197	32	22
				Mammae 10
	Paresnath, Hazaribagh	169	228	31
M. Daltongunj, Bengal	164	230	34	25
F. Gajhundi, Hazaribagh	164	208	31	24
				Mammae 10
F. Daltongunj	166	256	32	24
				Mammae 10
F. Singar, Gaya, Bihar	158	217	33	25
				Mammae 10
M. Singar	174	240	34	25
M. Paresnath	166	235	33	24
M. Gajhundi	168	211	34	?
M. Hazaria, Nepal Terai	160	226	35	24
M. Paresnath	173	215	32	25
F. Singar	170	203	33	25
M. Gajhundi	168	208	30	24
<i>Rattus rattus kelaarti</i>				
F. Ambawela, Ceylon	158	187	33	20
F. Ambawela	162	174	34	21
F. Pattipola, Ceylon	153	200	32	20
M. Pattipola	153	181	32½	21
M. Pattipola	166	175	31½	22
F. West Haputale	141	180	31	20
M. West Haputale	151	188	29	20
F. West Haputale	164	204	32	21
M. West Haputale	144	192	34	21
F. West Haputale	147	176	29	20
F. West Haputale	138	156	30	17
M. West Haputale	145	172	30	21
F. Pattipola	155	192	33	21
F. Ambawela	146	172	31	20
F. Ambawela	167	196	33	19½
	West Haputale	162	211	34
M. West Haputale	120	143	28	20
M. West Haputale	162	174	30	20
	West Haputale	133	152	29
M. Pattipola	155	188	33	20½
F. West Haputale	141	180	31	21
	Pattipola, type	156	176	32

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus bhotia</i>					
	Hasimara, Bhutan Duars	131	186	34	20
M.	Hasimara	145	194	33	21
M.	Hasimara	166	220	35	23
M.	Hasimara	141	187	32	21
	Hasimara	146	185	31	21
	Hasimara	133	183	30	18
M.	Hasimara	143	184	30	21
M.	Hasimara	131	190	33	22
M.	Hasimara	155	198	32	23
M.	Hasimara	147	172	31	21
M.	Hasimara	145	180	32	21
M.	Hasimara	142	200	32	21
M.	Hasimara	147	184	34	21
F.	Hasimara	139	180	29	19
	Hasimara	148	174	31	21
M.	Hasimara, type	149	211	33	20
<i>Rattus rattus narbadae</i>					
F.	Chichpalli, Chanda	158	212	31	22
					Mammae 10
F.	Dhain, Hoshangabad	147	197	32	21
					Mammae 10
M.	Dhain	161	220	32	23 (?)
M.	Dhain	153	211	31	22
F.	Rorighat, Hoshangabad	158	225	34	27
					Mammae 10
F.	Chanda	161	212	33	23
					Mammae 10
M.	Sonawahnee, Balaghat	152	208	31	21
F.	Sonawahnee	158	217	31	24
					Mammae 10
M.	Dhain	153	200	33	22
M.	Chichpalli, Chanda	159	200	32	23
M.	Rorighat	163	210	33	23
F.	Chanda	155	220	31	23
					Mammae 10
F.	Sakot, Hoshangabad, type.	164	221	31	26
<i>Rattus rattus 'girensis' (= narbadae)</i>					
F.	Sasan, Junagadh, type	160	215	30	23
F.	Sasan, Junagadh	148	198	32	21
M.	Sasan	154	177	32	23
M.	Sasan	150	201	31	21
M.	Sasan	143	206	34	21
	Sasan	152	?	29	?
					Mammae 10
M.	Sasan	147	201	32	20
F.	Sasan	153	202	31	22

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus satarae</i>				
F. Ghatmatha, Satara	151	230	31	25
F. Ghatmatha	165	245	32	27
F. Shevaroy Hill	152	240	32	24
Chettiri Range, Salem district	153	219	33	?
Shevaroy Hill	155	250	33	25
M. Konkan	190	240	35	25
M. Ghatmatha	141	243	32	24
M. Chettiri Range	151	241	32	23
Shevaroy Hill, immature	116	195	31	23
Ghatmatha, type	146	233	32	25
<i>Rattus rattus tistae</i>				
M. Gopaldhara, Sikkim	175	167	26	17
M. Pashok, Sikkim	161	194	33	22
F. Pashok	150	180	31	22
M. Angarakhata, N. Kamrup	198	196	36	23 (?)
M. Golohat, Assam	170	193	34	20
F. Dening, Mishmi	175	183	31	23
F. Golohat, Assam	153	158	30	20
F. Golohat	150	185	31	19
F. Golohat	158	178	31	20
M. Dening, Mishmi	190	160	30	23
M. Lohit Valley, Sadiya	150	172	31	22
F. Dening, Mishmi	150	177	31½	21
M. Lohit Valley, Sadiya	162	190	29	22
F. Dening, Mishmi	163	208	32	23
M. Dening	163	183	33	22
M. Dibong, Sadiya	163	186	31	21
M. Dening, Mishmi	180	159	32½	21
F. Margherita, Naga Hills	164	180	30	22
				Mammae 12
M. Tura, Garo Hills, Assam	187	190	31	22
F. Pashok, Sikkim	135	169	32	21
F. Pashok	158	180	32	23
F. Pashok	149	159	32	22
M. Pashok	160	183	33	23
M. Pashok	155	183	33	22
F. Pashok	153	180	30	22
F. Pashok	151	181	33	21
M. Pashok	145	168	31	21
F. Batasia, Sikkim	151	206	31	21
				Mammae 10
F. Gopaldhara, Darjeeling	172	188	32	23
M. Gangtok, Sikkim	167	191	33	21
M. Narbong, Darjeeling	161	195	34	23
F. Rongli, Sikkim	153	170	31	21
				Mammae 10
F. Rongli	148	167	32	21

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus tistae</i> (concl'd.)					
M.	Gopaldhara, Darjeeling	180	159	31	19
F.	Gangtok, Sikkim	150	179	31	20
M.	Gopaldhara, Darjeeling	202	176	32	22
F.	Gopaldhara	170	186	32	23
F.	Narbong, Darjeeling	156	179	31	22
				Mammae 10	
F.	Gopaldhara, Darjeeling	165	170	31	23
F.	Angarakhata, Kamrup	163	195	31	22
M.	Angarakhata	150	157	32	21½
F.	Angarakhata	180	187	32	21
				Mammae 10	
M.	Angarakhata	156	168	32	20
	Angarakhata	160	186	33	20
F.	Angarakhata	174	155	31	20
M.	Khojdar, 4 miles east of Digboi	205	184	31	20
F.	Gopaldhara, Darjeeling	172	168	32	23
F.	Gopaldhara	180	220	32	27
M.	Gopaldhara	180	182	32	23
F.	Gopaldhara	180	170	33	22
F.	Gopaldhara	165	170	30	23
M.	Gopaldhara	180	190	26	20
F.	Cherrapunji, Assam	167	171	29	22
				Mammae 10	
M.	Rongli, Sikkim	158	183	34	21
F.	Rongli	156	185	33	21
				Mammae 10	
M.	Angarakhata, Kamrup	187	166	31	22
M.	Batasia, Sikkim	163	188	35	22
	Type, Pashok	155	196	32	21
<i>Rattus rattus wroughtoni</i>					
M.	Coonoor, Nilgiris	164	200	32	21
M.	Coonoor	154	199	30	22
M.	Kolar, East Mysore	201	232	35	22½
M.	Dharwar	168	190	33	21
M.	Kardibetta Forest, Mysore	182	250	36	25
M.	Ootacamund	170	220	35	25
F.	Coonoor	164	228	32	24 (?)
				Mammae 8	
M.	Dharwar	146	178	33	21
M.	East Madura	185	200	37	20
F.	Dharwar	175	200	33	23
M.	Dharwar	154	176	32	22
M.	Dharwar	159	160	31	21
M.	Dharwar	150	181	31	23
F.	Kolar, Mysore	189	225	35	22
F.	Kolar	169	200	32½	21
M.	Kardibetta Forest	160	210	33½	22

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus wroughtoni</i> (concl'd.)					
M.	Kolar, Mysore	176	205	35	22
	Sagar, Mysore	160	198	32	20½
	Kardibetta Forest	170	237	33	22
M.	Bangalore, Mysore	174	197	33	21
M.	Kolar	164	212	33	21½
	Seringapatam, Mysore	175	214	32	22
	Poumudi	172	213	35	?
F.	Silver Cascade	170	220	33	23
	Gersoppa, Kanara	177	246	35	22
	Perumal	150	194	32	22
	Poumudi	178	177	25	?
M.	Perumal	160	200	33	23
M.	South Mahratta	165	194	32	22½
F.	Wotekolli, Coorg	195	258	35	24
	Perumal	173	212	33	24
M.	Shambalgamur	185	243	37	25
M.	Shambalgamur	182	215	34	24
F.	Trivandrum	155	200	32	?
M.	? Trivandrum	180	190	32	?
M.	Coonoor, Nilgiris	185	218	33	23
M.	Trivandrum	180	190	32	?
M.	Halery Estate, Coorg	193	220	32	22
	Shambalgamur	140	189	30	20
F.	Gersoppa, Kanara	169	217	34	21
F.	Kil Kotagiri, Nilgiris	146	218	31	24
	Type, M. Coonoor	187	215	34	22
<i>Rattus rattus gangutrianus</i>					
M.	Sitabani, Ramnagar, Kumaon	166	204	33	22
M.	Ramnagar	177	224	34	25
M.	Ramnagar	164	211	35	25
F.	Sitabani, Ramnagar	157	202	33	23
					Mammae 10
F.	Ramnagar	162	222	34	25
F.	Ramnagar	163	218	34	22
					Mammae 10
F.	Khati, Kumaon	170	200	33	25
					Mammae 12
F.	Khati	162	187	29	23
					Mammae 12
F.	Khati	173	211	32	25
					Mammae 12
F.	Khati	158	188	30	22
					Mammae 12
M.	Lwarkhet, Kumaon	163	208	34	25
M.	Takula, Kumaon	179	221	34	26
M.	Ratighat, Kumaon	157	212	33	22
F.	Ratighat	168	213	33	24
					Mammae 12

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus gangutrianus</i> (concl'd.)				
Lohaghat, Kumaon	162	207	34	24
M. Khati	160	189	32	23
M. Lohaghat, Kumaon	159	196	31	23
M. Chamba, Punjab	174	216	34	24
M. Jagatsukh, Kulu, Lahul	167	?	35	25
M. Gopalpur, Kangra	150	220	34	25
M. Baratissa, Chamba	168	190	35	25
F. Dharmsala, Punjab	164	203	32	21
M. Chamba, Punjab	170	191	32	24
M. Chamba	161	181	33	23
F. Dharmsala, Punjab	164	207	32	24
F. Gopalpur, Kangra	182	228	32½	22
M. Kyelang, Lahul	182	189	34	26
M. Chamba	182	203	34	23
M. Chamba	179	199	32	25½
F. Lohaghat, Kumaon	150	196	32	22
F. Takula, Kumaon	170	208	33	24
M. Ratighat, Kumaon	161	214	34	23
M. Ranibagh, Naini Tal	182	229	36	25
M. Sitabani, Ramnagar	187	241	37	28
Type, Ranibagh	183	223	35	25
<i>Rattus rattus khyensis</i>				
M. Near Toungoo, Burma	148	166	30	18
20 miles NW. of Toungoo	187	198	35	24
			Mammæ 2-3 = 10	
Maymyo, Burma	182	170	?	?
M. Maymyo	185	170	?	?
Madaya, Maymyo district	154	156	26	18
M. Pyaunggaung, Shan States	195	222	35	24
25 miles W. of Kindat	160	176	33½	22½
M. 6 miles W. of Kindat	183	194	34	22½
M. Kaing Reserve, Burma	163	138	?	?
M. Mount Poppa, Burma	173	213	33	24
F. Shwebo, Burma	185	189	30	20
F. 20 miles NW. of Kindat	181	175	33½	23
			Mammæ 12	
F. Mount Poppa	170	222	33½	22
F. Mount Poppa	160	195	32	22
F. Mount Poppa	160	200	33½	23½
M. Mount Poppa	181	217	34	25
M. Pyaunggaung, Shan States	166	181	32	23
F. Pyaunggaung	158	168	31	21
Pyaunggaung	173	199	34	21
Pyaunggaung	190	211	34½	25
M. Pyaunggaung	180	193	33	23
M. Gokteik, Burma	178	197	34	23
F. Kin, Burma	184	215	34	24½
F. Type, 25 miles west of Kindat	166	184	32	22½

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus khyensis</i> ('tatkonensis')				
F. Nyapinium, Irrawaddy	184	206	34	22
F. Mingun, Burma	172	188	32	23
M. Mingun	187	182	33	22
M. Mingun	187	220	34	22
M. Hsipaw, Burma	176	194	32	22
Kyauknaung, Irrawaddy	184	232	33½	25
F. Mingun, near Sagaing	173	194	32	24
M. Mingun	180	182	34.3	22
M. Tatkon, Burma	156	206	36	22
Type, Tatkon	171	209	34	22
<i>Rattus rattus macmillani</i>				
F. Hkamti, Burma	154	187	32½	21.75
F. Hkamti	169	222	32.25	22
M. Hkamti	150	211	35	21½
M. Hkamti, type	158	205	34	22
<i>Rattus rattus tikos</i>				
M. Victoria Island, Tenasserim	174	200	37½	23
Victoria Point, Tenasserim	188	216	34	23½
F. Victoria Island	172	181	34	21
M. Victoria Island	184	200	38	21
M. Victoria Point	172	161	33	21
M. Victoria Point	162	188	34	21
M. Victoria Point	161	181	35	22
F. Victoria Point	160	176	34	21
M. Malcolm Island, Mergui	210	180	35	25
F. Malcolm Island	200	142	34	23
F. Malcolm Island	192	189	33	23
F. Malcolm Island	195	175	32	24
M. Malcolm Island	160	175	33	21
F. Sullivan Island	190	174	33	24
M. King Island	200	177	38	22
M. King Island	209	165	36	25
F. Victoria Point, Tenasserim	160	183	33½	20
Bankachon, Tenasserim	172	177	34½	21
M. Thaget, Tenasserim	168	179	32	20
F. Lampea, Tenasserim	161	220	34	23
F. Tenasserim Town	169	183	33	19
F. Bankachon	156	177	33	21
F. Thaget	158	168	32	21
M. Tenasserim Town	180	177	36	23½
M. Locality ?	205	186	38	22
F. Victoria Point, Tenasserim	176	192	34	22
F. Victoria Point	168	188	34	21
F. Victoria Island	167	?	34	20½

TABLE 65.—*External body measurements of Rattus rattus (concl.)*

	Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus tikos</i> (concl.)				
F. Tenasserim Town Seen also from Tagoot, Tenasserim	169	183	33	19
M. Type, Tenasserim Town	173	191	35½	21½

The above are mainly whitish-bellied skins. Note that those from the Mergui Islands have usually the tail shorter than the head and body length.

Rattus rattus ? dentatus

This was named from Hastings Island, Mergui Archipelago, by Miller in 1913. We have skins from that locality labelled '*tikos*', but *dentatus* antedates that name. Skins below, which I very provisionally refer to *dentatus*, have dull bellies, as in *brunneus* or *tistae*. I cannot place them in my key as their skulls are not available to me.

F. Hastings Island	189	192	31	22
F. Hastings Island	172	200	33	23
M. Hayes Island	195	210	35	22
Hayes Island	195	193	36	22
M. Hayes Island	183	195	30	19
M. Ross Island	178	187	37	23
Criddles Island	200	200	36	23
F. Criddles Island	210	185	36	23
M. Tavoy Island	222	173	32	23
M. Tavoy Island	220	205	34	24

Rattus rattus kandianus

M. Wellawaya, Ceylon	149	199	33	20
M. Wellawaya	156	220	21	20½
F. Colombo	150	?	31½	22
F. Colombo	174	195	30	21
F. Kumbukkan, Ceylon	152	202	30	20½
F. Kumbukkan	150	192	30	20½
M. Kumbukkan	140	186	31	20½
F. Kumbukkan	129	195	30	20
F. Urugalla, Ceylon	150	?	30	21½
Urugalla	158	185	33	21
Urugalla	144	189	28½	20½
F. Horton Reserve, Kandy	123	187	30½	21
M. Anasigalla, Ceylon	150	200	32	20
F. Hambantota, Ceylon	137	177	28	20½
F. Hambantota	145½	196	30	21½
M. Hambantota	148	209	32½	21½
F. Maha-oya, Ceylon	146	210	32	22½
Maha-oya	168	193	31½	21½
F. Maha-oya	151	222	31½	21

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus kandianus</i> (concl'd.)					
M.	Kandy	178	210	33½	21
M.	Udugama, Ceylon	180	246	35	23½
F.	Udugama	161	204	31	20
M.	Udugama	174	190	32	20
F.	Mankeni, Ceylon	150	205	29	22½
M.	Hambantota, Ceylon	137	181	32½	19
F.	Wellawaya, Ceylon	137½	203	31	21
M.	Valaichenai, East Province, Ceylon	141½	?	34	22½
F.	Udugama, Ceylon	175	237	28½	23
F.	Maha-oya	167	225	34	21½
M.	Anasigalla, Ceylon	147	216	35	22
<i>Rattus rattus brunneus</i>					
F.	Ferping, Nepal	170	212	38	27
F.	Godaveri, Nepal	183	232	36	28
F.	Godaveri	185	195	36	26
F.	Hathibun, Nepal	180	208	37	27
F.	Changoo, Nepal	162	215	35	26
F.	Ferping	184	235	39	28
	White-bellied skins				
M.	Changoo, Nepal	184	?	37	27
	Changoo	165	203	35	21
<i>Rattus rattus</i> probably <i>rufescens</i>					
Dark-bellied skins, from Sind					
Frost collections—					
F.	28. Panoaqil, Sind	160	225	32	20
F.	41. Panoaqil	170	210	27	20
F.	42. Panoaqil	168	215	32	20
F.	44. Panoaqil. Young	135	175	30	22
F.	45. Panoaqil	125	170	28	18
F.	58. Panoaqil	160	210	30	23
	71. Panoaqil	145	190	27	20
<i>Rattus rattus</i> probably <i>tistae</i>					
Dark-bellied skins, from Naga Hills					
Frost collections—					
M.	213. Naga Hills	150	158	35	25
M.	214. Naga Hills	150	160	35	22
	215. Naga Hills	135	140	35	22
M.	222. Naga Hills	134	137	35	20

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus rattus</i> probably <i>tistae</i> (concl.)						
Intermediate rather dark or grey-bellied specimens						
Frost collections—						
M.	243.	Naga Hills	175	175	32	28
M.	248.	Naga Hills	165	175	32	22
M.	349.	Naga Hills	140	160	33	21
M.	350.	Naga Hills	155	166	30	20
M.	351.	Naga Hills	135	161	30	20
M.	356.	Naga Hills	130	175	31	20
M.	357.	Naga Hills	140	150	30	20
M.	376.	Lake Loktak, Manipur	135	160	31	21
M.	514.	Pashok, Sikkim (Teesta Valley).	163	180	33	24
	521.	Near Kalimpong	135	150	31	21
<i>Rattus rattus</i> probably <i>brunneusculus</i> (' <i>sikkimensis</i> ')						
White-bellied specimens						
Frost collections—						
M.	201.	Naga Hills	130	168	32	20
M.	247.	Naga Hills	140	175	30	28
F.	377.	Lake Loktak, Manipur	160	172	33	24
M.	382.	Lake Loktak	162	176	32	22
F.	383.	Lake Loktak	145	181	30	23
M.	401.	Lake Loktak	170	204	34	23
	416.	Bishampur, Manipur. Young.	127	135	30	18
F.	417.	Lake Loktak	162	176	30	23
M.	418.	Lake Loktak	180	184	32	24
M.	419.	Lake Loktak	150	176	30	23
M.	502.	Kalimpong, Sikkim	160	175	32	22
M.	504.	Kalimpong	160	195	34	21
F.	506.	Kalimpong	145	169	30	21
	512.	Chakung, Sikkim	180	156	32	25
F.	517.	Chakung	140	175	30	22
<i>Rattus rattus rufescens</i>						
F.	12.10.4.70		164	208	32	22
	Bhuj, Cutch					Mammae 10
F.	14.7.10.110		170	222	33	24
	Pilibhit, Rohilkund					Mammae 10
M.	15.7.3.54		155	214	33	21
	Ghatmatha, Satara					
M.	12.11.29.124		179	223	33	24
	Lohagpur, Hoshangabad					
M.	23.11.3.75		196	232	34	24
	Pathankote, Punjab					

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus rufescens (contd.)</i>					
M.	15.7.2.15 Chorepura, Gwalior	180	205	33	24
F.	5.4.2.9 Rawalpindi, Punjab	137	170	31	22
F.	15.7.2.17 Chorepura, Gwalior	163	190	28½	21½
M.	13.9.18.66 Palanpur, Gujerat	178	225	35	25
M.	13.9.18.69 Danta, Gujerat	160	207	30	23
	12.6.29.96 Dharwar	164	188	31	23
M.	14.7.10.108 Pilibhit, Rohilkund	163	214	30½	22
M.	14.7.10.107 Pilibhit	151	193	31	21
F.	12.10.4.71 Bhuj, Cutch	163	217	33	23
F.	12.10.4.69 Bhuj	165	220	31	24
F.	12.11.28.108 Gersoppa, Kanara	185	241	35	24
F.	13.8.8.117 Keshod, Junagadh	160	211	33	24
M.	13.4.11.86 Bangalore, Mysore	185	185	32	21½
F.	13.4.11.94 Kolar, Mysore	164	230	33½	21½
F.	30.5.24.169 Kurumbapatti, Salem	148	205	32	21
F.	13.8.8.118 Keshod, Junagadh	150	224	33	23
F.	14.7.10.99 Ramnagar, Kumaon	142	190	31	22
M.	14.7.10.102 Jerna, Ramnagar	161	192	32	21
M.	12.11.29.121 Sakot, Hoshangabad	139	181	31	21
M.	14.7.10.98 Ramnagar	178	?	34	23
F.	15.7.3.52 Helwak, Satara	175	214	32	18
F.	12.11.29.115 Sonawahnee, Balaghat	158	215	32	22
M.	12.11.29.122 Bori, Hoshangabad	163	224	35	24
F.	12.6.28.33 Chandgarh, Nimar	159	195	31	22
M.	12.10.4.66 Bhuj, Cutch	155	224	32	23-

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus rufescens</i> (contd.)					
M.	15.7.2.16	174	205	31	21
	Chorepura, Gwalior				
	12.6.29.93	175	229	34	24
	Dharwar				
M.	5.4.2.7	170	201	32	23
	Rawalpindi				
F.	14.7.10.100	150	191	33	22
M.	30.5.24.167	159	224	33	23
	Balapalli, Cuddapah				
M.	12.11.29.114	155	213	32	23
	Sonawahnee, Balaghat				
M.	12.11.29.118	146	220	33	22
	Chichpalli, Chanda				
M.	13.8.8.121	157	206	32	23
	Junagadh, Kathiawar				
F.	12.11.29.127	147	203	31	21
	Dhain, Hoshangabad				
F.	13.4.11.96	168	213	32	23
	Seringapatam, Mysore				
F.	14.7.10.106	164	211	32	23
	Dela, Ramnagar				Mammae 12
F.	12.11.29.116	146	215	30	?
	Sonawahnee, Balaghat				Mammae 10
F.	14.7.10.101	170	?	32	22
	Ramnagar				
F.	13.9.18.67	165	227	34	23
	Palampur				Mammae 10
M.	12.11.29.113	159	190	33	24
	Sonawahnee, Balaghat				
M.	12.3.8.9	157	210	33	23
	Pili, Sipna, Berar				
F.	12.3.8.10	150	199	31	22
	Harisel, Berar				
M.	12.11.28.105	198	212 ?	34	22
	Gersoppa, Kanara				
M.	13.4.10.47	161	180	30	?
	Vijayanagar, Bellary				
M.	12.6.28.30	145	200	32	23
	Ganoor, Nimar				
F.	13.8.8.120	150	192	30	21
	Rajkot, Kathiawar				
M.	5.4.2.6	154	224	32	24
	Rawalpindi				
M.	12.10.4.68	160	225	33	22
	Bhuj, Cutch				
F.	12.11.29.119	150	210	32	?
	Chanda				
M.	12.6.29.94	168	214	32	21½
	Dharwar, Mahratta				

TABLE 65.—*External body measurements of Rattus rattus (concl.)*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus rufescens</i> (concl.)					
F.	14.7.10.109 Pilibhit, Rohilkund	171	233	32	23
M.	13.8.8.116 Keshod, Junagadh	166	?	33	23
	30.5.24.166 Balapalli, Cuddapah	157	?	35	22
F.	11.12.21.22 Ghodesgaon, Khandesh	158	209	33	22
M.	11.12.21.21 Bhadgaon, Khandesh	198	240	35	25
M.	13.8.8.119 Rajkot, Kathiawar	150	195	30	21
M.	30.5.24.168 Balapalli, Cuddapah	156	195	35	22
M.	14.7.10.104 Jerna, Ramnagar	167	230	36	23
M.	13.4.11.83 Bangalore, Mysore	178	220	34	23
M.	14.7.10.103 Jerna, Ramnagar	142	201	33	21
F.	12.11.29.126 Sakot, Hoshangabad	175	214	31	25
M.	13.9.18.68 Mt. Abu, Rajputana	170	?	32	24
M.	13.4.11.85 Bangalore, Mysore	166	176	32	23
F.	12.6.29.98 Hubli, S. Mahratta	157	200	30½	22
F.	14.7.10.105 Jerna, Ramnagar	163	222	35	22
F.	23.11.3.76 Ara, Salt Range, Punjab	162	200	32	22
M.	12.11.29.123 Bori, Hoshangabad	166	233	35	25
M.	12.11.29.117 Chichpalli, Chanda	158	225	32	24
F.	12.6.29.97 Gadag, Mahratta	157	200	30	20
M.	12.6.29.95 Gadag	156	188	31	21
M.	8.1.22.12 Umankot, Sind	137½	183½	33½	21½
F.	5.4.2.8 Rawalpindi	148	?	26	20
M.	12.6.28.31 Ganoor, Nimar	152	220	35	23

A few other skins, from Liukiu Islands, Bangkok in Siam, Biserat in Malaya.

TABLE 65.—*External body measurements of Rattus rattus (contd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus ceylonus</i>					
F.	15.3.1.183 Kandy, Ceylon	163	171	31	22
F.	15.3.1.187 Trinco, East Ceylon	. 171	204	30	21½
F.	15.3.1.179 Mannar, Ceylon	170	221	34	22½
F.	15.3.1.184 Kandy	173	180	29½	22
M.	15.3.1.185 Trinco	168	186	32	22
M.	15.3.1.182 Kandy	159	204	42	21½
F.	15.3.1.180 Mannar	170	190	30½	20
F.	15.3.1.186 Trinco	180	204	30	22½
F.	15.3.1.174 Colombo, Ceylon	203	215	32	21
	15.3.1.173 Colombo	. 209	235	34	23
M.	15.3.1.175 Hambantota	.. 175	212	31½	22
F.	15.3.1.176 Hambantota	164	215	31½	22½
F.	15.3.1.181 Mannar	160	231	32½	21
M.	15.3.1.178 Mannar	175	202	31½	21
<i>Rattus rattus ? alexandrinus</i>					
F.	8.1.22.10 Jacobabad, Sind	181	227	35½	23
F.	8.1.22.9 Jacobabad	161	193	31	22
F.	15.11.1.115 Kashmor, Sind	157	197	35	22
M.	17.10.2.2 Jacobabad	. 150	196	35	23
F.	15.11.1.113 Kashmir	. 157	197	35	22
M.	25.6.10.28 Chakdulla, Campbellpore	166	218	35	23
F.	10.11.7.75 Pasri, Baluchistan	170	225	37	25
M.	19.11.7.73 Pasri	.. 142	211	34	23
M.	17.10.2.1 Jacobabad	160	193	32	24

TABLE 65.—*External body measurements of Rattus rattus (concl'd.)*

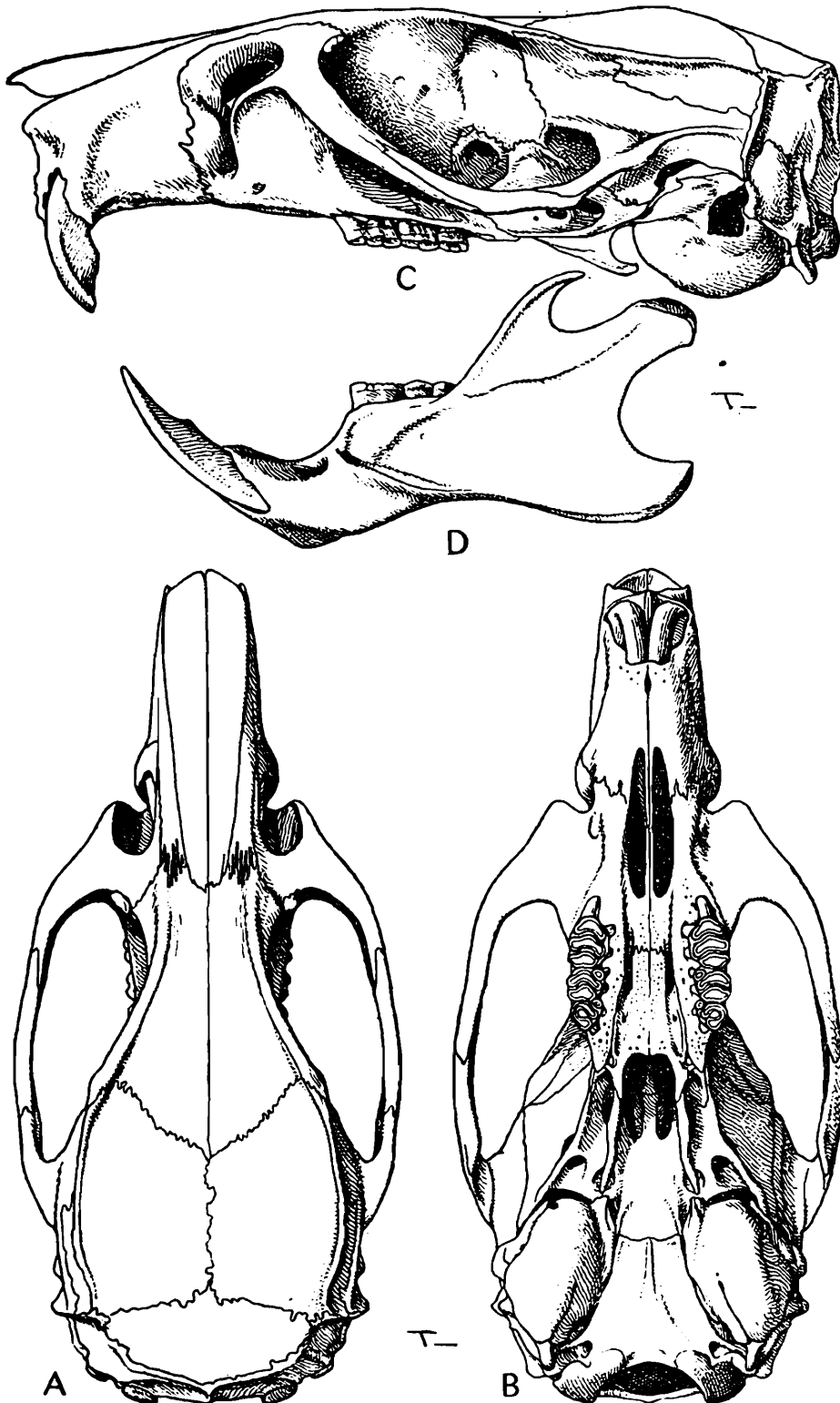
		Head and body	Tail	Hind- foot	Ear
<i>Rattus rattus</i> ? <i>alexandrinus</i> (concl'd.)					
F.	19.11.7.74 Pasri, Baluchistan	156	210	34	24
F.	17.10.2.4 Jacobabad (white-bellied)	154	195	35	21

Some other skins from Chahabar, Persian Gulf.

<i>Rattus rattus rattus</i>					
M.	12.11.28.104 Gersoppa, Kanara	160	192	34	22
	9.4.25.2 Bombay	?	?	34	20

Some time ago I worked out percentages for various characters for all wild Asiatic races of this species, in the London collection (about 33 in number). In these, the palate averaged 51–55% of the occipitonasal in the various races, but only once (*girensis*, an Indian form) as low as 51% and very rarely as high as 55%. The palatal foramina varied in these figures between 17 and 19% of the occipitonasal, with the exception of one Siamese island race, *R. r. poenitentiari*, which seems to have them about 21% on average, and the bullae in races with a moderately representative number of skulls varied between 16 and 18% of the occipitonasal as a rule, though occasionally they can be as low as 15% (or individually, rarely, even lower) and as high as 19%.

There are well-marked supraorbital ridges on the skull of this species, covering the frontals and tending to extend on to the parietals. The braincase is normally rounded and not narrowed (compare *Rattus norvegicus*). The nasals are proportionately shorter than those of *Rattus nitidus*. The interparietal as a rule is large and well developed. As indicated above, the bullae are large and well inflated. The pterygoid fossae are moderately deep. Palate long, as indicated in percentage figures given above, and usually extending well behind last molars. The palatal foramina are long, reaching about tooththrows. The zygomatic plate is quite well cut back above. Lower jaw with well-ridged lower border and well-developed coronoid process.



TEXT-FIG. 36. *Rattus rattus rattus* (Linnaeus), ♂. A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. ($\times 2\frac{1}{2}$). (After Ellerman, 1941, pp. 152, 153.)

Dental characters.—Upper incisors of medium width, normally plain, and yellow or red in colour. Molars moderately cuspidate. M. 3 is smaller than M. 2 but not very strongly reduced. M. 1 is 5-rooted normally. M. 1 has three cusps on the front lamina, three on the second, and two on the third. M. 2 has typically only the anterointernal cusp remaining of the original front lamina; its second and third laminae are like those of M. 1. M. 3 is fairly similar to M. 2, but smaller. Very occasionally M. 2 may have a small anteroexternal cusp traceable, but it is unusual apparently. First lower molar with three laminae, second and third lower molars each with two. These laminae originally each bear two cusps, except the last in M. 3 which is single. A well-marked terminal heel at the back in the centre of M. 1 and M. 2. Sometimes traces of a small extra third outer row of cusps present.

Cranial measurements.—As in Table 66, below.

TABLE 66.—*Cranial measurements of the Indian races of Rattus rattus*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus kandianus</i>								
F.	15.3.1.202 Kumbukkan, Ceylon	36.4	18.6	8.6	6.9	6.1	5.8	13.2
F.	15.3.1.189 Colombo, Ceylon	38.9	19.9	9.7	7.0	6.7	5.7	14.0
M.	15.3.1.190 Colombo, Ceylon	41.9	21.4	10.6	8.0	6.7	6.2	14.7
M.	15.3.1.191 Colombo. Old	46.7	24.3	12.1	9.0	6.6	6.9	18.4
F.	15.3.1.193 Udugama, Ceylon	42.5	22.6	10.5	7.6	6.3	6.6	16.1
M.	15.3.1.199 Wellawaya, Ceylon	39.6	20.7	9.6	7.4	6.9	6.3	13.6
F.	15.3.1.203 Kumbukkan, Ceylon	36.7	19.0	8.2	6.9	6.0	6.1	12.7
F.	15.3.1.204 Kumbukkan	38.3	19.8	9.5	7.3	6.4	5.8	14.4
M.	15.3.1.205 Maha-oya, Ceylon. 5 roots M. 1	42.8	22.2	11.0 <i>circa</i>	8.7	7.2	6.0 <i>circa</i>	14.9
F.	15.3.1.208 Maha-oya	39.4	20.4	9.8	7.7	6.6	5.9	14.4
F.	15.3.1.209 Mankeni, Ceylon	40.2	20.8	9.7	8.4	6.7	6.0	15.0
M.	15.3.1.210 Valaichenai, Ceylon	39.6	20.9	10.2	7.8	6.1	5.8	14.6

TABLE 66.—*Cranial measurements of Rattus rattus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus kandianus</i> (concl'd.)								
M.	15.3.1.213 Urugalla, Ceylon	39.6	20.8	10.0	7.5	6.3	6.3	14.8
M.	20.9.26.50 .. Anasigalla, Ceylon	40.3	21.2	10.1	7.7	6.4 <i>circa</i>	6.3	14.7 <i>circa</i>
M.	20.9.26.51 Anasigalla	40.9	20.9	?	7.7	6.7	6.1	14.9
<i>Rattus rattus kelaarti</i>								
M.	15.3.1.217 Pattipola, Ceylon	39.3	21.1	9.5	7.4	6.4	6.4	14.2
F.	15.3.1.218 Pattipola	39.4	21.1	10.4	7.8	6.4	6.1	13.8
F.	15.3.1.221 Pattipola	39.2	20.3	9.4	7.4	6.4	6.4	13.5
	15.3.1.223 .. Ambawela, Ceylon. Old	40.2	20.7	9.9	7.4	6.4	6.1	15.0
M.	35.10.6.4 West Haputale, Ceylon	37.9	19.4	8.5	6.5	6.5	6.0	?
The type has the occipitonasal length about 41.5 mm.								
<i>Rattus rattus bhotia</i>								
M.	17.7.2.17 Hasimara, Bhutan Duars	40.5	21.4	9.8	8.2	7.1	7.1	14.4
M.	17.7.2.18 Hasimara	40.8	21.7	10.5	7.6	7.4	6.6	15.2
M.	17.7.2.19 Hasimara. Foramina measurement = longer side	40.1	21.3	9.6	7.3	7.1	6.9	14.9
M.	17.7.2.20 Hasimara, type	40.5	21.8	10.2	7.7	7.2	7.2	14.5
M.	17.7.2.22 Bhutan Duars. Old; teeth worn out	39.2	21.1	9.7	7.4	6.9	(6.5)	13.9
M.	17.7.2.23 Hasimara	36.9	20.2	9.3	7.0	6.7	6.5	13.7
M.	17.7.2.25 Bhutan Duars	39.2	21.1	10.1	7.9	7.2	6.7	14.5
M.	17.7.2.26 Bhutan Duars. Old. Foramina measurement = longer side	42.0	22.7	10.6	8.1	7.3	6.9	16.6
M.	17.7.2.27 Bhutan Duars	44.1	24.3	11.5	8.2	6.7	7.4	16.8
F.	17.7.2.28 Hasimara. Rather young	38.9	20.3	9.3	6.9	6.6	6.4	14.1
F.	17.7.2.29 Hasimara. Rather young. M. 1 5-rooted	37.8	20.1	9.5 <i>circa</i>	7.1	7.0	5.9 <i>circa</i>	12.3
F.	17.7.2.30 Bhutan Duars	39.2	21.2	10.0	7.7	7.1	6.7	14.4
M.	17.7.2.31 Hasimara	40.7	21.8	10.1	7.1	7.0	7.0	14.3

TABLE 66.—Cranial measurements of *Rattus rattus* (contd.)

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus arboreus</i>								
M.	22.5.16.40 Hazaria, Nepal	40.8	21.3	10.3	7.6	7.6	6.9	14.5
M.	15.4.3.93 Singar, Gaya, Bihar and Orissa	41.6	22.3	10.5	7.6	7.4	6.5	14.6
F.	15.4.3.96 Hazaribagh	41.2	21.9	10.1	7.9	7.1	6.6	14.8
	9.4.25.4 Cawnpore	41.2	22.2	10.5	7.8	7.3 <i>circa</i>	6.3	14.7
F.	15.4.3.97 Gajhundi, Hazaribagh	39.3	20.7	9.7	7.8	7.4	6.4	13.6
M.	15.4.3.98 Daltongunj	40.5	21.5	10.2	7.6	7.3	6.5	14.3
F.	15.4.3.92 Singar, Gaya	41.2	21.7	10.4	7.5	7.2	6.7	14.4
F.	15.4.3.99 Daltongunj	41.0	21.9	10.4	7.4	7.2	?	14.4
M.	15.4.3.91 Singar, Gaya	42.3	22.8	10.9	8.0	7.8	6.7	15.2
M.	15.4.3.88 Hazaribagh.	40.9	22.4	11.0	8.3	7.7	6.6	14.8
M.	15.4.3.95 Gajhundi	41.1	21.6	9.9	7.8	7.5	6.7	14.1
M.	15.4.3.87 Hazaribagh. Old	41.9	22.7	11.2 <i>circa</i>	8.0	7.4	6.3 <i>circa</i>	15.1
<i>Rattus rattus wroughtoni</i>								
F.	12.11.28.115 Gersoppa, Kanara	42.6	22.3	11.0	7.5	7.4	6.4	15.4
M.	12.11.28.113 Kardibetta Forest, Mysore	42.0	21.7	10.3	8.1	7.0	6.5	14.8
F.	12.11.28.114 Kardibetta Forest	42.0	21.8	10.2	7.4	7.5	6.5	15.0
M.	13.4.11.91 Kolar, Mysore	42.4	22.6	10.7	8.3	7.2	6.1	14.9
M.	13.4.11.89 Kolar	39.2	?	9.5 <i>circa</i>	7.0	6.8	5.9	13.1
F.	13.4.11.92 Kolar	40.2	21.6	10.3	7.6	6.8 <i>circa</i>	6.4	14.2
F.	13.8.22.73 Wotekolli, Coorg	45.4	24.8	12.3	8.5	6.8	7.3	16.8
M.	13.4.11.90 Kolar, Mysore.	37.9	19.8	9.4	7.4	6.5	5.9	12.5
M.	13.4.11.84 Bangalore, Mysore	37.6	19.6	8.8	7.1	6.4	5.9	12.9

TABLE 66.—*Cranial measurements of Rattus rattus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus wroughtoni</i> (concl'd.)								
F.	13.11.11.97 ..	40.5	21.4	10.2	7.5	7.4	5.9	14.3
	Seringapatam, Mysore							
M.	13.8.22.72	40.5	21.7	10.5	7.5	7.2	6.3	15.5
	Haleri, Coorg							
F.	12.11.28.116	38.6	?	?	6.8	6.4	6.0	13.2
	Gersoppa, Kanara							
M.	98.3.5.22 ..	41.9	22.3	10.5	7.5	7.3	6.2	15.7
	Coonoor, Nilgiris							
M.	98.3.5.23	39.2	19.9	9.7	7.4	6.4	6.1	13.5
	Coonoor							
M.	12.6.29.99 .	38.9	20.3	9.4	6.9	6.8	6.4	13.6
	Dharwar district							
F.	12.6.29.101 .	36.4	17.7	7.8	6.4	6.5	6.4	12.2
	Dharwar district. Young							
M.	12.6.29.102	39.7	21.0	10.2	6.5	7.0	6.3	14.3
	Dharwar district							
M.	19.6.2.49 ..	43.8	23.1	11.3	8.2	6.6	6.8	16.1
	Ootacamund, Nilgiri Hills. Old							
F.	19.6.2.50	44.7	23.8	11.4	7.9	6.6	6.9	17.1
	Coonoor							
F.	19.6.2.51 ..	41.9	21.2	10.2	7.7	6.4	6.4	15.1
	Kotagiri, Nilgiri Hills							
M.	21.11.5.33 ..	40.2	21.0	10.0	7.3	7.1	(5.7)	14.9
	Seetragund, Malabar. Old; teeth worn out							
	21.11.5.34	45.7	24.8	12.4	9.0	6.8	7.2	17.8
				<i>circa</i>			<i>circa</i>	
	Seetragund. M. 1 is 5-rooted							
M.	21.11.5.35 ..	39.7	20.1	9.8	7.7	6.6	6.1	14.0
	Shernelly, Cochin							
M.	21.11.5.39	41.5	21.4	10.4	7.8	7.1	5.9	14.3
	Kotengady Estate, Cochin						<i>circa</i>	
M.	21.11.5.40	41.3	21.5	10.2	7.7	7.1	6.4	15.0
	Kotengady Estate							
F.	21.11.5.41	39.5	20.4	9.5	6.8	6.6	6.2	13.8
	Kotengady Estate							
M.	25.10.1.42 .	44.9	23.2	11.2	7.9	7.0	6.9	17.2
	Shambalgamur, Palni Hills							

The type has the occipitonasal about 41.1 mm.

Rattus rattus macmillani

M.	15.5.5.250	39.0	21.2	9.9	7.5	6.6	5.8	13.9
	Hkamti, Burma							
	15.5.5.226 .	40.5	21.8	10.4	7.4	6.3	6.8	14.6
M.	Hkamti, type							

TABLE 66.—Cranial measurements of *Rattus rattus* (contd.)

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus brunneus</i>								
F.	22.5.16.65	46.8	25.3	12.2	8.5	7.9	7.4	17.8
				<i>circa</i>			<i>circa</i>	
	Ferping, Nepal.	M. 1	5-rooted					
M.	22.5.16.54	45.7	24.7	12.4	8.7	7.1	7.2	17.6
				<i>circa</i>			<i>circa</i>	
	Sipuri, Nepal.	M. 1	5-rooted					
M.	22.5.16.60	46.5	24.9	12.0	8.2	7.3	7.2	17.0
	Changoo, Nepal							
F.	22.5.16.61	42.1	22.3	10.2	7.6	7.5	7.1	14.9
	Changoo							
F.	22.5.16.63	43.8	22.9	10.7	8.2	7.0	6.6	14.5
				<i>circa</i>		<i>circa</i>	<i>circa</i>	
	Hathibun, Nepal.	M. 1	5-rooted					
F.	22.5.16.64	44.9	24.5	12.2	8.0	7.7	6.7	16.4
				<i>circa</i>			<i>circa</i>	
	Hathibun.	M. 1	5-rooted					
	21.1.5.33	45.9	24.4	11.9	8.9	7.5	7.6	16.7
	Katmandu, Nepal							

The type has the occipitonasal length about 45.6 mm. A specimen of *brunneus*, No. 22.5.16.62, has a 4-rooted M. 1.

<i>Rattus rattus tikos</i>								
M.	14.12.8.183	40.8	21.6	10.4	8.4	7.1	6.7	15.3
	Victoria Island, Tenasserim.			5 roots	M. 1			
M.	14.12.8.182	42.3	23.4	10.8	7.3	6.9	7.1	15.4
	Victoria Island							
F.	14.12.8.166	40.8	21.3	9.7	7.8	?	6.9	13.8
	Bankachon, Tenasserim							
M.	14.12.8.170	41.6	22.3	10.8	7.3	7.6	6.7	14.9
	Thaget, Tenasserim							
F.	14.12.8.179	41.3	22.1	10.7	7.5	8.0	7.0	14.8
	Victoria Point, Tenasserim							
M.	14.12.8.176	39.6	20.7	9.5	7.3	7.0	7.0	13.9
	Victoria Point							
F.	14.12.8.185	41.1	22.3	10.7	8.2	7.2	6.5	15.4
	Victoria Island							
M.	14.12.8.167	44.3	24.1	10.2	8.5	8.0	7.2	15.8
	Tenasserim Town							
M.	14.12.8.175	41.8	22.6	11.1	8.2	7.5	6.6	15.9
	Victoria Point							
F.	14.12.8.171	40.0	21.4	10.1	7.8	7.3	6.4	14.5
	Thaget, Tenasserim							

The type has the occipitonasal about 42.5 mm.

TABLE 66.—*Cranial measurements of Rattus rattus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus gangutrianus</i>								
F.	14.7.10.114 . Khati, Kumaon	38.9	20.0	9.4	7.4	6.9	6.3	14.3
M.	14.7.10.111 Khati	40.6	20.6	10.2	7.8	6.7	6.5	14.8
M.	14.7.10.126 .. Ranibagh, Naini Tal, Kumaon	44.4	23.5	10.9	8.4	7.4	7.3	16.4
M.	14.7.10.133 Sitabani, Ramnagar, Kumaon.	45.4	23.9	11.4	8.3	8.0	7.3	16.9
F.	14.7.10.115 Khati	42.2	21.8	10.4	8.2	7.2	6.9	16.6
F.	14.7.10.112 Khati	40.7	21.0	9.8	7.3	6.9	6.2	15.1
M.	14.7.10.117 Ramnagar	40.6	21.2	10.1	7.3	7.5	6.7	14.1
M.	14.7.10.129 Ratighat, Kumaon	41.3	22.2	10.0	8.3	7.1	6.9	15.0
M.	14.7.10.130 Ratighat, Kumaon	40.8	21.4	10.2	7.4	7.3	6.6	14.8
F.	14.7.10.134 Sitabani, Ramnagar, Kumaon	40.7	22.0	10.4	7.8	7.6	7.1	14.7
F.	14.7.10.118 Ramnagar	40.6	20.9	10.2	7.7	7.0	6.4	14.3
F.	14.7.10.113 Khati	41.6	21.5	10.3	7.8	7.4	6.7	15.7
M.	14.7.10.120 Lohaghat, Kumaon	38.6	21.1	10.3	7.6	6.8	6.5	14.3
F.	14.7.10.122 Lohaghat, Kumaon	40.3	21.2	9.8	7.4	6.7	6.5	14.6
F.	14.7.10.125 Takula, Kumaon	41.5	22.3	10.5	7.9	6.9	6.8	14.6

The type has the occipitonasal about 45.3 mm.

<i>Rattus rattus satarae</i>								
F.	15.7.3.57 .. Ghatmatha, Satara district	42.6	22.9	11.0	7.8	7.3	6.9	15.2
M.	15.7.3.55 Ghatmatha	43.0	23.0	11.3	8.7	7.0	6.5	15.5
F.	15.7.3.56 . Helwak, Satara district.	42.4	22.7	10.8	8.0	6.3	6.9	15.3
F.	15.7.3.58 . Helwak, Satara district	42.6	22.6	10.6	7.9	6.9	6.9	14.8

<i>Rattus rattus ? andamanensis</i>								
	6.7.2.3 . Narcondam, Andaman Islands.	44.2	24.2	11.6	8.7	7.5	?	15.5
	Co-type, 81.11.10.2 .. Andaman Islands	45.6	24.9	12.1	8.9	7.6	7.1	16.4
								<i>circa</i>

TABLE 66.—Cranial measurements of *Rattus rattus* (contd.)

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus khyensis</i> (' <i>tatkonensis</i> ')								
F.	14.7.19.164 .. Kyauknyaung, Burma	43.3	23.9	10.8	8.3	7.8	7.4	15.7
F.	14.7.19.166 Mingun, Burma	42.0	22.4	10.4	7.9	7.9	6.8	15.3
M.	14.7.19.167 Mingun	43.1	22.9	10.4	7.1	7.8	7.1	16.1
F.	14.7.19.169 Mingun. Old	41.5	22.2	10.1	7.2	7.4	6.7	14.5
F.	14.7.19.170 Mingun	40.3	21.0	9.6	6.9	7.2	6.9	13.6
M.	14.7.19.168 Mingun. Old	43.0	23.6	11.4	8.1	7.7	7.0	15.5
M.	15.5.5.225 Tatkon, Burma	39.3	20.8	9.1	7.0	7.3	6.9	14.2
M.	14.7.8.37 Hsipaw, Burma	43.4	22.4	10.7	7.5	7.2	6.6	15.0
F.	15.5.5.227 Tatkon	41.5	21.8	10.1	7.6	6.7	6.6	15.0

The type of '*tatkonensis*' has the occipitonasal about 42.5 mm.

<i>Rattus rattus khyensis</i>								
F.	14.7.19.163 . Mount Poppa, Burma	38.9	20.9	9.1	7.6	7.6	7.0	13.7
M.	14.7.19.159 Mount Poppa	40.2	21.8	10.1	8.2	7.9	6.4	14.2
M.	14.7.19.160 Mount Poppa	40.4	22.1	10.3	7.6	7.2	6.6	14.5
F.	14.7.19.161 Mount Poppa	38.9	20.5	8.7	7.1	6.9	6.8	13.4
M.	14.7.8.38 Gokteik, Burma	40.2	21.8	9.7	7.3	7.2	6.9	14.3
M.	14.7.8.39 . Pyaunggaung, Burma. The foramina measurement = longer side	45.0	24.1	11.5	8.5	7.6	7.2	16.2
F.	15.5.5.228 Kin, Burma	43.6	23.0	10.3	7.3	7.1	7.2	16.7
M.	14.7.8.41 Pyaunggaung	42.2	21.8	10.1	8.0	7.3	6.9	15.3
F.	14.7.8.42 Pyaunggaung	43.0	23.1	11.1	8.0	7.0	6.8	15.6
F.	14.7.8.44 Pyaunggaung. The foramina measurement = longer side	38.3	20.9	9.3	6.9	7.3 <i>circa</i>	6.8	13.8
M.	16.3.26.55 Kindat, Burma	39.1	20.3	9.0	7.0	7.3	7.2	14.1
F.	16.3.26.56 . Kindat	41.3	22.4	10.2	7.7	7.2	6.6 <i>circa</i>	14.4

TABLE 66.—*Cranial measurements of Rattus rattus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus narbadae</i>								
M.	12.11.29.129 Hoshangabad	38.7	20.6	9.7	6.9	6.9	6.1	13.9
M.	12.11.29.130 Hoshangabad	39.5	20.2	8.4	6.7	6.9	6.4	13.3
M.	12.11.29.135 Chanda	39.7	20.4	9.8	7.5	7.3	6.1	13.8
F.	12.11.29.134 Hoshangabad.	40.5	20.9	9.9	7.8	7.2	6.6	14.3
F.	12.11.29.138 Chanda	39.9	21.0	10.0	7.4	7.1	6.3	14.3
F.	12.11.29.137 Chanda	40.8	21.0	10.1	7.3	7.5	6.3	14.6
F.	12.11.29.136 Chanda	40.1	20.9	10.0	7.2	7.6	5.8	14.0
M.	12.11.29.131 Hoshangabad	40.4	20.7	10.0	7.0	7.1	5.9	14.3
F.	12.11.29.133 Hoshangabad	38.0	19.9	8.5	6.6	6.8	6.0	13.6

The type has the occipitonasal about 41.3 mm.

Rattus rattus narbadae ('girensis')

M.	17.7.2.1	37.5	18.9	9.4 <i>circa</i>	6.8	6.2	5.6 <i>circa</i>	13.1
	Sasan, Kathiawar.	5 roots	M. 1					
M.	17.7.2.2	39.0	19.7	9.2	6.9	7.1	6.1	13.4
	Sasan							
M.	17.7.2.3	38.4	20.0	9.9	7.1	6.5	6.2	14.1
	Sasan							
F.	17.7.2.5	38.7	19.2	9.1	6.9	7.2	6.2	14.3
	Sasan							
F.	17.7.2.6	38.9	20.0	9.8	7.1	6.7	6.1	14.2
	Sasan							
M.	13.8.8.123	39.8	20.7	9.7	7.3	7.0	6.4	14.1
	Sasan, Kathiawar							
M.	13.8.8.122	39.5	20.6	9.7	7.7	6.9	6.2	14.5
	Sasan							

The type has the occipitonasal length about 41.0 mm., the palate length about 21.9 mm.

Rattus rattus rufescens

F.	12.6.28.32	39.3	20.5	10.2	7.5	7.3	6.1	13.8
	Asirgarh, Nimar							
F.	12.6.28.33	40.4	21.0	9.9	7.4	7.1	6.3	14.5
	Asirgarh							

TABLE 66.—*Cranial measurements of Rattus rattus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus rufescens (contd.)</i>								
M.	12.6.29.93 Dharwar district	41.8	22.0	10.5	7.8	7.3	6.1	14.6
F.	12.6.29.96 Dharwar district. Old	38.4	20.2	9.9	7.5	6.9	5.7	14.0
M.	12.11.28.105 Gersoppa, Kanara	44.1	22.8	10.6	7.6	7.3	6.4	16.0
M.	12.10.4.66 Bhuj, Cutch	40.3	20.4	9.7	7.5	7.4	6.5	14.4
F.	12.3.8.10 Hariseh, Berars	39.0	20.1	9.2	7.0	7.3	6.1	14.0
M.	12.3.8.9 Pili, Sipna Valley, Berars	39.3	20.4	9.5	7.3	7.1	6.7	13.3
M.	12.10.4.67 Bhuj, Cutch	40.6	20.7	9.7	7.4	7.3	6.4	15.1
M.	12.10.4.68 Bhuj	40.1	20.8	9.5	7.2	7.2	6.5	14.6
F.	12.10.4.69 Bhuj	40.3	21.1	10.1	7.5	7.6	6.4	14.0
F.	12.10.4.70 Bhuj	38.9	20.6	9.8	7.6	7.3	6.2	13.7
F.	12.10.4.71 Bhuj	41.2	21.7	10.2	8.0	7.3	6.5	14.6
F.	13.4.11.94 Mysore, Kolar	39.1	?	9.6	7.2	6.7	5.8	13.7
F.	13.4.11.96 Seringapatam, Mysore	39.1	19.8	9.3	7.0	6.9	6.2	13.6
F.	13.4.11.88 Bangalore, Mysore	40.9	21.0	10.1	7.2	6.9	6.1	14.8
M.	13.9.18.66 Palanpur, Gujerat	43.0	22.8	11.2	8.1	7.7	6.2	15.4
M.	12.6.28.31 Asirgarh, Nimar	39.5	19.8	9.6	6.8	7.0	6.1	13.3
F.	14.7.10.109 Pilibhit, Rohilkund, Kumaon.	42.3	22.7	11.1	7.9	7.4	6.5	14.9
F.	14.7.10.110 Pilibhit, Rohilkund	41.6	22.2	10.7	7.5	7.5	6.8	14.6
F.	14.7.10.101 Ramnagar, Kumaon	41.4	21.5	10.5	7.6	6.4	6.4	14.5
M.	13.4.11.83 Bangalore, Mysore	40.4	21.0	10.5	7.3	7.2	5.7	14.6
F.	14.7.10.99 Ramnagar, Kumaon	38.4	19.5	9.5	7.0	6.5	6.4	13.4
F.	14.7.10.108 Pilibhit, Rohilkund	40.6	21.5	10.3	7.4	7.3	6.0	15.1
F.	15.7.2.18 Gwalior, Central India	40.5	21.2	10.1	6.9	7.9	6.0	14.5

TABLE 66.—*Cranial measurements of Rattus rattus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus rufescens (contd.)</i>								
F.	15.7.3.53 .	42.4	21.7	10.8	7.4	7.7	6.2	15.5
	Helwak, Satara district							
	13.9.18.69	40.0	21.1	10.1	7.6	6.9	6.3	14.5
	Palanpur, Gujerat							
M.	15.7.3.51 .	41.2	21.2	10.3	7.5	7.1	6.3	14.5
	Helwak, Satara district							
F.	15.7.2.17	37.6	19.7	9.1	6.9	6.9	6.3	13.4
	Gwalior							
M.	15.7.2.16	41.2	22.6	11.1	7.6	7.0	6.2	14.8
	Gwalior. Old							
M.	15.7.2.15	40.9	21.7	10.6	8.2	7.5	6.3	15.2
	Gwalior							
M.	15.7.3.54	39.2	20.2	9.5	7.3	7.0	6.0	13.2
	Helwak, Satara							
M.	98.3.5.24 ..	38.2	20.1	9.6	6.7	6.4	5.9	13.7
	Coonoor, Nilgiris							
M.	8.1.22.12 ..	39.1	20.4	9.4	7.3	7.1	6.5	13.4
	Umankot, Sind							
F.	5.4.2.8 .	38.1	20.3	9.8	7.0	6.9	5.7	13.3
	Rawalpindi, Punjab							
F.	5.4.2.9	37.0	19.4	9.2	7.1	6.5	6.0	12.6
	Rawalpindi							
M.	12.11.29.124	42.3	22.6	11.0	7.7	7.3	6.4	15.1
	Hoshangabad					<i>circa</i>		
F.	13.8.8.117 .	40.1	21.0	10.0	8.0	7.5	5.9	14.3
	Keshod, Kathiawar							
F.	12.8.8.118	42.5	22.4	10.7	7.2	7.4	6.6	15.5
	Gersoppa, Kanara							
F.	13.8.8.118 .	38.4	20.3	9.4	7.4	6.9	6.2	13.5
	Keshod, Kathiawar							
M.	13.4.11.86 .	38.9	20.0	9.9	7.4	6.5	5.5	14.2
	Bangalore, Mysore							
F.	12.11.29.115 ..	39.8	21.1	9.9	7.7	7.2	6.5	14.2
	Sonawahnee, Balaghat							
M.	12.11.29.114 ..	40.4	21.0	9.9	7.5	7.4	6.6	13.6
	Sonawahnee, Balaghat							
M.	5.4.2.7 .	39.4	21.3	10.1	7.3	6.8	6.2	13.5
	Rawalpindi, Punjab							
M.	13.8.8.121 ..	39.6	20.6	9.8	7.7	6.7	6.0	13.9
	Junagadh, Kathiawar							
M.	12.11.29.116 ..	38.9	20.3	9.3	7.1	6.9	6.2	14.1
	Sonawahnee, Balaghat							
M.	12.11.29.118	39.4	20.7	9.6	7.1	7.2	6.5	13.2
	Chanda							
F.	12.11.29.127 .	38.1	19.3	8.9	6.8	7.4	5.9	13.4
	Hoshangabad							
	12.6.28.30	38.1	19.3	8.9	6.9	6.8	6.5	13.0
	Asirgarh, Nimar							

TABLE 66.—Cranial measurements of *Rattus rattus* (contd.)

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus rufescens</i> (concl'd.)								
M.	12.11.29.113 Balaghat	40.9	21.3	10.2	7.9	7.3	6.5	14.4
F.	12.11.29.119 Chanda	40.5	21.1	10.0	7.6	6.9	6.2	14.7
F.	13.8.8.120 Rajkot, Kathiawar	38.5	20.4	9.8	7.3	7.0	6.3	14.1
M.	13.8.8.116 Keshod, Junagadh, Kathiawar	40.2	20.4	9.4	7.2	7.0	6.1	14.0
M.	13.8.8.119 Rajkot, Kathiawar	39.1	20.3	9.9	7.1	7.0	5.9	13.8
M.	13.4.11.85 Bangalore, Mysore	40.4	21.0	10.0	7.9	6.8	6.2	14.6
F.	12.11.29.126 Hoshangabad	42.0	22.3	11.0	8.2	7.3	6.4	15.6
M.	12.11.29.123 Hoshangabad	41.1	21.8	10.3	8.0	7.1	6.4	14.7
F.	12.6.29.98 Dharwar district	38.6	20.3	9.3	7.1	7.1	6.1	14.2
F.	12.6.29.97 Dharwar district	38.6	19.7	9.4	7.1	6.9	5.7	13.2
M.	12.11.29.117 Chanda	40.5	21.1	9.5	7.0	7.2	6.2	14.2
Frost collections—								
F.	28. Panoaqil, Sind. Old	41.7	22.3	11.4	7.6	7.4	5.9	14.7
F.	41. Panoaqil	39.1	21.1	10.8	7.7	7.0	5.5	14.4
F.	42. Panoaqil	40.0	21.3	10.1	7.3	7.1	6.1	15.0
F.	58. Panoaqil	40.1	21.0	10.5	7.5	7.4	5.9	13.7
F.	71. Panoaqil	36.7	18.9	9.0	7.0	6.8	5.5	13.1
<i>Rattus rattus alexandrinus</i>								
(As identified by Mr. Hinton)								
M.	15.11.1.110 Jacobabad, Sind	39.0	20.8	9.5	7.5	6.6	6.2	13.4
F.	8.1.22.9 Jacobabad. Old	41.5	22.5	10.9	7.9	7.0	5.7	14.8
F.	15.11.1.112 Kashmor, Sind	39.7	21.4	9.7	7.4	7.0	6.5	13.5
F.	15.11.1.113 Kashmor	38.9	20.2	9.2	7.5	6.5	6.1	13.0
M.	8.1.22.11 Sukkur, Sind	41.5	22.0	10.5	7.3	7.0	6.3	15.3
F.	15.11.1.114 Jacobabad	37.3	19.7	8.7	6.9	6.6	6.2	12.9

TABLE 66.—*Cranial measurements of Rattus rattus (contd.)*

		Oecipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus alexandrinus</i> (concl'd.)								
M.	15.11.1.115 Gambat, Sind	40.1	20.7	9.6	7.0	7.4	6.2	13.8
F.	19.11.7.74 Pasni, Baluchistan	41.8	21.6	10.3	8.1	7.5	6.2	15.1
F.	19.11.7.75 Pasni, Baluchistan	44.2	22.9	11.2	8.4	7.8	6.5	16.1
M.	19.11.7.73 Pasni, Baluchistan	39.3	20.1	9.3	6.8	7.4	6.2	13.7
<i>Rattus rattus ceylonus</i> ('nemoralis')								
F.	15.3.1.174 Colombo, Ceylon	40.3	21.0	9.9	6.4	6.5	6.0	14.6
F.	15.3.1.184 Kandy, Ceylon	40.2	21.2	10.5	7.4	6.9	6.2	14.9
F.	15.3.1.183 Kandy	38.2	19.4	9.0	6.9	6.6	6.2	13.5
F.	15.3.1.180 Mannar, Ceylon	40.2	21.3	10.2	7.5	7.1	6.0	14.1
M.	15.3.1.178 .. Colombo, Ceylon	43.8	23.5	11.7	7.8	7.4	6.1	15.8
F.	15.3.1.181 Colombo	40.4	20.8	10.1	7.4	6.9	6.1	14.4
M.	15.3.1.175 Hambantota, Ceylon	42.8	22.3	10.7	8.2	6.8	6.1	15.7
M.	15.3.1.182 Kandy	39.4	20.4	9.6	7.3	6.8	6.1	14.1
<i>Rattus rattus brunneusculus</i> ('sikkimensis')								
F.	17.7.2.16 Pashok	38.5	20.5	9.1	7.0	6.5	6.9	13.5
M.	17.7.2.33 .. Gopaldhara, Sikkim	43.7	23.6	11.3	8.2	7.0	7.3	16.6
M.	17.7.2.37 Pashok	42.8	23.7	11.0	8.2	7.1	7.4	15.9
M.	17.7.2.38 Pashok	43.8	23.9	11.2	8.3	6.7	7.5	16.4
	17.7.2.39 Pashok	45.4	24.8	12.0	8.5	7.2	7.6	16.9
F.	17.7.2.40 Gopaldhara	42.3	23.2	10.5	8.3	6.9	7.4	14.9
F.	17.7.2.42 .. Gopaldhara	40.5	21.9	10.4	7.7	6.9	6.9	14.2
F.	17.7.2.41 .. Gopaldhara	41.2	22.4	11.1	7.7	7.2	?	16.0

TABLE 66.—*Cranial measurements of Rattus rattus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus brunneusculus</i> (' <i>sikkimensis</i> ') (concl'd.)								
F.	17.7.2.43 Pashok, Sikkim	39.2	21.0	9.8	7.5	6.5	6.7	13.8
F.	17.7.2.44 Pashok. Old	41.7	23.4	11.4	8.2	6.6	6.9	15.6
F.	17.7.2.45 Gopaldhara	41.2	23.2	10.9	7.8	6.9	6.9	15.4
F.	17.7.2.47 Pashok	43.5	23.9	11.6	8.7	6.8	6.8	16.5
F.	17.7.2.48 Pashok. Old	43.5	22.9	11.2	8.2	7.2	7.1	15.5
M.	20.11.1.69 Tura, Garo Hills, Assam	41.6	22.6	10.4	8.1	6.9	7.2	15.8
M.	20.11.1.70 Tura	43.6	23.4	11.8	7.7	7.1	7.5	16.5
F.	20.11.1.71 Tura	42.1	23.0	10.6	7.6	7.0	7.1	15.4
F.	20.11.1.72 Durabanda, Garo Hills	43.2	23.3	11.2	7.6	7.4	7.1	16.1
M.	15.9.1.146 Ringin, Sikkim	39.4	21.7	9.9	7.1	6.7	7.4	14.9
M.	15.9.1.138 Rongli, Sikkim	44.7	24.1	11.4	8.4	6.8	7.4	16.4
F.	15.9.1.140 Gangtok, Sikkim	41.4	23.0	10.4	7.6	6.4	7.2	14.7
F.	15.9.1.145 Singhik, Sikkim	41.3	22.8	10.4	7.8	6.9	7.2	15.2
Frost collections—								
M.	201. Naga Hills	38.6	21.4	9.4	6.8	6.8	6.7	13.8
M.	247. Naga Hills	37.1	20.3	8.9	6.8	6.5	7.1	12.7
F.	417. Lake Loktak, Manipur	39.3	21.3	9.5	7.1	6.5	6.2	13.7
M.	419. Lake Loktak	38.1	19.6	8.8	6.8	6.5	6.8	12.5
M.	502. Kalimpong	40.8	23.0	10.5	7.5	6.8	7.1	15.5
Foramina measurement = shorter side								
F.	506. Kalimpong	37.5	20.3	9.0	6.8	6.4	7.0	14.0
F.	517. Chakung, Sikkim	39.3	21.1	9.8	7.3	6.7	6.6	15.2

The type of '*sikkimensis*' has the occipitonasal length about 44.3 mm.

Rattus rattus brunneusculus

F.	21.5.1.24 Pathebaghan, Nepal. Old	43.2	22.8	10.9	8.2	7.2	7.2	15.7
F.	21.1.5.26 Nagarcot, Nepal	38.7	21.8	10.0	7.3	6.7	6.9	13.9

TABLE 66.—*Cranial measurements of Rattus rattus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus brunneusculus</i> (concl'd.)								
M.	22.5.16.55 ..	42.8	22.9	10.7	7.8	6.6	7.2	15.4
	Chalna Khall, Nepal							
M.	22.5.16.57 ..	42.8	23.5	10.7	8.1	6.8	6.8	15.6
	Nagarcot, Nepal							
	22.5.16.56 .	41.2	21.6	10.0	7.6	6.4	7.1	15.0
	Bouzini, Nepal. M. 1	5-rooted		<i>circa</i>			<i>circa</i>	
M.	22.5.16.58 ..	38.5	20.7	9.6	7.5	6.4	7.0	13.5
	Nagarcot, Nepal. Rather young							
M.	22.5.16.59 .	38.3	20.2	9.6	7.0	6.5	6.3	13.4
	Kakan, Nepal. Rather young							
F.	21.5.1.28	43.6	22.8	10.5	8.0	7.4	7.5	15.8
	Sunachurn, Nepal					<i>circa</i>		

The type has the occipitonasal length about 38.7 mm. and is rather young.

Rattus rattus tistae

F.	15.9.1.144	39.4	20.7	9.3	6.7	7.4	6.6	13.8
	Sikkim							
F.	15.9.1.153 .	39.1	21.3	9.9	7.2	7.3	6.8	14.2
	Narbong, Darjeeling							
M.	15.9.1.137	39.5	21.3	9.9	6.9	6.4	?	14.0
	Rongli, Sikkim. M 1	5-rooted		<i>circa</i>				
F.	15.9.1.142	38.0	20.4	9.8	6.8	7.0	6.5	13.6
	Rongli							
M.	15.9.1.143 .	41.2	22.7	10.9	7.8	7.3	6.7	14.9
	Gangtok. Old							

Frost collections—

M.	350. Naga Hills	36.8	20.3	9.0	6.8	6.7	6.8	13.9
M.	351. Naga Hills	36.2	18.5	8.2	6.6	6.4	7.0	12.6
M.	356. Naga Hills	39.8	20.2	9.7	7.5	6.7	6.5	15.0
M.	357. Naga Hills	36.7	19.6	9.1	6.5	6.5	6.3	13.1
M.	213. Naga Hills	39.8	20.7	10.1	7.3	6.1	6.2	15.0
M.	214. Naga Hills	35.1	21.2	9.9	7.5	6.1	6.3	15.8
	215. Naga Hills	38.2	19.9	9.6	7.0	6.1	6.3	14.1
M.	222. Naga Hills	37.5	19.5	9.4	7.2	6.1	5.9	14.1
	376. Lake Lok-					<i>circa</i>		
	tak, Manipur	39.2	20.4	9.3	7.0	6.8	6.5	13.2
M.	514. Pashok,	40.8	22.4	10.5	6.9	7.0	7.0	14.5
	Sikkim. Foramina measurement = shorter side							
M.	17.7.2.8 .	41.5	22.5	10.6	7.9	6.9	6.9	15.0
	Pashok, Sikkim. Old							
M.	17.7.2.9	42.0	22.7	11.1	7.9	7.4	7.3	15.4
	Pashok							

TABLE 66.—Cranial measurements of *Rattus rattus* (concl'd.)

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattus tistae</i> (concl'd.)								
F.	17.7.2.10 Pashok	39.4	21.3	10.5	7.2	6.7	6.5	15.0
F.	17.7.2.12 Pashok. Old	39.7	21.2	10.2	6.9	6.7	6.2	14.9
M.	20.6.7.36 Digboi, Lakhimpur, Assam.	41.4	22.0	10.7	7.7	7.1	7.0	14.6
					Foramina measurement = shorter side			
M.	20.6.7.38 Sadiya, Assam	40.1	21.7	10.1	7.1	7.2	6.8	15.0
M.	20.6.7.39 Sadiya	39.9	21.5	10.0	7.4	6.9	7.0	14.8
M.	20.6.7.40 Sadiya	38.6	20.7	9.7	7.6	6.6	6.8	14.1
F.	20.7.6.41 Locality ?	39.0	20.8	10.2	7.0	6.7	6.5	14.5
F.	20.7.6.43 Margherita, Naga Hills, Assam	39.6	21.7	10.4	7.0	6.9	6.3	14.9
M.	20.11.1.73 Golohat, Assam	39.4	20.6	9.5	7.3	7.4	6.8	14.5
F.	20.11.1.74 Golohat	38.1	20.6	9.2	7.4	6.7	6.8	14.2
F.	20.11.1.76 Cherrapunji, Assam	40.0	21.1	10.1	7.5	7.1	6.4	14.1
M.	21.7.8.122 Angarakhata, Kamrup	41.8	22.2	10.2	7.8	7.3	6.9	14.5
F.	21.7.8.124 Angarakhata	40.5	21.2	10.2	7.8	7.1	6.7	15.0
M.	21.7.8.123 Angarakhata	39.9	22.2	?	7.7	7.2	7.2	14.1
M.	23.1.7.21 Dening, Mishmi	37.4	20.7	8.8	7.0	6.6	6.7	12.5
F.	20.6.7.37 Digboi, Lakhimpur	39.4	20.9	9.6	6.8	6.8	6.8	14.4

The type has the occipitonasal length about 38.6 mm.

*Approximate dimensions of Rattus rattus, in British Museum material (not including European commensal forms, nor specimens from outside Asia).—*The head and body varies between about 115 mm. (? immature) or 120 mm. and 222 mm. The tail between 115 mm. (? immature) and 283 mm., but rarely over 250 mm. Hindfoot 21–40 mm. The occipitonasal length varies between 36.2 mm. and 49.5 mm. (One skull in the Frost collection appears to be 35.1 mm., but I may have identified it wrongly.) Toothrow 5.5–7.9 mm.

*Provisional key to the better-known Indian subspecies of
Rattus rattus*

1	(22)	The underparts are in the majority of the specimens white, or dirty white, or lighter. (Exceptions, always fewer than light-bellied examples, most prevalent in the races <i>tikos</i> , <i>khyensis</i> , <i>wroughtoni</i> , and in a small degree <i>gangutrianus</i> .)	2
2	(3)	The tail usually exceeds 150% of the head and body length. (Tooth-row long, usually about 6.9 mm.)	1. <i>Rattus rattus satarae</i>
3	(2)	The tail averages less than 150% of the head and body length.	4
4	(11)	The toothrow usually does not exceed 6.6 mm. In individual exceptions, the toothrow is usually less than 16% of the occipitonasal length.	5
5	(10)	The tail is usually more than 130% of the head and body.	6
6	(7)	Length of the occipitonasal most often approximates to or exceeds 41 mm.	2. <i>Rattus rattus arboreus</i>
7	(6)	Length of the occipitonasal most often does not reach 41 mm.	8
8	(9)	The bullae are most often less than 17% of the occipitonasal length.	[anus 3. <i>Rattus rattus kandi-</i>
9	(8)	The bullae in the majority of specimens approximate to or exceed 17% of the occipitonasal length.	[dae (with 'girensis')
10	(5)	The tail is usually less than 130% of the head and body length.	4. <i>Rattus rattus narba-</i> [oni
11	(4)	The length of the toothrow is usually 6.6 mm. and more. In individual exceptions, the toothrow mostly exceeds 16% of the occipitonasal length.	5. <i>Rattus rattus wrought-</i>
12	(13)	The tail (sometimes shorter than head and body) is in the majority of specimens less than 110% of the head and body length.	12
13	(12)	The tail in the majority of specimens exceeds 110% of head and body length.	6. <i>Rattus rattus tikos</i>
14	(15)	The tail is usually less than 120% of the head and body length.	14 [(with 'tatkanensis')
15	(14)	The tail usually exceeds 120% of the head and body length.	7. <i>Rattus rattus khyensis</i>
16	(19)	Tail long, normally over 130% of the head and body length.	16
17	(18)	The bullae in adult skulls exceed 6.6 mm. in length. Dorsal coloration slightly lighter.	17
18	(17)	The bullae in adult skulls do not, in the scanty material available,	8. <i>Rattus rattus bhotia</i>

- exceed 6.6 mm. Dorsal coloration slightly darker.
- 19 (16) Tail moderate in length, usually less than 130% of the head and body.
- 20 (21) The bullae usually exceed 17% of the occipitonasal length.
- 21 (20) The bullae are usually less than 17% of the occipitonasal length
- 22 (1) The underparts in the majority of the specimens are dull or dark. (About a quarter of the available specimens of *tistae* (some perhaps wrongly identified) are exceptions, and individual exceptions occasionally occur in *brunneus* and *kelaarti*).
- 23 (26) The upper toothrow usually is 6.6 mm. in length, or more. In individual exceptions, the toothrow is usually more than 16% of the occipitonasal length.
- 24 (25) Occipitonasal length not less than 42 mm.
- 25 (24) Occipitonasal length normally not reaching 42 mm.
- 26 (23) The upper toothrow very rarely reaches 6.6 mm. in length.
- 27 (30) The tail apparently is mostly under 120% of head and body length.
- 28 (29) Fur thicker. Underparts on the average lighter. In most specimens examined, the bullae 6.4 mm. at highest.
- 29 (28) Fur shorter. Underparts average darker. In specimens examined, the bullae 6.5 mm. at lowest.
- 30 (27) The tail is apparently mostly more than 120% of the head and body length.
9. *Rattus rattus macmil-* [lani
20
[trianus
10. *Rattus rattus gangu-*
11. *Rattus rattus brun-*
neusculus (with 'sikkim-
ensis')
23
24
[neus
12. *Rattus rattus brun-*
13. *Rattus rattus tistae*
27
28
14. *Rattus rattus kelaarti*
15. *Rattus rattus ceylonus*
16. *Rattus rattus rufes-*
cens and *R. r. alexandri-*
nus (Indian specimens)

Hinton keys the last two races as follows :

- Dorsal colour rufous; hair of belly
rough with rusty tinge. *rufescens*
Dorsal colour rarely rufous, bellies
without rusty tinge. *alexandrinus*'

Personally, I can detect no constant colour difference between the small series from India labelled *alexandrinus* and the much larger series labelled *rufescens*. Owing to pressure of

other work, I have never been able to make a detailed study of the commensal races of the present species and I do not know whether it is possible to distinguish *rufescens* from *alexandrinus* which is the earlier name, on other characters.

I am not able to place *R. r. dentatus* (Hastings Island and other Islands, Mergui Archipelago) in the key because I have no skulls available. Owing to paucity of material I am unable to include *R. r. andamanensis* in the key.

Hinton has based his key to the Indian races of *Rattus rattus* apparently in a large part on mammary formula. I have found this to be so individually variable elsewhere and in this species that I prefer to offer another key to the races, which gives very similar results to Hinton's but is based on other characters. Hinton's key did not include the Nepalese forms *brunneus* and *brunneusculus*, which are two of the oldest names in the species.

(i) *Rattus rattus alexandrinus* (Desmarest)

1803. *Mus alexandrinus* Geoffroy, *Cat. Mamm. H.N. Paris*, 192.
(Unavailable, as this work was never published.)
1817. *Mus alexandrinus* Desmarest, *Nouv. Dict. Hist. nat.* (ed. 2),
29, 47. (Alexandria, Egypt.)
(1837. *Mus asiaticus* Gray, *Ann. Mag. nat. Hist.*, 1, 585. India.)
(1859. *Mus crassipes* Blyth, *J. Asiat. Soc. Beng.*, 28, 295. India.
(But perhaps a form of *Mus musculus*).)

Range.—Specimens referred to this race have been seen from BALUCHISTAN, Pasni, and SIND, Jacobabad, Kashmor, Gambat, Sukkur, Chakdulla, Campbellpore. Chahabar, Persian Gulf.

This is the first name, apparently, for the commensal house-rat of Europe and elsewhere when not in the 'dark above and below' colour phase of typical *R. r. rattus*. Perhaps Punjab specimens listed below as *rufescens* belong here.

The colour is typically less rufous than *rufescens* and the underparts are grey or dusky. The toothrow in Indian specimens I have measured is 6.5 mm. and less, usually less.

(ii) *Rattus rattus rufescens* (Gray)

1822. *Mus indicus* Desmarest, *Mamm.*, 2, 299. Not of Bechstein, 1800.
1837. *Mus rufescens* Gray, *Ann. Mag. nat. Hist.*, 1, 585.
1839. *Mus flavescens* Elliot, *Madras J. Litt. Sci.*, 10, 214. (Dharwar.)
1863. *Mus infralineatus* Blyth, *Cat. Mamm. As. Soc.*, 116, *nom. nud.*

Type-locality.—Dharwar.

Range.—Specimens have been examined from Asirgarh, NIMAR; DHARWAR district; Gersoppa, KANARA; Hariseh, BERARS; Bhuj, Cutch; Pili, Sipna Valley, BERARS; Kolar in MYSORE; Seringapatam, MYSORE; Bangalore, MYSORE; Palanpur, GUJERAT; Pilibhit, Rohilkund in KUMAON; Ramnagar, KUMAON; Gwalior, CENTRAL INDIA; Helwak, SATARA district; Coonoor in NILGIRI HILLS; Panoaqil in SIND (identification provisional); Umankot in SIND (perhaps the last two refer to *alexandrinus*); Rawalpindi, PUNJAB (possibly *alexandrinus*); Keshod, KATHIAWAR; Sonawahnee, BALAGHAT; Junagadh, KATHIAWAR; CHANDA (Chichpalli); Rajkot, KATHIAWAR; Ghatmatha, SATARA; Pathankote, PUNJAB; Danta, GUJERAT; Kurumbapatti, SALEM district; Bori, Hoshangabad, and Sakot; Chandgarh, NIMAR; Balapalli, CUDDAPAH; Dhain, HOSHANGABAD; Vijayanagar, BELLARY; Ganoor, NIMAR; Ghodesgaon, KHANDESH; Bhadgaon, KHANDESH; Mount Abu, RAJPUTANA; Hubli, south MAHRATTA; Ara, Salt Range, PUNJAB; Gadag, MAHRATTA, etc. Also from Liukiu Islands, Bangkok in Siam, Biserat in Malaya.

As the above somewhat formidable list shows, this is the common commensal form of Western India. The dorsal colour is supposed to be more rufous in this race than in *alexandrinus*. The underparts are dull (as opposed to the whitish or white of wild races). The toothrow only exceeds 6.6 mm. twice in sixty-five specimens and is most often less.

(iii) *Rattus rattus ceylonus* (Kelaart)

1850. *Mus ceylonus* Kelaart, *J. Ceylon Br. Asiat. Soc.*, 2, 213.

1851. *Mus nemoralis* Blyth, *J. Asiat. Soc. Beng.*, 20, 168. Not of de Sélys Longchamps, 1841.

Type-locality.—Ceylon.

Range.—Specimens examined from CEYLON: Kandy, Trinco, Mannar, Colombo and Hambantota.

Toothrow 6.2 mm. and less. It is exceedingly difficult to say whether this is a really definable race, or merely a synonym of *rufescens*. Hinton states, 'In outward form and coloration this rat is hardly to be distinguished from *rufescens*', and he gives no characters in his key. It does seem that the comparatively small series for this supposed commensal race in the London collection averages a little shorter-tailed than in the very large series for *rufescens*, but there are, of course, intermediate and overlapping specimens.

(iv) **Rattus rattus brunneus** (Hodgson)

1845. *Mus brunneus* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 266.

Type-locality.—Nepal.

Range.—Specimens examined from NEPAL: Changoo, Fering, Godaveri, Hathibun, Katmandu, Sipuri.

An unusually large local commensal race; skulls usually approximating to or exceeding 44 mm. in occipitonasal length; toothrow 6.6 mm. and more but normally exceeding 7 mm. Underparts dusky (with two exceptions, which Hinton regarded as intermediate individuals between *brunneus* and the white-bellied *brunneusculus*). Tail usually more than 120% of head and body.

(v) **Rattus rattus brunneusculus** (Hodgson)

1845. *Mus brunneusculus* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 267.

1919. *Rattus rattus sikkimensis* Hinton, *J. Bombay nat. Hist. Soc.*, **26**, 394. (Pashok, 3,500 ft., Sikkim.)

Type-locality.—Nepal.

Range.—Specimens examined from NEPAL: Bouzini, Kakani, Nagarcot, Patibaghan, Sipuri, Chalna Khall, Sunachurn, Mircourt, Nanglepang and Deosali (Gorkha). MISHMI, Dreyi and Dening; SIKKIM: Gopaldhara, Pashok, Rongli, Ringin, Singhik, Kalimpong and Chakung. ASSAM: Tura and Darabanda in Garo Hills. Naga Hills. MANIPUR: Bishampur and Lake Loktak.

Specimens identified by Hinton as from BHUTAN DUARS, Hasimara bearing the name '*sikkimensis*' are more likely to represent *bhotia*, which has its type-locality there. Certainly in tail length the two skins agree with *bhotia* rather than '*sikkimensis*'

So far as I can see, all measurements taken for '*sikkimensis*' are about overlapped by those of *brunneusculus*. The latter is the first name that I am aware of for an Asiatic wild white-bellied race of *Rattus rattus*. Hinton, 1922 (*J. Bombay nat. Hist. Soc.*, **28**, 1058), only gave average measurements to distinguish between '*sikkimensis*' and *brunneusculus*, and overlaps seem so numerous that I propose to merge the two forms. *R. r. brunneusculus* is a supposedly wild race, characterized by its white underparts and by its long toothrow; the teeth are 6.6 mm. and more with two exceptions (one a young specimen and one a possible wrong identification) but are most often over 7 mm.

(Roughly, 36 skulls or more measured.) Hinton gave the tail % average for *brunneusculus* as 124 and for *sikkimensis* as 131; but the majority of the *sikkimensis* I have seen, including several new specimens in the Frost collection, have the tail rather under 130% of the head and body. Mammae generally 12, according to Hinton. The type of *brunneusculus* has the underparts yellowish, not very typical for a wild race.

(vi) ***Rattus rattus kandianus*** (Kelaart)

1850. *Mus kandianus* Kelaart, *J. Ceylon Br. Asiat. Soc.*, 2, 212.
 1850. *Mus tetragonurus* Kelaart, *loc. cit.*, 217. (330 in 1887 reprint.) (Hendala, near Colombo, Ceylon.)
 1887. *Mus kandianus* Kelaart, *loc. cit.*, 326 (emendation, in reprint of the 1850 publication).

Type-locality.—Newera Eliya, Ceylon.

Range.—Specimens seen from CEYLON: Anasigalla, Colombo, Hambantota, Maha-oya, Udugama, Valaichenai, Wellawaya, Mankeni, Kumbukkan, Kandy, Urugalla.

This is apparently the second name for a whitish-bellied subspecies of *Rattus rattus*. It differs from *brunneusculus* in having a relatively short toothrow. Thus in 15 specimens, the measurement of 6.6 mm. is reached only twice (and exceeded only once). The tail is long; usually more than 130% of the head and body. Hinton states 10 mammae are usually present.

All subsequently named races require comparison with the first two names, *brunneusculus* and *kandianus*, and all fall either into the *brunneusculus* rather long-toothed section or the *kandianus* rather short-toothed section of subspecies.

(vii) ***Rattus rattus arboreus*** (Horsfield)

1851. *Mus arboreus* (Buchanan Hamilton) Horsfield, *Cat. E. Ind. Mus.*, 141.

Type-locality.—Bengal.

Range.—Specimens examined from NEPAL TERAI: Hazaria. BENGAL, Jalpaiguri. BIHAR, Paresnath, Gajhundi, Dalton-gunj, Singar. U.P., Cawnpore.

This race seems very like *kandianus*. A few specimens reach 6.7 mm. in toothrow length, but the majority have the teeth 6.6 mm. and less. Hinton gives the tail average as exceeding 130% of head and body. There appear to be 10 mammae. The skull averages a trifle larger than in *kandianus*; the occipitonasal length approximates to or

exceeds 41 mm. in 10 out of a dozen specimens, whereas in *kandianus*, the measurement is reached in only 5 out of 15. Apart from this, the bullae seem consistently to exceed 7 mm. in the present race, whereas in the *kandianus*, with one exception, they are below 7 mm.

(viii) ***Rattus rattus kelaarti*** (Wroughton)

1915. *Epimys kelaarti* Wroughton, *J. Bombay nat. Hist. Soc.*, **24**, 48.

Type-locality.—Pattipola, Ceylon.

Range.—Specimens examined from CEYLON: Ambawela, Pattipola and West Haputale.

It occurs in the highlands, 5,000–6,000 ft.

Hinton placed this form in his key among the commensal subspecies, as its ventral fur is slaty-based, though white-tipped. Perhaps it is a commensal type or perhaps an intermediate race between the white-bellied and dull-bellied groups of races. It was treated as a species by Hinton and Wroughton, but merely seems to be a subspecies rather closely resembling *R. r. wroughtoni* of South India in some ways. The tail is usually less than 130% of the head and body. Toothrow 6.4 mm. and less. It has thicker fur than *ceylonus*, with average lighter underparts and apparently smaller bullae.

(ix) ***Rattus rattus tistae*** Hinton

1918. *Rattus rattus tistae* Hinton, *J. Bombay nat. Hist. Soc.*, **26**, 68.

Type-locality.—Pashok, Sikkim.

Range.—Specimens seen from KAMRUP: Angarakhata; SIKKIM: Batasia, Gopaldhara, Gangtok, Narbong, Pashok, Rongli. MISHMI: Dening. ASSAM: Margherita in Naga Hills, Golohat in Naga Hills, and no exact locality, Naga Hills; Cherrapunji, Khasi Hills; Digboi, Lakhimpur; Tura in Garo Hills; Dibong, Sadiya and Lohit Valley in Sadiya. MANIPUR: Lake Loktak. Also near Kalimpong, Sikkim.

This form occurs extensively with *brunneusculus* ('*sikkimensis*'), and I therefore conclude it is a commensal type which occurs with the white-bellied type much as does *rufescens* with such forms as *wroughtoni*, etc., in Western India. It is smaller than *sikkimensis*, the occipitonasal being usually less than 40 mm. in length (9 exceptions in about 34), whereas in *sikkimensis* and *brunneusculus*, the occipitonasal length is

usually over 40 mm. (about 11 exceptions in 38). *R. r. tistae* has the toothrow mostly over 6.6 mm. or not under that length, but there are about a dozen individual exceptions in the series examined; but these exceptions usually have the teeth exceeding 16% of the occipitonasal. To this race I am referring the dull-bellied rats from Manipur and Assam in the Frost collection. Hinton stated that several specimens had the ventral hairs with slaty bases and light tips, with a suffusion of buff present, while others have white underparts, and yet others have white and slaty-based hairs occurring together in variable proportions. In the material I have seen, the underparts seem to be on average dull, at least as compared with '*sikkimensis*' of the same neighbourhood. The tail averages given by Hinton seem to be about 122–124% of the head and body, and that author states there are 10 mammae. From *R. r. brunneus* this race is easily separated by its smaller skull. (In the material I have seen, the tail seems mostly well under 120% of the head and body, and in several skins seems actually shorter than head and body.)

(x) *Rattus rattus bhotia* Hinton

1918. *Rattus rattus bhotia* Hinton, *J. Bombay nat. Hist. Soc.*, **26**, 72.

Type-locality.—Hasimara, Bhutan Duars.

Range.—Specimens examined from BHUTAN DUARS: Hasimara. Most of the specimens seen have the tail exceeding 130% of the head and body. The toothrow is usually 6.6 mm. and more, as in *brunneusculus* and allies; but if not so, then it usually exceeds 16% of the occipitonasal length. The occipitonasal rarely reaches 41 mm. and in about half the specimens seen is below 40 mm. This averages a trifle smaller than in *brunneusculus* and its tail averages proportionately longer than in that race. Mammae 10, according to Hinton.

(xi) *Rattus rattus narbadae* Hinton

1918. *Rattus rattus narbadae* Hinton, *J. Bombay nat. Hist. Soc.*, **26**, 77.

1918. *Rattus rattus girensis* Hinton, *J. Bombay nat. Hist. Soc.*, **26**, 83.

Type-locality.—Of *narbadae*: Sakot, Hoshangabad, 1,200 ft. and of '*girensis*': Sasan, Junagadh, Kathiawar, 400 ft.

Range.—Specimens examined from CENTRAL PROVINCES: Sonawahnee, Balaghat, Dhain, Rorighat and Sakot, Hoshangabad; Chichpalli, Chanda. KATHIAWAR: Sasan ('*girensis*').

This belongs to the short-toothed branch of races, for which earlier names are *kandianus* and *arboreus*. The tooth-row only once reaches 6.6 mm. in material examined. This subspecies works out as being very close to *kandianus*, but the bullae appear to average larger proportionately. Most of the specimens I have seen have the occipitonasal length less than 40 mm. (about 6 exceptions in 18). Thus the skull averages smaller than in *arboreus*. The tail is rather long, mostly exceeding 130% of head and body. Mammae mostly 10 in material I have seen, but evidently variable, according to Hinton.

I find it extremely difficult to separate '*girensis*' from *narbadae*. I had thought that *girensis* could be kept separate on its average shorter palate, but I find that this is not constant. *R. r. girensis* averages a fraction smaller in skull length, but it is likely that one or two of the skulls measured are not quite adult.

The differences between the two forms seem to me to be differences which elsewhere in the present work I have not regarded as of subspecific value.

(xii) *Rattus rattus satarae* Hinton

1918. *Rattus rattus satarae* Hinton, *J. Bombay nat. Hist. Soc.*, 26, 87.

Type-locality.—Ghatmatha, Satara district, about 2,000 ft.

Range.—Specimens examined from Western Ghats; Ghatmatha (Satara) and Konkan. EASTERN GHATS: Chettiri Range, Salem and Shevaroy Hill. Also Helwak, Satara district.

Immeasurably the most distinct of the races of India, this form is characterized by its excessively long tail, which is usually more than 150% of head and body length; its length in the majority of adults 230–250 mm. It also differs sharply, so far as I can see, from all other West Indian races in having a long toothrow, usually 6.9 mm. in length, in the few skulls seen. Usually 10 mammae, according to Hinton. This form requires no special comparison with the others and might almost be given specific rank.

(xiii) **Rattus rattus wroughtoni** Hinton

1919. *Rattus rattus wroughtoni* Hinton, *J. Bombay nat. Hist. Soc.*,
26, 384.

Type-locality.—Coonoor, Nilgiri Hills, 6,000 ft.

Range.—Specimens seen from SOUTHERN INDIA: Trivandrum, Travancore; Seetragund, Malabar; Kotengady Estate, East Madura, Shernelly, Cochin. Ootacamund, Coonoor (both Nilgiri Hills), Shambalgamur, Palni Hills; Kotagiri, Silver Cascade and Perumal; Kolar, Bangalore, Kardibetta Forest and Sagar, all in Mysore. Dharwar. Gersoppa, Kanara. South Mahratta. Seringapatam, Mysore. Haleri and Wotekolli, Coorg. Poumudi, Travancore.

This seems to be the common white-bellied southern-west Indian race. It belongs to the short-toothed *kandianus* section; but there are several specimens whose teeth actually exceed the 6.6 mm. which seems near the dividing line between 'long-toothed' and 'short-toothed' races (about 5 in 27). These usually have the toothrow below 16% of the occipitonasal length. Requiring special comparison with the forms *kandianus*, *arboreus* and *narbadae*, all of which antedate it, *wroughtoni* is best distinguished by its relatively shorter tail, which is generally under 130% of the head and body length. Mammae usually 10 (Hinton). Sometimes the underparts are rather dirty white.

(xiv) **Rattus rattus gangutrianus** Hinton

1919. *Rattus rattus gangutrianus* Hinton, *J. Bombay nat. Hist. Soc.*,
26, 389.

Type-locality.—Ranibagh, Naini Tal, Kumaon, 2,500 ft.

Range.—Specimens examined from KUMAON: Takula, Ratighat, Sitabani, Ramnagar, Lohaghat, Khati, Lwarkhet, Jagatsukh. PUNJAB: Chamba, Kyelang, Darmsala, Bara Tissa, Gopalpur. And the type-locality.

This apparently belongs in the long-toothed section. The toothrow is usually 6.6 mm. and more (6 exceptions in about 16 skulls); most of these have the toothrow more than 16% of the occipitonasal. Mammae 10 or 12. This form seems to work out as being nearest *brunneusculus*, but with average proportionately larger bullae. Tail usually over 120% of head and body length, but under 130%. In nearly all specimens the occipitonasal length exceeds 40 mm.

(xv) *Rattus rattus khyensis* Hinton

1919. *Rattus rattus khyensis* Hinton, *J. Bombay nat. Hist. Soc.*, **26**, 398.

1919. *Rattus rattus tatkonensis* Hinton, *J. Bombay nat. Hist. Soc.*, **26**, 402. (Tatkon, western bank Chindwin River, Burma.)

Type-locality.—25 miles west of Kindat, 600 ft., Chin Hills, Burma.

Range.—Specimens seen from BURMA: 25 miles west of Kindat, Maymyo, Madaya, Mount Poppa, near Toungoo, Pyaunggaung, Gokteik, Kin and Shwebo. Tatkon, Mingun near Sagaing, Hsipaw, Nyapinium, Kyauknaung.

Generally white-bellied, although there are specimens with a certain mixture of slaty-based hairs ventrally. Long-toothed section; toothrow only once under 6.6 mm. in 21 skulls. Chiefly distinguished from *brunneusculus* and other names which antedate it, above, by the fact that the tail is rather short, usually under 120% of head and body length in material available. Hinton thought that *tatkonensis* differs from *khyensis* in having larger bullae, but I cannot agree that this is so, if the skulls which I have measured above are correctly identified. Some *tatkonensis* have very large bullae, others have not. The length of the bullae in *khyensis* varies apparently from 6.9 to 7.9 mm., and in *tatkonensis*, from 6.7 to 7.9 mm., so I cannot see where the difference is supposed to be and propose to treat the two forms as one. The type skin has the underparts dirty grey.

(xvi) *Rattus rattus tikos* Hinton

1919. *Rattus rattus tikos* Hinton, *J. Bombay nat. Hist. Soc.*, **26**, 400.

Type-locality.—Tenasserim Town.

Range.—Specimens examined from TENASSERIM: Tenasserim Town, Tagoot, Victoria Point, Victoria Island, Thaget, Lampea, Bankachon. MERGUI ISLANDS: Malcolm, King and Sullivan Islands.

Much like *khyensis*, but still shorter-tailed, the tail being in most specimens less than 110% of head and body (and in a considerable number, though not the majority, shorter than the head and body). Toothrow usually 6.6 mm. and more; two exceptions have the toothrow about 16% of the occipitonasal, which usually exceeds 40 mm. Mammae apparently 11, 10 or 12. (Hinton.)

(xvii) ***Rattus rattus macmillani* Hinton**

1919. *Rattus macmillani* Hinton, *J. Bombay nat. Hist. Soc.*, **26**, 409.

Type-locality.—Hkamti (west bank), Upper Chindwin, Burma.

Range.—Specimens seen from BURMA: Hkamti.

I have little material for this form. The type skull seems to have the long toothrow customary among eastern races (6.8 mm.) but another specimen has the toothrow shorter. Hinton's measurements indicate that it is a long-toothed type. The tail seems long, usually over 130% of head and body. It seems to be very close to *R. r. bhotia* but with smaller bullae. Hinton gave it specific rank but for no apparent reason, as it seems to be an ordinary race of *R. rattus*, though little known. 12 mammae, apparently.

(xviii) ***Rattus rattus andamanensis* (Blyth)**

1860. *Mus (Leggada) andamanensis* Blyth, *J. Asiat. Soc. Beng.*, **29**, 103.

Type-locality.—Andaman Islands.

Range.—Specimens seen from ANDAMAN ISLANDS. Narcondam, and no locality.

This form is so little known that all I can say is that, judging by a co-type, it is a form of *Rattus rattus*. Toothrow long, about 7.1 mm. in a co-type. Wroughton states the hindfoot is 45 mm., which certainly is larger than is usual in *R. rattus*, but further material is required before the form can be correctly placed. The type skin, in poor condition, seems to have yellowish underparts more as in commensal races. Fur rather spiny.

(xix) ***Rattus rattus dentatus* (Miller)**

1913. *Epimys rattus dentatus* Miller, *Smithson. misc. Coll.*, **61**, 21, 14.

Type-locality.—Hastings Island, Mergui Archipelago.

Range.—Specimens, labelled *R. r. tikos*, have been examined from Hastings Island, MERGUI.

They appear to differ from *tikos*, on average, by their darker bellies, and to this form I would very provisionally refer the specimens from Criddles Island, Hayes Island, Tavoy Island and Ross Island, all Mergui Archipelago. All of these seem essentially rather dull-bellied and short-tailed types. No skulls available to me.

(xx) *Rattus rattus rattus* (Linnaeus)

Text-fig. 36

1758. *Mus rattus* Linnaeus, *Syst. Nat.*, 10th ed., 1, 61. Sweden.

Two specimens, respectively from Gersoppa, Kanara and Bombay, seem to represent this melanistic commensal form. Doubtless they are imported ship rats.

(xxi) *Rattus rattus bullocki* Roonwal1948. *Rattus rattus bullocki* Roonwal, *Proc. nation. Inst. Sci. India*, 14, 385.

Roonwal (1948, *Proc. nation. Inst. Sci. India*, 14, 385)* has separated the form inhabiting Manipur (of which we have few specimens) as *Rattus rattus bullocki*, which is described as nearest *khyensis*, *tatkonensis*, *tikos*, *tistae* and *brunneusculus*, but closest to the first two; separable by larger head and body (over 160 mm. average) and shorter tail (subequal to or shorter than head and body) and moderately large bullae, 7.2 mm. or 17.9% of the occipitonasal length. Type-locality, about 16 miles north of Imphal, Manipur, *circa* 3,500 ft. 111 adults gave head and body 148–197 mm. (mean 172 mm.), tail 130–216 mm. (172), foot 28–36 mm. (32). Mammae mostly 12. Skull (26 adults): occipitonasal, mean, 40.3 mm., bullae 7.2 mm., nasals 15.2 mm., diastema 10.4 mm., palatal foramina 7.2 mm., upper molars, crowns, 6.9 mm.

(xxii) *Rattus rattus khumbuensis* Biswas and Khajuria

See Appendix.

Other races of Rattus

Named forms of *Rattus* unrepresented in the British Museum, including some races of this species, will be dealt with at the end of the genus.

* For further information about this subspecies, see Appendix; and also:

Roonwal, M. L., 1949. *Trans. nation. Inst. Sci. India*, Calcutta, 3 (2), pp. 87–99 and Pl. 4, Fig. 2 (biology and ecology).

Roonwal, M. L., 1950. *Rec. Indian Mus.*, Delhi, 47 (1), pp. 20–23; 28–29; Pls. I and II.

77. *Rattus montanus* Phillips

1932. *Rattus montanus* Phillips, *Ceylon J. Sci.*, Sec. B, **16**, 323.

Type-locality.—West Haputale, Ohiya, Ceylon.

Range.—Specimens examined from CEYLON: West Haputale.

This species may perhaps be given specific rank, compared with *Rattus rattus*, on account of the fact that its molars appear to be curiously and unusually angularly cuspidate, almost reminiscent of those of *Golunda*, though much less extreme than in that genus. Otherwise it is much like *R. rattus*; the palate is very long; the bullae are medium in size, about 15% of the occipitonasal length, the nasals are not specially elongated (compare *R. nitidus*) and the tail is wholly dark, compare *R. rattoides*. The palatal foramina are long.

External characters.—Heavy-looking rats, with the fur thick and soft. Tail longer than head and body, wholly dark. Foot with five toes, clawed; apparently six plantar pads; fifth toe longer than hallux, shorter than central three. Hand with four functional fingers.

Colour.—Rather dark brown above, the fur darker basally; underparts yellowish grey. Feet dark, but toes white. Tail wholly black.

External measurements.—

	Head and body	Tail	Hind- foot	Ear
M. West Haputale, Ohiya, Ceylon	189	224	37	20
M. West Haputale	185	232	35	23
West Haputale. Type	180	198	34	21

Skin notes.—West Haputale, 'trapped in the jungle'

Cranial characters.—I have only seen two skulls for this species. The occipitonasal length varies between about 42.2 and 43.4 mm. The rostrum is rather pointed and the frontals little constricted. Well-developed supraorbital ridges are present, which tend to extend back slightly on to the parietals. Interparietal large. Suture of frontals and parietals nearly straight. The bullae are quite well inflated and are about 15% of the occipitonasal length. The palate is long, clearly over half the length of the occipitonasal. The toothrows are rather long and heavy (17% of occipitonasal). The palatal foramina are very long (19% of the occipitonasal) and extend back to the toothrows. (One

specimen has the foramina more than 20% of the occipito-nasal.) Zygomatic plate nearly straight anteriorly. Mandible with well-developed coronoid process, which is somewhat hook-like, and with the lower border of the jaw well ridged.

Dental characters.—Upper incisors yellow and ungrooved. Upper molars heavy and with the rows of cusps forming noticeably sharp angles with each other, the centre row wider than the inner and outer rows, but these well marked in M. 1 and M. 2. The first upper molar has eight main cusps; traces of a vestigial posterointernal and a vestigial postero-external cusp may also be seen. M. 2 is like M. 1 but lacks the centre front cusp, as usual. The anteroexternal cusp is in this tooth rather small. M. 3 has a large anterointernal cusp, followed by a lamina bearing apparently three cusps, followed by a narrow posterior lamina. Lower molars as usual, with three laminae on M. 1, two each on M. 2 and M. 3; two rows of cusps on all laminae except the last which is single; and clear traces of a small subsidiary outer row of cusps on the lower molars.

Cranial measurements.—

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
M.	35.10.6.5	42.2 <i>circa</i>	22.6	11.3	8.4	6.6	7.6	14.5 <i>circa</i>
	West Haputale, Ceylon							
M.	35.10.6.6	43.4	22.6	11.4	8.8	6.7	7.8	14.7
	West Haputale							

Dimensions of Rattus montanus, in British Museum material.—The head and body length varies between 180 and 189 mm. The tail between 198 and 232 mm. Hindfoot 34–37 mm. The occipitonasal length varies between 42.2 and 43.4 mm. Toothrow 7.6–7.8 mm.

78. *Rattus rattoides* (Hodgson)

The Turkestan Rat

1845. *Mus rattoides* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 267.

Distribution.—SIKKIM, NEPAL, PUNJAB, KASHMIR, Afghanistan. Southern and eastern Russian Turkestan. Parts of southern China, including Fukien.

Essentially like *Rattus rattus*, but occurring with it, and distinguishable in nearly all specimens by the colour of the tail, which is of two colours, normally dark above and pale below, and if tending to be of one colour, then normally wholly pale.

Several rats, which are like *Rattus rattus* but have a bicolor tail, occur with that species on the mainland of Asia. Their status and the character significance are not very well understood. Owing to lack of representative material for many of the Asiatic forms, I am not in a position to give very full notes on these forms, but the following points should be stated.

I accept Hinton's identification of *Rattus rattoides* from Nepal as in the *J. Bombay nat. Hist. Soc.*, 1922. If this identification is accepted, *rattoides* becomes the first name for this species or group of subspecies. It must be admitted, however, that the typical material for *rattoides* is in bad condition, and that there is very little in the description of that form which is of value. I made the following note recently on re-examining the type skin: 'Very bad condition, but tail not obviously bicolor' Dark-tailed individuals of *R. r. rattoides* become hard to distinguish from *Rattus rattus brunneus*, but there seems good reason for stating that the white-bellied bicolor-tailed *Rattus vicerex* of Kashmir and the Punjab intergrades into the dull-bellied less bicolor-tailed *rattoides* of Nepal and Sikkim, particularly through an intermediate series of skins labelled '*vicerex*' from Kumaon, as mentioned by Hinton, p. 1062. *Rattus turkestanicus* Satunin, 1903, from Fergana, Turkestan, antedates *Rattus vicerex* Bonhote, May, 1903, from Simla. In the present state of knowledge I am unable to say whether the two can be separated racially or not.

External characters.—The tail is longer than the head and body in most measured specimens from India, for both races. There is a certain growth of hair throughout its length. Fur usually soft, sometimes stiffer in the typical race than in the northern '*vicerex*'. Foot with five toes, all bearing claws, the fifth shorter than the central three, but longer than the hallux, and apparently with six plantar pads. Hand with four functional fingers. Mammae usually 12, sometimes 10.

Colour.—Above varying from grey, at extreme pale grey, to brown, almost red brown rarely; the typical race, as a rule, is darker brown above. Feet, as a rule, white, though in some specimens from Nepal and Sikkim they are darker. Tail normally dark above, white or pale below; occasionally

wholly pale; bicoloration usually clear, but sometimes poorly marked. A very few individuals, as noted in detail and by number below, have the tail all dark. These come very near the commensal form *Rattus rattus brunneus*, but differ, so far as I can tell by present material, in the slightly smaller proportions of head and body length and tail length. Nos. 8.7.6.77 and 83, Kashmir, have measurements in inches on the labels, and their tails are shorter than head and body length (7 and 7.35 inches respectively, tails 6.2 and 6.5 inches). Colour of underparts white in *turkestanicus* in nearly all skins, occasionally dirty white, usually pure. In *rattoides*, the underparts are yellowish to greyish, markedly darker than is usual in *turkestanicus* (Kumaon and Sikkim skins here referred to *rattoides*).

External measurements.—As in Table 67, below.

TABLE 67.—*External measurements of the Indian races of Rattus rattoides*

			Head and body	Tail	Hind- foot	Ear	
<i>Rattus rattoides turkestanicus</i> (' <i>vicereus</i> ')							
M.	Gandhala, Salt Range, Punjab	179	216	32	23		
M.	Ara, Salt Range	171	217	32	24		
M.	Gandhala	170	235	33	25		
M.	Kallar-kahar, Salt Range	163	189	34	24		
F.	Sakesar, Salt Range	155	227	31	24	Mammæ 12	
M.	Gandhala	185	237	33	25		
M.	Gandhala	158	228	32	23		
M.	Gandhala	168	219	32	25		
F.	Bhurban, Murree	170	196	32	24		
M.	Murree, Punjab	168	216	35	25		
M.	Lehtrar, Murree	170	213	34	24		
M.	Lehtrah, Murree	169	208	35	24		
M.	Sambli, Murree	170	223	34	22		
F.	Patriata, Murree	171	202	32½	25		
F.	Lehtrah, Murree	166	205	34	24		
M.	Bhurban, Murree	172	216	34	25		
M.	Patriata, Murree	172	209	33	?		
M.	Murree	167	217	32	24		
M.	Sambli, Murree	152	195	32½	22		
M.	Murree	161	197	34	24		
M.	Murree	176	223	33	24½		
M.	Murree	161	213	34	24		
M.	Murree	139	195	34	24		
M.	Kothi	176	203	32	22½		
F.	Kothi, Kulu Valley	150	177	30	24		
M.	Lehtrar, Murree	164	213	33	?		
M.	Murree	168	207	32	23½		

TABLE 67.—*External measurements of Rattus rattoides (contd.)*

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus rattoides turkestanicus</i> (' <i>vicereus</i> ') (concl'd.)						
F.	Patriata, Murree	156	210	33	25	
M.	Bhurban, Murree	182	222	34	23½	
F.	Murree	163	205	32	25	
F.	Pattan Valley, Lahul	149	175	31½	24	
F.	Rahla, Lahul	163	182	31	25	Mammae 3-3 = 12
F.	Pattan Valley	161	184	32	25	
F.	Rahla, Lahul	180	195	33	24	Mammae 12
M.	Rahla, Lahul	205	213	33	31	
M.	Chalan Tissa, Chamba	173	201	36	26	
M.	Bara Tissa, Chamba	187	212	35	25	
M.	Kahlal, Chamba	170	?	34	23	
M.	Chalan Tissa	198	218	34	26½	
F.	Chakdulla, Campbellpore	156	198	30	24	
M.	Chatri, Chamba	175	206	33	23	
M.	Chakdulla	158	201	33	23	
F.	Dangail, Kishtwar	167	178	32	24	
M.	Sardalla, Kashmir	168	205	36	22	
M.	Kargil, Ladak	170	194	30	24	
F.	Sardalla	171	203	33	23	
F.	Doonglagali, N.W.F.P.	210	214	35	26	
F.	Chasma State ?	149	197	35	24	
M.	Chalan Tissa, Chamba	165	194	33	23	

Other skins from Beriji, Gilgit, Hyderabad, Poonch Road, Kashmir, Wardwan, Mani, Vale of Kashmir.

Two skins from Tribeni, Nepal Terai, with white bellies, have the tail black. They measure, respectively, 166-158 head and body, 34-32 hindfoot, 24-23 ear, and 165 tail (missing in the other). But on account of their black tails, I think they represent a form of *R. rattus* and not this species.

Rattus rattoides rattoides

The Kumaon series are intermediate between *rattoides* and *vicereus*, and bear the latter name.

		Head and body	Tail	Hind- foot	Ear	
F.	Khati, Kumaon	163	200	33	25	Mammae 12
M.	Khati	155	202	34	24	
M.	Khati	152	170	33	24	
F.	Khati	166	189	31	23	Mammae 12
M.	Khati	185	201	35	27	
F.	Dhakuri, Kumaon	162	180	32	26	Mammae 12
F.	Chuntang, Sikkim	161	190	33	24	Mammae 10
M.	Chuntang	150	182	33	24	
F.	Ghoom, Darjeeling	156	171	34	22	

TABLE 67.—*External measurements of Rattus rattoides (concl'd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Rattus rattoides rattoides (concl'd.)</i>				
F. Nagarcot, Nepal	150	157	?	?
F. Ferping, Nepal	170	225	33	26
F. Chuntang, Sikkim	149	184	34	25
M. Hathibun, Nepal	160	210	36	27
M. Hathibun	155	212	35	26
F. Chuntang, Sikkim	154	178	34	26
M. Thankot, Nepal	156	205	35	25
F. Nagarcot, Nepal	164	208	34	25
Chuntang, Sikkim	154	178	34	26
F. Chuntang	149	184	34	25
F. Nagarcot, Nepal	164	208	34	25
M. Thankot, Nepal	156	205	35	25
M. Hathibun, Nepal	155	212	35	26
M. Hathibun	160	210	36	27
F. Ferping, Nepal	170	225	33	26

Notes from skins.—

R. r. rattoides and intermediate specimens from Kumaon. Chuntang, Sikkim, weight $3\frac{1}{2}$ oz. and $4\frac{1}{2}$ oz., mammae 10 and 4 oz. Khati, Kumaon, 7 oz. and $5\frac{1}{4}$ oz., mammae 12 and 4 oz. and 5 oz. Dhakuti, Kumaon, 12 mammae.

R. r. turkestanicus: Doonglagali, N.W.F.P., 'caught in a timber stack' Murree, trapped in a storeroom. Gandhala, weight 5.25 oz. and 5 oz. Kothi, weight 2.15 oz. Bhurban, Murree, weight 5.75 oz. and 6 oz. Hyderabad, Poonch Road, Kashmir, in a hut, ground under snow. Rahla, Kulu Valley, Lahul, weight 3.25 oz., mammae 3-3 = 12. Dangail, Kishtwar, trapped in hut. Lehtrar, Murree, 5 oz. Sardalla, Kashmir, trapped in hut. Rahla, contained 8 fetuses, mammae 12. Kargail, Ladak, trapped in house. Sakesar, Salt Range, 12 mammae.

Cranial characters.—The skull has quite well-developed supraorbital ridges present. The constriction of the frontals is not excessive. Interparietal large. Bullae large, usually about 16-17% of the occipitonasal length. The palate exceeds half the occipitonasal length. In some specimens it is proportionately shorter than in many races of *R. rattus*, but this is not a constant character. The palatal foramina are long, usually reaching the toothrows, but in most specimens under 20% of the occipitonasal. Zygomatic plate moderately or slightly cut back above. Coronoid process of mandible well developed.

Dental characters.—Molars moderately cuspidate, not very angular. M. 3 little reduced. Eight main cusps in M. 1, six in M. 2 (the anterointernal, three on the second, two on the third laminae). M. 3 much like M. 2, but a little smaller. An exceedingly reduced anteroexternal cusp may be traced in M. 2 in some individuals. M. 1 has 5 roots. Lower molars biserially cuspidate, as usual, and with quite a strong terminal heel in M. 1 and M. 2.

Cranial measurements.—As in Table 68, below.

TABLE 68.—*Cranial measurements of the Indian races of Rattus rattoides*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus rattoides turkestanicus</i> ('vicerex')								
M.	5.11.19.7	39.8	20.2	9.8	7.6	6.7	6.4	14.5
	Murree, Punjab			<i>circa</i>		<i>circa</i>		
	85.8.1.310	40.2	20.4	9.5	?	7.1	6.4	14.8
	Simla, Punjab							
M.	5.11.7.8	44.8	23.7	11.8	9.2	7.5	6.7	16.6
	Murree, Punjab. Old							
F.	8.7.6.79	41.2	21.2	10.3	8.1	7.1	6.8	15.0
	Kishtwar, Kashmir							
M.	8.7.6.75	45.4	23.7	11.2	8.1	7.3	6.9	16.9
	Poonch, Kashmir							
M.	8.7.6.77	39.9	21.0	10.3	7.0	6.6	6.3	15.0
	Wardwan, Kashmir. Foramina measurement = longer side							
M.	8.7.6.83	44.3	23.6	?	8.5	6.9	?	16.4
	Kashmir. M. 1 is 5-rooted							
M.	8.7.6.84	37.8	20.2	9.7	6.7	6.2	6.3	13.7
	Main valley of Kashmir							
M.	8.7.6.85	42.7	22.8	11.6	7.6	6.7	6.3	15.4
	Main valley of Kashmir							
F.	8.7.6.86	39.2	19.7	10.7	6.6	6.2	6.0	13.8
	Main valley of Kashmir							

The type, from Simla, has the occipitonasal length 41.2 mm.

<i>Rattus rattoides rattoides</i>								
F.	22.5.16.49	41.5	21.8	10.8	7.6	6.5	6.8	15.0
	Nagarcot, Nepal. 5 roots M. 1						<i>circa</i>	
F.	22.5.66.50	41.2	21.7	10.0	7.8	6.8	7.3	15.2
	Ferping, Nepal							
M.	22.5.16.51	40.6	21.0	10.1	8.0	6.4	7.2	15.3
	Thankot, Nepal. Old							
M.	22.5.16.52	42.5	22.4	10.7	7.5	7.0	7.3	16.0
	Hathibun, Nepal							
M.	22.5.16.53	41.6	22.1	11.0	7.8	6.7	7.2	15.3
	Hathibun							

TABLE 68.—*Cranial measurements of Rattus rattoides (concl'd.)*

		Occipito- nasal	Palate	Diastema	Palate foramina	Bullae	Toothrow	Nasals
<i>Rattus rattoides rattoides (concl'd.)</i>								
M.	14.7.10.135	40.6	20.5	10.0	8.3	6.8	6.7	14.8
	Dhakuri, Kumaon							
M.	14.7.10.137	44.7	23.2	11.3	8.5	7.9	6.7	17.0
	Khati, Kumaon. Old							
M.	14.7.10.138	40.2	20.3	9.8	7.9	7.4	6.5	14.7
	Khati, Kumaon							
F.	14.7.10.140	41.0	20.9	10.1	8.3	7.2	6.6	15.8
	Khati, Kumaon							
M.	15.9.1.165	38.8	20.3	9.5	7.1	6.6	7.2	13.5
	Chuntang, Sikkim							
F.	15.9.1.168	40.2	21.4	10.0	7.3	6.5	6.9	15.0
	Chuntang. M. 1 is 5-rooted							
F.	15.9.1.171	40.5	21.8	10.7	8.2	6.3	6.6	16.2
	Chuntang							

Dimensions of Rattus rattoides, in British Museum material.—The head and body length varies between 139 and 210 mm. The tail between 143 and 237 mm. Hindfoot 30–36 mm. The occipitonasal length varies between 37.8 and 45.4 mm. so far as at present ascertained, and the toothrow between 5.7 and 7.7 mm.

If Hinton is correct in his identification of the name *rattoides*, then that name is the first for the present species. I would refer specimens from Kumaon and Sikkim to the typical race, and restrict '*vicere*x' = *turkestanicus* to the Punjab and Kashmir in India.

Key to the Indian races

- 1 (2) Underparts normally white *R. r. turkestanicus*
(Punjab and Kashmir.)
- 2 (1) Underparts normally grey or darker *R. r. rattoides*
(Kumaon, Nepal and Sikkim.)

Apart from three skins from Tribeni, which I think may well represent a form of *Rattus rattus*, bicoloration seems fairly constantly traceable in the tail in the vast majority of specimens, and many have been examined. Sometimes it is clear, sometimes obscure. But the following seem to have black tails: *rattoides*, 22.5.16.51, Thankot, Nepal; *rattoides*, 15.9.1.166, Chuntang, Sikkim; *rattoides* (labelled *vicere*x), 15.9.1.168, Chuntang, Sikkim; *vicere*x, 8.7.6.83, Kashmir; *vicere*x, 8.7.6.77, Wardwan.

The latter, too, has a slightly duller belly than usual. 8.7.6.83 is one of the specimens with rather unusually large skull. These seem the only absolutely dark-tailed skins in about 90 specimens.

Possibly they are misidentified specimens of *Rattus rattus* and the possibility that *rattoides* is merely a colour phase of *Rattus rattus* cannot be dismissed, as their skulls are indistinguishable.

(i) *Rattus rattoides rattoides* (Hodgson)

1845. *Mus rattoides* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 267.

Type-locality.—Nepal.

Range.—Specimens examined from Ghoom (Darjeeling). NEPAL: Ferping, Hathibun, Nagarcot, Thankot and Katmandu (skull). KUMAON: Dhakuri and Khati. SIKKIM: Chuntang.

Dull or grey-bellied race.

(ii) *Rattus rattoides turkestanicus* (Satunin)

1903. *Mus turkestanicus* Satunin, *Ann. Mus. St. Petersb.*, **7**, 588.

(April, 1903.) Assam-bob, Ferghana, Russian Turkestan.

1903. *Mus vicereis* Bonhote, *Ann. Mag. nat. Hist.*, **11**, 473.

(May, 1903.) Simla, Punjab.

Range.—Specimens seen from KASHMIR: Beriji, Gilgit; Danggail, Kishtwar; Kargil, Ladak; Hyderabad; Sardalla; Mani; Wardwan; Poonch. PUNJAB: Ara, Gandhala, Kallarkahar and Sakesar, all Salt Range; Chakdulla, Campbellpore; Baratissa, Kahlal, Chalan Tissa and Chatri, all Chamba; Pattan Valley, Rahla, Kothi, all Lahul; Simla. Bhurban, Lehtrar, Patriata, Sambli, all Murree. N.W. FRONTIER PROVINCE: Doonglagali. Afghanistan: Paghman. One specimen from Russian Turkestan.

White-bellied race.

79. *Rattus nitidus* Hodgson

The Himalayan Rat

1845. *Mus nitidus* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 267.

Distribution.—NEPAL, ASSAM, NORTHERN BURMA, North Indo-China, Fukien, Yunnan, and quoted by Glover Allen from Hainan, Kansu and Szechuan. It is said also to occur in Siam.

(Allen made *humiliatus*, from Chihli, a race of this, but *humiliatus* is based, according to Schwarz, on a young specimen of *Rattus norvegicus caraco*, and has nothing whatsoever to do with *nitidus*.)

In appearance much like a commensal form of *Rattus rattus*, but occurring with that species in many places, and differing in the length of the nasals, which are unusually long, most often more than 40% of the occipitonasal length. The bullae tend to be relatively smaller than is normal for *Rattus rattus*.

External characters.—In this species the fur is soft and quite thick, particularly in the typical race. The tail is nearly naked, but with signs of growth of hair through its length. Hindfoot with five toes, all clawed; the hallux shorter than the fifth, which is shorter than the central three; apparently six plantar pads. Hand with four clawed fingers as usual. Tail little longer than head and body as a rule (107% average for typical race, Hinton; 99% average for *obsoletus*). Mammae 12, as a rule; 8 in one specimen and 13 in one.

Colour.—The back is usually dark brown, occasionally with a darker mid-dorsal patch or line. Feet usually yellowish or whitish, rarely dark. Tail normally wholly dark. (Two skins with a bicolor tail in the London collection bearing this name, from Nagarcot, Nepal, Nos. 21.5.1.38 and 39, are probably *rattoides*. Others from this locality are normal dark-tailed types.) Underparts dull grey (silvery) or brownish, darker or lighter; only one skin, 15.9.1.149, Ghoom, has the belly nearly white.

External measurements.—As in Table 69, below.

TABLE 69.—*External measurements of the Indian races of Rattus nitidus*

	Head and body	Tail	Hind- foot	Ear	
<i>Rattus nitidus obsoletus</i>					
M. 50 miles west of Kindat	187	175	34½	21½	Mammae 12
F. 65 miles W. of Kindat .	174	186	37	23½	
Type. 50 miles W. of Kindat	178	165	35	23	
<i>Rattus nitidus nitidus</i>					
F. Gangtok, Sikkim	162	187	36	22	Mammae 12
F. Pashok, Sikkim	160	192	36	22	
M. Pashok	173	195	36	23	
M. Pashok	162	190	35	22	

TABLE 69.—*External measurements of Rattus nitidus (concl'd.)*

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus nitidus nitidus (concl'd.)</i>						
M.	Ghoom, Darjeeling	178	191	36	22	
F.	Pashok	157	164	32	22	
M.	Pashok	150	182	36	21	
M.	Pashok	148	180	30	21	
F.	Ghoom, Darjeeling	175	192	34	23	Mammae 12
F.	Pashok	135	157	33	23	
M.	Pashok	153	168	35	21	
F.	Ghoom, Darjeeling	167	162	34	21	Mammae 12
M.	Gangtok, Sikkim	171	182	36	22	
M.	Pashok	131	160	32	20	
M.	Pashok	169	171	33	20	
F.	Pashok	124	156	29	19	
F.	Pashok	125	150	34	21	
F.	Pashok	135	170	35	22	
M.	Pashok	165	182	35	23	
F.	Pashok	142	160	32	20	
M.	Pashok	145	167	34	22	
M.	Shangpung, Jaintia Hills	185	183	36	23	
F.	Dening, Mishmi	171	198	35½	22½	Mammae 2-2 = 8
M.	Dening, Mishmi	208	?	38	23	
F.	Khonshnong, Jaintia Hills	185	180	34	23	
F.	Jowai, Jaintia Hills	182	185	35	24	
M.	Dening, Mishmi	164	174	34½	22½	
M.	Shangpung, Jaintia Hills	200	188	35	22	
F.	Dening, Mishmi	190	196	37½	25	Mammae 12
M.	Lohaghat, Kumaon	180	?	37	21	
F.	Lohaghat	163	182	36	21	Mammae 12
F.	Khati, Kumaon	162	164	34	20	Mammae 12
M.	Lohaghat, Kumaon	161	178	37½	20	
F.	Lohaghat	171	193	36	21	Mammae 12
M.	Khati, Kumaon	165	171	37	21	
F.	Khati	154	154	35	20	
M.	Lohaghat, Kumaon	170	186	37	21	
F.	Khati	176	179	34	21	Mammae 12
F.	Lohaghat, Kumaon	179	185	35	21	Mammae 12
M.	Lohaghat	171	184	36	21	
F.	Lwarkhet, Kumaon	170	175	32	21	Mammae 12
F.	Nagarcot, Nepal	147	182	34	25	
M.	Ramchi, Nepal	173	188	36	23	
F.	Godaveri, Nepal	195	175	30	22	
	Thankot, Nepal	160	184	37	23	
M.	Nagarcot, Nepal	185	198	37	26	
M.	Nagarcot	175	142	34	27	
M.	Murree, Punjab. Identi- fication not certain	164	176	30	26	
M.	Kalimpong, Sikkim	160	188	35	23	
F.	Gopaldhara, Darjeeling	170	180	33	21	
M.	Gopaldhara	190	183	36	24 ?	
M.	Gopaldhara	170	155	35	22	
F.	Mongpu, Darjeeling	168	180	33	21	

Notes from skins.—obsoletus: Chin Hills, weight 6 oz., mammae 12 and weight 7 oz.

nitidus: Ghoom, mammae 12: 5 oz. and mammae 12: 4 oz. and 4½ oz. Lohaghat, mammae 12: 5½ oz., also 6 oz., 6½ oz. and 5 oz. Khati, 4¼ oz. and mammae 13, also mammae 12: 6 oz. Jowai, Jaintias, 5 oz. Ghoom, 6½ oz. Dening, 4.75 oz. and mammae 12. Gangtok, mammae 12. Lwarkhet, mammae 12: 6 oz. Dening, mammae 2-2 = 8. Lohaghat, 7 oz. and 6¼ oz.

Cranial characters.—The skull, which most often exceeds 40 mm. in length, has well developed supraorbital ridges. Suture of frontals and parietals nearly straight; interparietal large. Nasals long, approximating to or exceeding 40% of the occipitonasal length in the majority. The bullae are moderately well inflated, but relatively small for a member of the typical subgenus. Thus in about one-third of the skulls available they are below 15% of the occipitonasal length (which is too small for this subgenus, including most specimens of the race *obsoletus*) and in the other specimens they do not, as a rule, much exceed 15% of the occipitonasal. Pterygoid fossae quite deep. Palate long, always much over half occipitonasal length. The palatal foramina are long (roughly 18-19% of the occipitonasal as a rule) and extend back to the toothrows. The zygomatic plate is well cut back above and may individually show signs of being concave in front, but this is not normal. Lower jaw with strong coronoid process.

Dental characters.—Upper incisors yellow and plain. Molars moderately cusped or little so; M. 1 lacks the posterointernal and has eight cusps; M. 2 with an anterointernal cusp, three cusps on the second and two on the third laminae; M. 3 like M. 2, but smaller (though not strongly reduced). Lower molars without extreme peculiarities.

Cranial measurements.—As in Table 70, below.

TABLE 70.—*Cranial measurements of the Indian races of Rattus nitidus*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
		<i>Rattus nitidus nitidus</i>						
F.	14.10.7.141	42.3	23.1	11.8	8.3	6.4	6.7	17.0
	Lwarkhet, Kumaon							
F.	14.7.10.143	39.8	20.6	10.0	7.7	5.8	6.8	16.0
	Khati, Kumaon							

TABLE 70.—*Cranial measurements of Rattus nitidus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus nitidus nitidus (contd.)</i>								
M.	14.7.10.146	42.7	23.0	11.6	8.4	6.2	6.7	17.1
	Lohaghat, Kumaon							
M.	14.7.10.147	42.8	23.2	12.1	8.4	6.4	6.7	17.7
	Lohaghat, Kumaon							
M.	14.7.10.149	42.2	23.1	11.5	8.8	6.3	6.8	17.7
	Lohaghat							
F.	14.7.10.151	43.9	23.7	12.6	8.8	6.4	6.5	18.2
	Lohaghat							
F.	14.7.10.152	44.5	24.0	12.1	8.6	6.4	6.5	18.2
	Lohaghat					<i>circa</i>		
M.	15.9.1.157	42.3	22.8	12.0	7.6	6.2	6.3	17.6
	Gangtok, Sikkim							
F.	15.9.1.158	42.3	22.3	10.5	7.6	6.4	6.9	17.7
	Gangtok, Sikkim							
F.	15.9.1.161	42.7	22.8	11.4	7.9	6.5	6.6	17.2
	Ghoom, Darjeeling							
F.	15.9.1.163	41.6	21.8	10.4	7.3	6.5	6.7	16.3
	Ghoom							
M.	17.7.9.1	39.1	20.4	9.1	7.3	6.3	7.3	14.6
	Pashok, Darjeeling.							
	(Not typical. Perhaps <i>R. rattus</i> subsp.)							
M.	17.7.9.4	40.3	21.5	10.2	7.6	6.4	6.5	15.7
	Pashok							
M.	17.7.9.5	41.9	22.6	11.0	7.6	6.1	6.0	17.2
	Pashok							
M.	17.7.9.6	42.0	22.5	10.9	7.8	6.6	?	16.6
	Pashok.							
	5 roots to M. 1			<i>circa</i>				
M.	17.7.9.7	43.0	23.3	11.1	8.0	6.5	6.7	17.2
	Pashok							
M.	17.7.9.8	44.9	24.1	11.8	8.5	6.5	?	18.6
	Pashok							
				<i>circa</i>				
M.	17.7.9.9	43.7	23.7	11.7	8.7	6.7	6.7	17.8
	Pashok							
M.	17.7.9.13	40.8	21.8	10.4	7.3	6.4	6.6	16.3
	Pashok							
M.	17.7.9.11	44.4	24.2	12.3	8.3	7.0	7.0	17.4
	Pashok.							
	Old							
F.	17.7.9.16	39.3	20.7	?	7.6	6.2	?	15.6
	Pashok.							
	M. 1 5-rooted							
F.	17.7.9.18	40.4	21.8	?	7.6	6.4	?	15.4
	Pashok.							
	M. 1 5-rooted							
F.	17.7.9.19	41.5	22.3	10.5	7.7	6.7	6.7	16.0
	Pashok.							
	Old						<i>circa</i>	
F.	17.7.9.20	43.8	23.2	11.5	7.9	6.5	6.3	17.2
	Pashok.							
	Very old; teeth worn out						<i>circa</i>	
M.	21.1.6.83	42.7	22.4	10.8	7.8	6.6	6.2	16.9
	Shangpung, Jaintia Hills, Assam							
	21.16.84	44.0	23.3	11.9	8.9	7.4	6.5	17.1
	Shangpung. Old							

TABLE 70.—*Cranial measurements of Rattus nitidus (concl'd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Nasals
<i>Rattus nitidus nitidus (concl'd.)</i>								
F.	22.5.16.47 . Changoo, Nepal	43.2	23.0	11.4	8.2	6.3	6.8	18.3
M.	22.5.16.48 . Thankot, Nepal. Old	42.6	23.0	11.5	8.1	6.2	6.4	18.3
F.	91.10.7.121 Katmandu, Nepal. Old; not typical	45.2	24.6	12.5	8.9	7.9	6.9	16.6
	80.11.11.89 Darjeeling	43.2	23.8	11.4	8.3	6.6	7.1	17.2
F.	14.7.10.144 Khati, Kumaon	44.6	24.1	12.4	8.6	6.2	?	18.7
M.	17.7.9.2 Pashok. Rather young	39.7	21.0	9.9	7.0	6.2	6.7	15.1
M.	15.9.1.159 Darjeeling	44.1	24.2	11.3	8.2	6.4	7.1	17.4
M.	17.7.9.12 Pashok	43.1	?	?	8.0	6.4	6.8	17.5
	91.10.7.124 Sikkim	44.7	24.5	12.0	7.9	6.5	7.0	18.1
Frost collection—								
M.	499. Kalimpong	43.3	23.4	11.2	7.5	7.1	7.2	17.5
<i>Rattus nitidus obsoletus</i>								
M.	16.3.26.51 Chin Hills, Burma	42.8	22.9	10.9	7.7	6.4	6.3	17.1
F.	16.3.26.53 . Chin Hills. Rather old. 5 roots M. 1	45.5	24.9	?	8.5	6.4	?	18.7
F.	16.3.26.52 . Kindat. Type. Foramina measurement = shorter side	43.6	23.3	11.0	8.2	6.2	6.4	17.2

Dimensions of Rattus nitidus, in British Museum material.—The head and body length varies between 124 and 208 mm. The tail between 128 and 196 mm. Hindfoot 29–37 mm. The occipitonasal length varies between about 37.8 and 45.5 mm. Toothrow 6–7.3 mm.

The race *R. n. obsoletus* was based, by Hinton, on a few specimens from Western Burma. A difficulty in accepting its status is that there are only about three specimens in London, as against over fifty for the typical race. It was described as having a relatively shorter tail than *nitidus*, and shorter and thinner fur. The bullae appear to be smaller than is normal for true *nitidus*, indeed they are normally too small for subgenus *Rattus*, so that the form needs special

comparison with *R. mülleri* of subgenus *Stenomys*, from which it differs in actually smaller size (*mülleri* not under 47.9 mm. in occipitonasal length in our material; *nitidus*, not over 45.5 mm. in this length). *R. rogersi*, another species allied to *mülleri*, has the occipitonasal about 48 mm., so is also larger than the largest *nitidus*, but the two subgenera come very close to each other through forms like these.

Hinton states the underparts of *obsoletus* differ in colour from true *nitidus*, in having a 'rusty tinge' frequently, rather than 'silvery or hoary' for true *nitidus*, but in the material examined the distinction seems not constant, as some skins for *nitidus* can hardly be distinguished from *obsoletus*.

Further specimens are required for the latter, before its exact status is clear.

Provisional key to the races of Rattus nitidus

1	(2) Fur more harsh. Tail average 99% of head and body (Hinton). Bullae apparently normally just under 15% of the occipitonasal length. (Few specimens examined)	<i>R. n. obsoletus</i>
2	(1) Fur usually more soft. Tail average 107% of head and body (Hinton). The majority of the skulls have the bullae exceeding or approximating to 15% of the occipitonasal length.	<i>R. n. nitidus</i>

(i) *Rattus nitidus nitidus* (Hodgson)

1845. *Mus nitidus* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 267.
 1845. *Mus pyctoris* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 267.
 (Nepal.)
 1845. *Mus horeites* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 268.
 (Nepal.)
 1849. *Mus aequicaudalus* Hodgson, *Ann. Mag. nat. Hist.*, **3**, 203.

Type-locality.—Nepal.

Specimens seen from Fukien, Kuatun. Yunnan, Likiang Range. Tonkin, Chapa (identification of above not certain). SIKKIM: Gangtok, Ghoom, Pashok, Darjeeling, Gopaldhara, Kalimpong, Mongpu. NEPAL: Changoo, Godaveri, Nagarcot, Ramchi, Thankot. KUMAON: Khati, Lohaghat, Lwarkhet. MISHMI: Dening. ASSAM: Jowai, Khonshnong, Shangpung, all in Jaintia Hills. PUNJAB: Murree, 1 skin, identification not certain.

Usually softer-furred; bullae most often over 15% of the occipitonasal length; tail averages longer than head and body.

(ii) ***Rattus nitidus obsoletus* Hinton**

1919. *Rattus nitidus obsoletus* Hinton, *J. Bombay nat. Hist. Soc.*, 26, 415.

Type-locality.—50 miles west of Kindat, in Chin Hills, West Burma, 5,000 ft.

Range.—Specimens seen from BURMA: 50–65 miles west of Kindat.

Harsher-furred; bullae apparently under 15% of the occipitonasal length; tail averages just shorter than head and body. Occipitonasal length not exceeding 45.5 mm. (compare *R. mülleri*). Diastema proportionately shorter than in *R. bowersi*.

80. ***Rattus exulans* (Peale)**

The Little Rat

1848. *Mus exulans* Peale, *U.S. Explor. Exped.*, 8, 47. (This reference is not available to me for checking.)

Type-locality.—Tahiti; see Cassin, 1858, *U.S. Expl. Exp. Mamm.* 38.

Distribution.—BURMA, Indo-China, Siam, Malay States, Sumatra, Java, Borneo, Celebes, Philippine Islands, Flores, Ceram, New Guinea, Solomon Islands, thence eastward, doubtless owing to human introduction to the Pacific Islands, as New Zealand, Fiji, Hawaii and others.

Partly a commensal species, this is much like *Rattus rattus* as regards essential characters, i.e. long palate (tending to average a little shorter than *R. rattus*, but over half the occipitonasal length), large bullae and long palatal foramina, also in its wholly dark tail, but always averages smaller than in *R. rattus* and is actually smaller than in that species, with few exceptions. As the *exulans* group occurs from Burma to Australasia and the *rattus* group occurs from Ceylon to Australia, however, it is difficult to keep the two apart on size alone, as certain commensal *exulans* races from the Pacific tend to become larger in skull length than is usual, whereas certain insular Southern Australian *rattus* group types (i.e. insular races of *R. fuscipes*, for instance) tend to become somewhat dwarfed. The largest *exulans* skull I have measured approximates to 36 mm. in occipitonasal length. Only one specimen of *Rattus rattus*, out of some hundreds, is less than 36.4 mm. But, as mentioned above, *R. fuscipes*, of Australia, can be individually smaller than large *exulans*, but is extremely closely allied to *R. rattus*.

R. exulans is supposed to have only 8 mammae (as compared with 10 or 12 in *rattus*). But this is not verified in our material. In any case, one might expect it to be a variable character, as mammary formula so often varies in individuals in this genus.

Indian material of *exulans* is much smaller, in length of skull, than in the allied species of *Rattus* s.s. in India, and can easily be distinguished on this character alone. There is only one form of *exulans* in India the second name in the species, differing from the typical race in its average smaller size, apparently, and smaller teeth.

External characters.—Small rats, with harsh, somewhat bristly or finely spiny fur, and the tail somewhat longer than the head and body in all Indian specimens. It is scaly, but with a certain growth of hair throughout. Mammæ said to be eight.

Hand with four clawed fingers, the outer one the shortest. Foot with five toes, each bearing a claw; the fifth toe is noticeably longer than the hallux, although shorter than the central three.

Colour.—Above dark brown, feet usually slightly paler than back. Underparts drab and dark, paler brown than the back. Tail wholly dark.

External measurements.—

	Head and body	Tail	Hind- foot	Ear
<i>Rattus exulans concolor</i>				
M. Maliwun, Tenasserim	127	142	25	16½
M. Maliwun	115	139	25	16½
M. Maliwun	125	147	26	16.25
F. Tenasserim Town	126	142	23½	16½
F. Tenasserim Town	126	152	24	16½
F. Tenasserim Town	116	134	22½	16½
F. Mount Poppa, Burma	118	138	24	16
F. Mount Poppa	119	132	24	16
F. Mount Poppa	111	137	24	16
M. Mount Poppa	112	119	23½	15
M. Mount Poppa	113	139	23	15
F. Mount Poppa	110	145	24	16
F. Mount Poppa	132	149	24½	15½
F. Mount Poppa	117	138	23	17½
F. Mount Poppa	116	135	23	16½
M. Mount Poppa	117	142	25	15½
M. Pagan, Burma	111	137	24½	15
F. Homalin, Chindwin, Burma	120	149	24	16½
M. Tamanthe, Chindwin	128	148	26	16.75
M. Tamanthe	122	145	24	16.75
Kin, Chindwin	124	135	24	16.25
M. Kin	114	136	25½	16

	Head and body	Tail	Hind- foot	Ear
<i>Rattus exulans concolor</i> (concl'd.)				
M. Hkamti, Chindwin	114	134	25	17
F. Hkamti	110	131	25	15½
M. Hkamti	122	152	26½	17½
M. Bhamo, Burma	109	145	26	15
M. Toungoo, Burma	112½	140	23	16½
M. Toungoo	117	143	24	17
M. Toungoo	113	153	23	16½
M. Toungoo	122	131	22	16½

Notes from skins.—Toungoo, trapped in house in village. Trapped in house. Maymyo, caught in a bungalow compound. Toungoo, 'caught in my kitchen' Hkamti, 2 oz. Mount Poppa, weight 1½ oz.

Cranial characters.—Much smaller in size in India than other members of the subgenus *Rattus*. The largest Indian specimen available to me has an occipitonasal length of 32.5 mm. Frontals strongly ridged. Braincase rather broad and interparietal large. Bullae large, well inflated, roughly 18% of the occipitonasal length. Pterygoid fossae quite deep. The palate exceeds half the length of the occipitonasal, with very few individual exceptions (two out of twenty Indian specimens). It does not, as a rule, exceed half the length of the occipitonasal by very much. Palatal foramina long, about as long as the bullae (or a little less or more). Zygomatic plate moderately cut back above. Coronoid process of mandible well developed.

Dental characters.—Upper incisors narrow, yellow and plain. M. 1 with eight cusps (lacking only the postero-internal); M. 2 with an anterointernal cusp, a triserially-cusped second lamina and two cusps on the last lamina. M. 3 little reduced, rather like M. 2, but smaller than that tooth. Occasionally a very small anteroexternal cusp is traceable in M. 2. Lower molars apparently without special peculiarity.

Cranial measurements.—

	Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus exulans concolor</i>						
M. 14.7.19.173 Mount Poppa, Burma	30.9	15.5	7.3	5.8	5.3	4.7
M. 14.7.19.176 Mount Poppa	29.2	14.9	6.7	5.4	5.6	4.8

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus exulans concolor</i> (concl.)							
F.	14.7.19.179 Mount Poppa	29.9	15.4	7.3	5.7	5.3	4.6
F.	14.7.19.180 Mount Poppa	30.4	15.5	7.2	5.7	5.6	4.9
F.	14.7.19.181 Mount Poppa	31.1	16.0	7.6	5.9	5.5	4.8
F.	14.7.19.182 Mount Poppa. M. 1	29.0	14.9	7.0	5.8	5.5	4.3
F.	14.7.19.183 Mount Poppa	29.7	15.5	7.4	5.6	5.1	4.6
M.	14.12.8.186 Maliwun, Tenasserim.	30.7	15.3	7.1	5.4	5.6	4.7
The foramina measurement represents the longer side; much longer than the other side, which measures 4.8 mm.							
M.	14.12.8.188 Maliwun	30.1	14.7	7.2	5.2	5.6	4.5
	14.12.8.189 Tenasserim Town.	29.7	15.0	7.4	5.3	5.4	4.4
Rather young							
F.	14.12.8.190 Tenasserim Town.	30.7	16.1	7.7	5.3	5.4	?
The foramina measurement = the longer side							
M.	15.5.5.214 Hkamti, Burma.	31.4	16.0	8.1	5.7	6.0	4.7
The foramina measurement = the shorter side							
	15.5.5.215 Hkamti	29.4	14.8	7.0	5.5	5.3	4.6
F.	15.5.5.217 Tatkon, Burma.	30.7	15.6	7.6	5.7	5.4	4.2
Old							
M.	15.5.5.218 Chindwin, Burma	30.1	15.1	7.3	5.5	5.5	4.7
F.	15.5.5.219 Chindwin	29.7	15.5	7.3	5.8	5.5	4.9
M.	15.5.5.220 Tatkon, Burma	32.0	16.4	8.3	5.5	5.5	4.6
F.	15.5.5.221 Hkamti	29.5	14.8	7.3	5.6	5.3	4.4
M.	15.5.5.222 Chindwin, Burma	30.2	15.8	7.7	5.9	5.5	4.6
M.	88.12.1.48 Bhamo, Burma	32.5	16.8	8.1	6.0	5.9	5.0

Approximate dimensions of Rattus exulans, in British Museum material.—The occipitonasal length varies between 27.3 and 35.9 mm. Toothrow 4.2–6.2 mm. (rarely as high as 6 mm.). The head and body length varies between 89 and 145 mm. The tail between 105 and 158 mm. Hindfoot 21–30 mm.

(i) **Rattus exulans concolor** (Blyth)

The Little Burmese Rat

1859. *Mus concolor* Blyth, *J. Asiat. Soc. Beng.*, 28, 295.

Type-locality.—Schwegyin, Burma.

Range.—Specimens examined from BURMA: Bhamo, Hkamti, Kin, Pagan, Mount Poppa, Tamanthe, Homalin, Toungoo and Tatkon. TENASSERIM: Maliwun and Tenasserim Town. SIAM: Doi Sritepe, Chiengmai and Raheng. Lankawi, Bintang, Karimon and other Islands. JOHORE, Si Karang; Pelepak; Tanjong Surat; South Lebam. PERAK: Near Taiping and Maxwells Hill. Singapore, no exact locality. PAHANG: Kuala Lipis. SELANGOR, Batu. JALOR: Bukit Besar and Biserat. Tojam in Malaya. And if, as I suspect, *R. e. ephippium* Jentink, 1880, is the same, from Korinchi in Sumatra, Sarawak in BORNEO, Kangean Island off Java, South Flores, Palawan and Mindoro in Philippine Islands.

It is probably a commensal race and most likely *R. e. ephippium* Jentink, 1880, is indistinguishable from it; if this is so, it would range in Sumatra, Java, Borneo, Flores and Palawan as well as through Burma, Indo-China, Siam and the Malay States.

81. **Rattus blanfordi** (Thomas)

Blanford's Rat

1881. *Mus blanfordi* Thomas, *Ann. Mag. nat. Hist.*, 7, 24.

Type-locality.—Kadapa, Madras.

Range.—Specimens examined from MADRAS: Kadapa. TRAVANCORE. Shernelly, COCHIN. PALNI HILLS: Machur. MYSORE: Sivasamudram. KANARA: Sisti. EASTERN GHATS: Kurumbapatti and Shevaroy Hill. BOMBAY STATE: Ghatmatha, Satara; Khandesh; Khandalla; Matheran. CENTRAL PROVINCES: Khapa and Pachmiri, Hoshangabad; Mandla, Kolkaz (Berar) and Sembadoh, Berar; Pili, Sipna Valley, Berar. BIHAR: Lonra and Jagodih, both Hazaribagh, and Paresnath.

I have seen no Ceylonese specimens.

Distribution.—Peninsula of India and also Ceylon.

This is an aberrant species. Its unusually large bullae place it in the subgenus *Rattus* according to the classification here offered, but it stands rather well apart from typical

Rattus, and is probably allied to *Cremnomys*, which is another Western Indian *Rattus* offshoot. (In the Peninsula of India, besides *R. rattus* there is only *R. blanfordi* and the subgenera *Cremnomys* and *Millardia* to represent this genus, a very different state of affairs from the numerous species and subgenera of *Rattus* in Burma and the eastern Himalayas.)

The palate is in this species rather short; often less than half the occipitonasal length, or approximating to that length; only longer than this in a very few individuals. The palatal foramina tend to be elongated, though normally less so than in *Cremnomys*; usually about 20% of occipitonasal length. The bullae are strongly enlarged; actually and proportionately larger than in any race of *Cremnomys*. The molars tend to be somewhat angularly cuspidate. The tail is of two colours; wholly dark basally, wholly pale terminally, as a rule. There are six mammae. The characters of this species are not combined elsewhere within the subgenus, including species occurring in India and outside that country.

External characters.—Tail long, usually exceeding 120% of head and body length. Fur soft. The tail is well haired and tends to be slightly tufted terminally. Hand with four clawed fingers. Foot with five toes, all bearing claws; the fifth hindtoe rather long, not very much shorter than the central three. Apparently six plantar pads. Mammae 1-2 = 6.

Colour.—The colour of the back varies from lightish brown (at extreme nearly reddish brown) to grey (some specimens from Shernelly, Cochin (side by side with a red specimen), have an almost blackish mid-dorsal line). Dorsal fur is dark grey basally. Feet most often white. Belly and underparts white. The tail is usually wholly dark basally and wholly whitish terminally. The terminal white portion, as a rule, clearly contrasted and shorter than the dark portion. Rarely the tail is all white below.

External measurements.—

	Head and body	Tail	Hind- foot	Ear
<i>Rattus blanfordi</i>				
M. Kurumbapatti, Eastern Ghats	170	?	35	26
F. Shevaroy Hill, Eastern Ghats	155	235	35	27
M. Shevaroy Hill	158	202	35	27
M. Shevaroy Hill	174	220	37	26
M. Ghatmatha, Satara	176	204	36	30
M. Jagodih, Hazaribagh	177	219	35	26
M. Jagodih	188	215	37	29

	Head and body	Tail	Hind- foot	Ear	
<i>Rattus blanfordi</i> (concl'd.)					
M. Sirsi, Kanara	195	232	38	29	
F. Sirsi, Kanara	180	?	36	27	
M. Pachmiri, Hoshangabad	168	210	34	27	
F. Pachmiri, Hoshangabad	155	218	34	?	
M. Pachmiri, Hoshangabad	163	203	34	27	
M. Pachmiri, Hoshangabad	158	233	34	?	
M. Berar	165	217	34	27	
F. Kolkaz, Sipna, Berar	155	218	35	25	
M. Pili, Sipna, Berar	165	210	34	26	
M. Lonra, Hazaribagh	167	182	34	26	
F. Paresnath, Hazaribagh	159	225	35	27	Mammae 6
F. Paresnath	167	212	34	28	Mammae 6
F. Paresnath	173	223	34	28	Mammae 6
M. Machur, Palni Hills	167	?	33	26	
M. Matheran	149	179	33½	25	
M. Khapa, Hoshangabad	154	216	35	28	
F. Khapa	162	214	33	28	
M. Khandesh	168	212	36	25	
M. Khandalla	155	208	35	25	
F. Khandalla	162	215	35	27	
F. Sivasamudram, S. Mysore	177	216	34	23	

Notes from skins.—Khandalla, 'mammas one pair each groin, one small in axillae; four large embryos in uterus' Shernelly, Cochin, 'trapped among rocks in jungle; seems to vary in coloration' 'Rocks in jungle near rubber' 'Appears to live in small colonies' Sirsi, Kanara, 4½ oz., 5½ oz. Paresnath, mammae 6: 5½ oz. and 5¾ oz. Hazaribagh, weight 5 oz. Khapa, Hoshangabad, trapped in sandy bed of dried-up stream, 4¼ oz. and 4½ oz. Matheran: trapped in an old stone wall in jungle, not near houses. Pili, Sipna, 4 oz. Sembadoh, Berar, trapped among roots of tree, 4¼ oz. Pachmiri, Hoshangabad, trapped among rocks, 4¾ oz. Jagodih, 5 oz. and 5½ oz. Kolkaz, Berar, 4½ oz., trapped among roots of trees. Pachmiri, Hoshangabad, trapped among rocks; mammae 6: 5¼ oz. and 5½ oz.

Cranial characters.—The skull has rather long nasals and a pointed rostrum; the frontals are very little constricted, and tend to be rather evenly divergent backwards; they are well ridged. The ridges, however, do not extend much on to the parietals. The suture of the frontals and parietals is usually broadly V-shaped, though in some specimens it is nearly straight, and the interparietal is large. The bullae in this species are very large and well inflated, most often exceeding 18% of the occipitonasal length. The pterygoid fossae tend to be deep and the hamular processes are usually

in contact with the bullae. The palate is proportionately short in this species, most often less than half the occipito-nasal length, or about half this length. There appear only to be four exceptions in twenty-five skulls, in which the palate is more than half the occipitonasal. The palatal foramina are very long, usually about 20% of the occipito-nasal length. In nearly one-third of the skulls measured the percentage is rather higher than this. In a few specimens it is lower. The zygomatic plate is strongly cut back above, and a few specimens even show traces of concavity anteriorly of this portion of the skull. Mandible with well-developed coronoid process.

Dental characters.—Upper incisors narrow, red or yellow, and plain. First upper molar 5-rooted. The molars are originally rather angularly cuspidate. M. 1 has the usual eight main cusps (lacking only the posterointernal); M. 2 has seven main cusps (lacking the posterointernal and the centre front cusp, as usual); but the anteroexternal one is very small. M. 3 is medium in size and has an anterointernal cusp, followed by a three-cusped lamina, followed by a hind lamina with two cusps, apparently; the re-entrant folds of this tooth becoming rather clear and deep on the inner side with wear. Lower molars about as usual; three lamina on M. 1, two on the other teeth, each bearing two main cusps except the last in M. 3 which is single; a well marked terminal heel on M. 1 and M. 2 at the back, and traces of an extra outer row of cusps on some of the laminae.

Cranial measurements.—

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus blanfordi</i>							
M.	3.4.3.4 Mandla, C.P.	42.7	20.0	9.6	8.8	8.4	6.4
M.	3.4.3.5 Mandla	42.7	20.6	10.8	8.6	8.3	5.9
M.	5.6.6.1 Matheran, Bombay.	.. 38.0	18.6	9.2	7.0	7.5	6.3
M.	12.3.8.7 Sembadoh, Berar.	.. 41.6	20.2	9.8	9.1	7.8	6.2
F.	12.3.8.8 Kolkaz, Sipna Valley, Berar	.. 40.5	19.8	10.1	8.4	7.8	6.2
M.	12.11.28.118 Sirsi, North Kanara	46.5	23.7	12.0	9.3	8.3	6.7
F.	12.11.28.119 Sirsi, North Kanara	44.3	22.2	11.4	9.1	7.8	6.2

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus blanfordi</i> (concl'd.)							
M.	12.11.29.141 Hoshangabad	40.5	20.0	10.2	8.5	8.0	6.2
M.	12.11.29.143 Pachmiri, Hoshangabad. Old	42.5	21.3	11.3	9.2	7.9	6.2
F.	12.11.29.144 Khapa, Hoshangabad	41.3	20.7	10.7	9.0	8.1	6.2
F.	12.11.29.145 Pachmiri, Hoshangabad. 5 roots M. 1	43.2	21.6	11.6 <i>circa</i>	8.7	8.3	6.1 <i>circa</i>
F.	13.4.11.98 Sivasamudram, Mysore	40.7	20.6	10.3	8.7	8.1	6.4
F.	15.4.3.100 Paresnath, Hazaribagh	44.0	21.6	11.2	9.2	8.2	6.3 <i>circa</i>
F.	15.4.3.101 Paresnath. Old. M. 1 5-rooted	42.3	21.2	10.6 <i>circa</i>	9.3	8.4	?
F.	15.4.3.102 Paresnath	41.8	21.0	10.3	8.9	8.3	6.2
M.	15.4.3.105 Lonra, Hazaribagh. Old. M. 1 5-rooted	41.9	20.5	10.1	8.7	8.2	6.4
M.	19.6.3.70 Khandalla, Western Ghats	41.0	20.3	9.9	8.1	7.6	6.2
M.	21.11.5.27 Shernelly, Cochin	46.8	23.1	11.7	9.3	7.9	6.4
M.	21.11.5.28 Shernelly, Cochin	45.2	22.0	11.1	8.5	7.1	6.6
M.	21.11.5.29 Shernelly, Cochin. Old	46.5	24.0	12.3	9.8	8.2	6.8
F.	21.11.5.31 Shernelly, Cochin. M. 1 5-rooted. Note unusually short palatal foramina	45.0	22.3	10.9 <i>circa</i>	7.3	8.0	6.3 <i>circa</i>
F.	21.11.5.32 Shernelly, Cochin	44.7	22.2	11.4	8.4	8.2	6.7
M.	25.10.1.48 Machur, Palni Hills	43.2	21.5	10.2	9.0	8.3	6.5
M.	81.3.3.4 Kadapa, Madras. Topotype	41.8	21.5	10.7	9.0	7.8	6.4
F.	3.4.3.6 Mandla	42.0	20.9	10.3	8.6	8.2	6.3

The type skull is in the British Museum; a juvenile specimen.

Dimensions of Rattus blanfordi, in British Museum material.—The head and body length varies between 149 and 195 mm. The tail between 179 and 235 mm. Hindfoot 33–38 mm. The occipitonasal length varies between 38 and 46.8 mm. Toothrow 5.9–6.8 mm.

82. *Rattus norvegicus* (Berkenhout)

The Norway Rat or Brown Rat

1769. *Mus norvegicus* Berkenhout, *Outlines nat. Hist. Gt. Britain and Ireland*, 1, 5. (This reference is not available to me for checking.)
 1779. *Mus decumanus* Pallas, *Nov. Spec. Quad. Glir. Ord.*, 91.
 1814. *Mus decumanoides* Hodgson, *J. Asiat. Soc. Beng.*, 10, 915, *nom. nud.*

Type-locality.—Great Britain.

This species is commensal and is distributed throughout the greater part of the world, owing to accidental human agency. It is not regarded as a native of India by Wroughton, although Blanford under the name *Mus decumanus* included it in his work on Indian Mammals, 'it is certainly not indigenous in India, though now found in all large towns and villages, along the banks of navigable rivers, and on high roads'

It is the common rat of the Palaearctic region. In Europe, in many places, it appears to have almost exterminated *Rattus rattus*. But in Tropical Asia, *R. rattus* is very much the common species and *R. norvegicus* is only very intermittent in occurrence.

With the subgeneric characters of *Rattus* s.s., it is distinguished from *Rattus rattus* by its narrowed braincase and its shortened tail, which is nearly always in Asiatic skins obscurely bicolor, and which is shorter than the head and body almost always. These characters are not combined in *R. rattus*. In old specimens, the ridges of the skull become very heavy and exaggerated, and the zygomatic plate is extremely powerful and strongly thrown forward.

External characters.—Colour above brown, and below, light greyish below in Indian specimens; feet rather light. Tail obscurely bicolor in two skins, dark in a third. Hallux with claw.

External measurements.—

		Head and body	Tail	Hind- foot	Ear
M.	9.4.25.6. Calcutta	250	200	43	16

One skin in bad condition, from Ceylon, no locality, and another from Calcutta.

Cranial characters.—Supraorbital ridges in the typical race enormously powerful and extending right backwards over

the parietals to the occiput, which is high and prominent. Zygomatic plate unusually powerfully thrown forward. Palate long, well over half occipitonasal length. Foramina long relatively, and bullae relatively large. The occipitonasal length varies in our collection between roughly $36\frac{1}{2}$ and 55 mm. Molars not abnormal. No posterointernal cusp in upper molars. Incisors powerful, plain.

Apart from cranial details, this species differs from *R. rattoides* in its short tail. Specimens seen from CALCUTTA and CEYLON.

Cranial measurements.—

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow	Braincase width
<i>Rattus norvegicus norvegicus</i>								
M.	80.11.11.121 . Calcutta. Old	54.3	31.1	16.4	8.6	8.2	7.3	12.7
M.	9.4.25.6 Calcutta	50.7	27.3	14.1	9.0	7.3	7.0	12.9
	92.10.12.18 Calcutta	52.7	28.8	15.0	9.2	8.1	6.8	13.5
	92.10.12.9 Calcutta	49.2	27.3	14.0	9.0	<i>circa</i> 7.6	7.1	13.1

Subgenus (*b*) **Stenomys** Thomas

1910. *Stenomys* Thomas, *Ann. Mag. nat. Hist.*, 6, 507.

Based on *Mus verecundus*, Thomas, from New Guinea.

Distribution, as here understood.—New Guinea, Ceram, Solomon Islands, Celebes, Borneo, Java, Sumatra, Malay States, Siam, Indo-China, TENASSERIM, BURMA, ASSAM, ANDAMAN ISLANDS, Yunnan and Fukien in South China, and Christmas Island, south of Java.

This subgenus, as here understood, consists of rats with smaller bullae than is normal in typical *Rattus*, which are less than 15% of the occipitonasal length. They agree with typical *Rattus* in having the palate long, over half the occipitonasal length; and the palatal foramina are long. This group differs from subgenus *Maxomys* chiefly in having the palate elongated; and almost always the species of *Stenomys* have large, wide molars. The bullae are never so reduced as *Leopoldamys* and the diastema is not so elongated as in *Berylmys*.

Key to the species of subgenus Stenomys in India

1	(2)	The diastema proportionately longer, usually 28% of the occipitonasal length at lowest, 30% at highest. The supraorbital ridges relatively weak.	<i>Rattus bowersi</i>
2	(1)	The diastema is proportionately shorter, usually 27% of the occipitonasal length at highest. Supra-orbital ridges not particularly weak.	2
3	(4)	Tail normally longer than head and body length. (Occipitonasal length usually exceeds 50 mm., very rarely as low as 48 mm.).	<i>Rattus mülleri</i>
4	(3)	Tail apparently shorter than head and body length. (Occipitonasal length about 48 mm.)	<i>Rattus rogersi</i>

R. rogersi is from the Andaman Islands. It may be a race of one of the earlier named forms from the Nicobar or Andaman Islands, which are not represented in the British Museum, and are dealt with at the end of the genus. *R. bowersi* and *R. mülleri* are, so far as I am aware, the two earliest names which are referable to the subgenus, so need no special comparison with extralimital forms.

83. *Rattus mülleri* (Jentink)**Müller's Rat**

1879. *Mus mülleri* Jentink, *Notes Leyden Mus.*, 2, 16.

Type-locality.—Batang Singalan, Sumatra.

Distribution.—TENASSERIM, Malay States, Sumatra, Borneo and small adjacent Islands. Apparently the ANDAMAN ISLANDS and NICOBAR ISLANDS.

This is a somewhat generalized rat, with large size, heavy teeth, long palate, longish palatal foramina, but small bullae; it differs chiefly from *Rattus* s.s. in its smaller bullae. The tail is always longer than the head and body so far as I have had occasion to examine the species; a character to which I attach some importance on account of the fact that it is almost the only character I can find to distinguish this rather widely ranging species from its near ally *Rattus ringens* of New Guinea, Solomon Islands and Ceram, in which the tail has become shortened. The diastema is usually a little shorter proportionately than in *R. bowersi*, and the supra-orbital ridges are strong, well developed and normal. Most

often, but not always, the occipitonasal length exceeds 50 mm. We have about half a dozen races in the British Museum. The second named one, *validus*, has once been taken in Tenasserim. Our material for the typical race is far from representative, but below I have tried to give characters which seem to separate *validus* from it, as far as I can see. There is a skull in our collection from the Andaman Islands which was collected very many years ago and to which there is a skin, which I would also call a form of *mülleri*. Perhaps it represents one of the Andaman forms named by Miller, but at the moment I have not been able to identify it exactly.

In 1951 a specimen was sent to London from the Nicobar Islands which I identified as *mülleri*.

External characters.—Large rats, in British Museum material the head and body length goes up to 269 mm. Tail longer than head and body. Fur harsh but not spiny. (In the Andaman Islands skin written up below as *R. mülleri* subsp. ?, the fur tends to be spiny.) Tail very poorly haired. Digits of hands and feet without peculiarity; all with claws; five toes, four fingers. Six plantar pads, evidently.

Colour.—The Andaman Island skin (dating from 1881, and perhaps faded, and not in a good state) seems to be very light brown above, yellowish-whitish below, with the tail apparently wholly dark. *R. m. validus* is dark grey above, whitish below, with wholly dark tail, and rather dark feet. Sometimes the belly may become slaty.

I have not seen the Tenasserim skin (if it exists) and these notes are based on Malayan specimens, the size of which varies between 190 and 269 mm. head and body (usually over 200); 225 and 309 mm. in tail length; 39 and 68 (?), perhaps 52 mm., hindfoot length.

Cranial characters.—Largish rats, the occipitonasal length about 47–60 mm. Rostrum rather pointed and nasals tend to be narrow behind. The frontals have powerful supra-orbital ridges each side, and these ridges extend backwards over the parietals to a greater or lesser extent. Interparietal large and well developed. Occiput rather strong and up-standing. Bullae quite well inflated, but small, in the better represented races averaging 12–13% of the occipitonasal length. Palate long, well over half the occipitonasal length. Pterygoid fossae medium to rather deep. Palatal foramina long, usually extending to the toothrows, usually approximating to about 17% of the occipitonasal. Zygomatic plate rather well cut back above. Mandible with well-developed coronoid process; the lower border well ridged; and the

lower incisor root visible on the outer side of the jaw, though not forming a powerful knob.

Dental characters.—Upper incisors red, rather powerful and plain. Upper molars heavy; width of M. 1 often as much as 3 mm. or approximating to it; M. 1 with eight cusp spaces (lacking only the posterointernal); M. 2 with apparently seven cusp spaces in the better known races (the anterior lamina being represented by the anterointernal cusp and also by a small anteroexternal cusp); M. 3 but little reduced, with anterointernal cusp and two laminae behind it. Lower molars without special peculiarity.

M. 1 upper normally 5-rooted. I have seen a specimen, however, which seems to have it with four roots both sides, owing to apparent fusion of the two inner roots.

Cranial measurements.—

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus mülleri validus</i>							
M.	14.12.8.213	57.4	29.7	14.8	10.5	7.4	9.6
Thaget, Tenasserim. Width of M. 1 is 2.9 mm.							
<i>Rattus mülleri</i> subsp. ?							
F.	81.11.10.14	54.2	29.8	15.6	9.8	7.8	8.2
Andaman Islands. Very old. Width of M. 1 is 2.3 mm., teeth much worn							

Dimensions of Rattus mülleri, in British Museum material, all races included.—The occipitonasal length varies between 47.9 and 59.9 mm. Toothrow 7.5–9.6 mm. The head and body varies between 170 and 269 mm., the tail between 203 and 309 mm. Hindfoot 39–58 mm.

Provisional key to the two forms which might belong in R. mülleri represented in the British Museum

- 1

(2) Bullae approximately 12% of the occipitonasal length. Width of M. 1 approximates (in the Indian specimen) to 2.9 mm. Diastema proportionately shorter. Back dark grey.

R. m. validus
- 2

(1) Bullae approximate to 14% of the occipitonasal length. Width of M. 1 (teeth much worn) about 2.3 mm. Diastema proportionately longer. Back light brown.

[Andaman Islands
R. m. ? subsp. ? from

Possibly the last represents *Rattus taciturnus* Miller.

The races of *Rattus mülleri*.—The Tenasserim form, *R. m. validus*, requires comparison with the typical Sumatran race. Unfortunately we do not possess unbroken skulls for this. Our specimens of *validus* may be easily distinguished from our one skull for *mülleri* by relatively larger toothrow and longer palatal foramina. The teeth are longer in *validus* than in our Borneo specimens (*borneanus*) also. But we have not very many specimens for any of the races.

(i) *Rattus mülleri validus* (Miller)

1900. *Mus validus* Miller, *Proc. biol. Soc. Wash.*, **13**, 141.

Type-locality.—Trang, Siamese Malaya.

Range.—Specimens seen from TENASSERIM, Thaget. Perak, Maxwells Hill. Johore, no exact locality; Selangor: Cheras and Semangkoh Pass; Malacca, no locality; Trang, Lamra, and SW Siam, Maprit Patinju.

(ii) *Rattus mülleri* subsp. ?

One specimen from ANDAMAN ISLANDS, no exact locality. This differs from the last in much lighter colour, light brown instead of dark grey, proportionately larger bullae, narrower molars and longer diastema. It seems, although not close to *validus*, to be nearer *R. mülleri* than any other species of *Rattus* with which I am acquainted.

I imagine that this is the specimen mentioned by Blanford (1891, p. 410), 'A single specimen from the Andamans in the British Museum belongs either to a variety of *M. bowersi* or to a closely allied form'

84. *Rattus rogersi* (Thomas)

1907. *Mus rogersi* Thomas, *Ann. Mag. nat. Hist.*, **20**, 206.

Type-locality.—North of Ike Bay, west coast of South Andaman Island.

The type examined.

Perhaps a race of *Rattus pulliventer* Miller, from the Nicobar Islands but said to differ from that in larger size and markedly bicolor tail. I am not at all sure of the status of this species, which seems only known by the type. Mammae said to be 1-3 = 8. Apparently essentially like *R. mülleri* but with the tail shorter than the head and body. It can only be separated on average skull characters from

certain forms of *R. ringens* from New Guinea or the Solomon Islands which antedate it, and further fresh specimens are badly needed before its true characters can be assessed. The occipitonasal length of the type is about 48 mm.

External characters.—Mammae 1-3 = 8. Fur spiny. Above, the colour is rather light brown; underparts dull, yellowish or greyish. Tail dark above, pale below. Plantar pads 6. Hallux clawed (four fingers, five toes as usual). Tail shorter than head and body.

External measurements.—

	Head and body	Tail	Hind- foot	Ear
<i>Rattus rogersi</i>				
North of Ike Bay, South Andaman Island. Type	195	188	41	28

Cranial characters.—Essentially similar to *R. mülleri* as described above. The palatal foramina of the type and only specimen available to me are markedly narrow in front. The teeth of the type are worn and simple, but M. 2 seems to lack the anteroexternal cusp and the last lamina of M. 1 and M. 2 is broad, almost suggesting that the posterointernal cusp could be present.

Cranial measurements.—

	Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus rogersi</i>						
F. 6.4.13.2	48.0	26.0	13.2	9.0	6.9	7.7
North of Ike Bay, South Andaman Island. Type. Width of M. 1 is 2.2 mm.						

Dimensions of Rattus rogersi, known only by one specimen.—Occipitonasal length 48 mm., toothrow 7.7 mm., head and body 195 mm., tail 188 mm., hindfoot 41 mm.

85. *Rattus bowersi* (Anderson)

Bowers' Rat

1879. *Mus bowersi* Anderson, *Zool. Res. Yunnan*, 304.

Type-locality.—Hotha, Yunnan.

Range.—Yunnan, Fukien, ASSAM, BURMA, Indo-China, Siam, Malay States.

This rat, which has the long palate, small bullae and longish palatal foramina of the present group, is most easily distinguished by its unusually weak supraorbital ridges (in proportion to the size of the animal), which give a peculiar and characteristic aspect to the superior view of the skull. There are two groups of races, one of which, the typical, is large, occipitonasal length up to about 59 mm., the other, typified by *mackenziei*, is small, occipitonasal length as small sometimes as 40 mm. M. 1 is 5-rooted. The diastema averages a little longer proportionately than in *R. mülleri*. The lower incisor root forms a slight but evident process on the outer side of the lower jaw. This and the characters of the weak supraorbital ridges lead on towards the sub-genus *Berylmys* (*Rattus manipulus*), which may be an offshoot from one of the smaller races of *R. bowersi*, but it is always distinguishable by its even longer diastema due to the more proodont incisors. In *bowersi* the tail most often exceeds the head and body length, and is of two colours and the colour of the body is usually grey above, white below. According to Thomas, the mammae are 8 or 10 in the present species.

External characters.—Medium sized to large rats. Fur moderately soft. Ear quite large, usually more than one-tenth head and body length. Tail usually longer than head and body, not very well haired. Hand with four clawed fingers, the fifth one the shortest. Foot with five toes, all clawed; the centre three longer than the outer two; fifth toe longer than hallux; six plantar pads apparently.

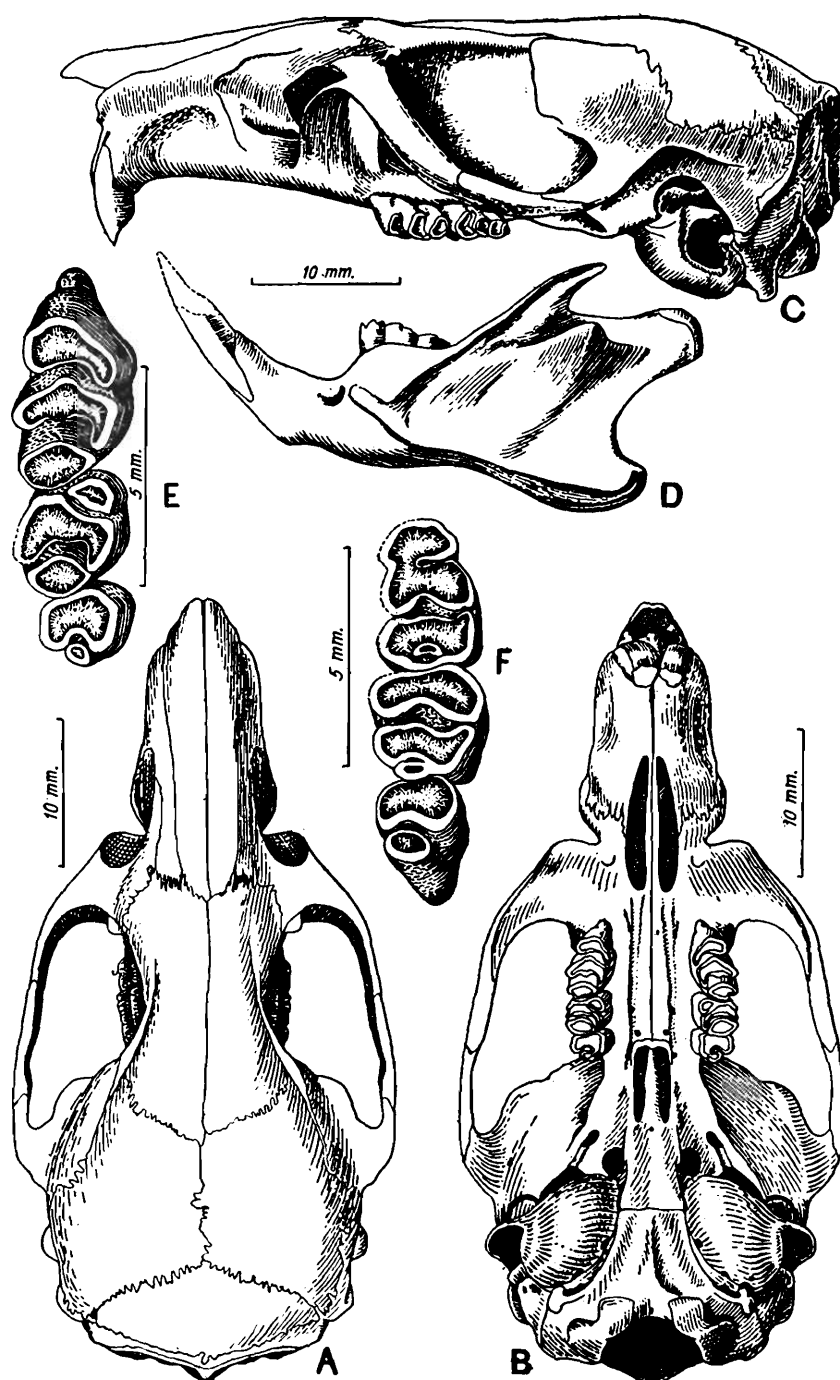
Colour.—The back is dark brown or grey. It appears some grey specimens have been called '*latouchei*' which is supposed to be a paler form than true *bowersi*. I am not disposed to recognize more than one large form in India. Some '*latouchei*' skins are quite indistinguishable from at least one *bowersi* and I think individual variation would probably cover any colour differences. The feet tend to have the digits white. Tail dark above basally, pale (whitish) terminally, as a rule; below, it is sometimes the same, sometimes tending to be wholly pale. Underparts white.

External measurements.—As in Table 71, below.

Notes from skins.—*R. b. mackenziei*, Chin Hills, weight 8 oz., 12 oz. and 14 oz. Hills east of Nam Tisang, 'caught in jungle'

R. b. bowersi, Chin Hills, weight 15 oz.

According to Thomas, there are 8 mammae in *bowersi*, 10 mammae in *mackenziei*,



TEXT-FIG. 37. *Rattus bowersi bowersi* (Anderson), ♀ A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. E, upper molar crowns of right side, in surface view. F, lower molar crown of right side, in surface view. (After Roonwal, 1950, Pl. IV.)

TABLE 71.—*External measurements of the Indian races of Rattus bowersi*

	Head and body	Tail	Hind- foot	Ear	
<i>Rattus bowersi bowersi</i>					
F. Nam Tamai Valley, N. Burma ('latouchei')	255	270	50	33	
F. Nam Tamai Valley	238	249	54	34	
F. 50 miles west of Kindat, Burma	236	271	54	33½	
F. 50 miles west of Kindat	246	268	54	34½	
Other skins from Mokokchung in Naga Hills, Kindat, Burma and Machi, Manipur.					
<i>Rattus bowersi mackenziei</i>					
M. 50 miles west of Kindat	238	254	48	30	
F. 50 miles west of Kindat	243	246	48	28	
M. 50 miles west of Kindat	216	245	46	29½	
F. Hills east of Nam Tisang, North Burma	240	255	52	32	
F. Locality ?	215	243	47	29	
F. 50 miles west of Kindat. Type	234	248	48	30½	Mammae 3-2 = 10. Contained 4 young.
<i>Rattus bowersi mackenziei</i> ('wellsi')					
Mawphlang, Khasi Hills, Assam. Type	197	220	48	33	Weight 6.75 oz.

Some further skins from the Frost collection :

<i>Rattus bowersi mackenziei</i>					
Frost collections—					
M. Naga Hills	220	240	48	30	
M. Naga Hills	165	193	43	28	
M. Naga Hills	170	210	45	28	
M. Naga Hills, 5,000 ft.	155	?	45	28	
M. Naga Hills	170	198	45	28	
M. Naga Hills	195	232	48	29	
M. Naga Hills	200	?	45	30	
M. Naga Hills	198	240	48	28	
M. Naga Hills	175	198	42	28	
M. Naga Hills	175	170	42	26	
M. Naga Hills	180	175	40	25	
M. Naga Hills	170	150	40	25	
Naga Hills	205	233	46	29	
Naga Hills	210	215	47	28	
M. Naga Hills	185	210	45	28	
M. Naga Hills	190	225	45	28	
M. Naga Hills	190	205	45	28	

TABLE 71.—*External measurements of Rattus bowersi (concl'd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Rattus bowersi mackenziei</i> (concl'd.)				
M. Bishampur, Manipur, 3,000 ft.	180	215	45	30
M. Bishampur	198	217	48	30
Bishampur, 3,500 ft.	160	190	43	26
M. Naga Hills	195	237	45	27
M. Naga Hills	180	?	45	28

Cranial characters.—The occipitonasal varies between about 40 mm. and about 59 mm. The typical race averages consistently larger than *R. b. mackenziei*, which is the best known of the smaller races. The rostrum is long and pointed and the nasals are usually narrowed posteriorly. The frontals are not much constricted, and rather evenly divergent backwards. Supraorbital ridges are present, but are weak in proportion to the size of the animal, often very weak, which gives the skull a somewhat characteristic appearance, enabling it to be easily distinguished from allied species of the genus. The ridges are usually not continued on to the parietals. Interparietal large in *R. b. bowersi*, apparently rather smaller and shorter in *R. b. mackenziei*. Occiput quite high. Bullae moderately well inflated, but small, roughly 13-14% of the occipitonasal length. Pterygoid fossae moderately deep. The palate is long, always more than half the occipitonasal length. Palatal foramina rather long, approximating to 18% of the occipitonasal length or a little more or less. Zygomatic plate slightly cut back above. Mandible with well developed coronoid process. The lower incisor root forms a slight but evident knob on the outer side of the jaw, well below the condylar process. Lower border of the jaw well ridged.

Dental characters.—Upper incisors orthodont, usually yellow (rarely very pale, as sometimes in *mackenziei*) and plain. Upper molars without peculiarity; eight cusp spaces in M. 1, six in M. 2; M. 3 with the anterointernal cusp, and two laminae behind it; this tooth is medium in size. M. 1 5-rooted. Lower molars without peculiarity; M. 1 with three laminae and terminal heel, M. 2 with two laminae and terminal heel, M. 3 bilaminate; biserially cuspidate as usual. The cusps of the teeth in this species are not very angular or well marked.

Cranial measurements.—As in Table 72, below.

TABLE 72.—*Cranial measurements of the Indian races of Rattus bowersi*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus bowersi bowersi</i>							
	16.3.26.68	56.5	29.8	17.6	11.8	8.2	?
	Chin Hills, Burma.	Old.	M. 1	5-rooted.	(Diastema		
				approximate.)			
	20.6.6.19	56.6	29.3	16.4	9.6	8.3	9.0
	Mokokchung, Naga Hills, Assam.			Foramina measurement =			
	shorter side						
F.	20.6.6.20	55.6	28.7	16.6	11.0	?	8.7
	Mokokchung						
F.	32.11.1.85	59.5	30.6	17.7	11.4	8.1	9.1
	Nam Tamai, Upper Burma ('latouchei')						
F.	32.11.1.86	54.7	28.5	15.6	10.2	7.5	8.3
	Nam Tamai ('latouchei')						
<i>Rattus bowersi mackenziei</i>							
M.	15.5.5.246	45.8	24.8	13.7	8.7	6.5	8.0
	Haingyan, East Manipur.						
					The foramina measurement =		
	shorter side						
M.	16.3.26.61	50.6	26.3	14.9	9.7	6.9	7.8
	50 miles west of Kindat						
M.	16.3.26.62	50.6	26.7	14.8	9.5	6.7	8.1
	Chin Hills, Burma					circa	
M.	16.3.26.63	51.2	27.1	15.2	9.2	6.2	8.3
				circa			
	50 miles NW. of Chin Hills.	Old.	M. 1	5-rooted			
F.	16.3.26.64	50.6	26.5	15.3	9.4	7.3	8.2
	50 miles west of Kindat						
F.	16.3.26.64	44.6	23.2	12.4	7.7	6.4	7.5
	Chin Hills. Rather young						
F.	16.3.26.66	48.4	25.7	14.4	8.6	6.4	8.5
	Manipur						
F.	32.11.1.83	52.0	27.3	15.0	10.4	7.1	8.7
	Nam Tisang, Upper Burma						
The type has the occipitonasal length about 50.6 mm.							
<i>Rattus bowersi mackenziei</i> ('wellsi')							
F.	20.11.1.56	47.1	24.8	13.2	8.3	7.0	8.2
	Mawphlang, Khasi Hills, Assam.						
	Type						
<i>Rattus bowersi mackenziei</i>							
Frost collections—							
M.	204	51.7	26.4	14.8	9.2	6.4	8.2
	Naga Hills, Assam						
M.	205	44.2	23.1	12.4	7.9	6.0	7.4
	Naga Hills						

TABLE 72.—*Cranial measurements of Rattus bowersi (concl'd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus bowersi mackenziei</i> (concl'd.)							
M.	206	44.6	23.4	12.5	8.0	6.2	7.6
	Naga Hills						
M.	223	42.5	22.6	11.9	7.6	6.4	7.9
	Naga Hills.					<i>circa</i>	
M.	224	48.1	24.1	13.1	8.4	6.6	8.0
	Naga Hills					<i>circa</i>	
M.	225	49.1	25.6	13.8	8.4	6.6	8.4
	Naga Hills.						
M.	240	45.4	24.0	13.1	8.7	6.5	7.8
	Naga Hills						
M.	241	43.4	23.1	12.2	8.1	6.3	7.3
	Naga Hills						
M.	273	42.0	22.3	11.5	8.5	6.1	7.4
	Naga Hills						
M.	274	41.5	21.7	10.9	8.0	6.1	7.2
	Naga Hills					<i>circa</i>	
M.	275	40.5	21.3	11.3	8.0	6.0	7.3
	Naga Hills						
M.	280	47.0	24.3	13.1	8.9	6.5	7.8
	Naga Hills						
M.	281	46.5	24.4	12.9	9.1	6.4	7.9
	Naga Hills						
M.	282	45.0	23.5	12.5	8.8	6.3	7.8
	Naga Hills						
M.	318	46.4	24.6	13.6	8.8	6.6	7.8
	Naga Hills						
M.	319	44.3	23.3	12.4	8.1	6.3	7.6
	Naga Hills						
M.	462	45.9	24.8	13.3	8.1	6.6	7.6
	Bishampur, Manipur						
M.	463	46.0	24.2	13.0	8.2	6.4	7.4
	Bishampur, Manipur						
M.	239	45.6	23.8	12.6	8.7	6.8	7.9
	Naga Hills						
<i>Rattus bowersi feae</i>							
	88.12.1.47	49.9	26.5	15.2	9.0	7.0	8.4
	Thagata, Tenasserim, type						

Dimensions of Rattus bowersi, all specimens included, in British Museum material.—The occipitonasal length varies between 40.5 and 59.5 mm. The toothrow 6.4–9.5 mm. The head and body length varies between 155 and 285 mm. Tail between 150 and 310 mm. Hindfoot 40–53 mm,

Key to the Indian races of R. bowersi

1	(2)	The occipitonasal length not under 53 mm. in fully adult skulls, and only once under 54 mm. in British Museum material (young skulls not included)	<i>R. b. bowersi</i>	
2	(1)	The occipitonasal length 52 mm. and less, but only once reaching 52 mm. in British Museum material, and most often under 50 mm.. ..		3
3	(4)	Tail (according to published measurements) exceeds 260 mm. in length; hindfoot (according to published measurements) 51-52 mm.	<i>R. b. feae</i>	
4	(3)	Tail length less than 260 mm. Hindfoot (with one exception in 29 skins), not reaching 50 mm.. ..	<i>R. b. mackenziei</i>	

Besides the two well-known races, there are two very little known forms, '*wellsi*' from Assam, which I think will prove a synonym of *mackenziei*, and *feae* of Tenasserim. *Wellsi*, based on a single specimen, with the occipitonasal length about 47 mm., was thought to be distinguishable from *mackenziei*, by its smaller skull and its 'large smooth braincase and small muzzle'. However, many skulls of the largish collection brought home by Frost for *R. b. mackenziei* are smaller than the type of *wellsi*; this series varies in occipitonasal length between 40.5 and 51.7 mm. *R. b. feae* from Tenasserim is based on about two examples. It is widely separated geographically from the other *mackenziei*-like races; its occipitonasal length is just under 50 mm. The type is in spirit. It is said to differ from *mackenziei* by having larger tail and feet, and having only the extreme tip of the tail white.

Thomas's dimensions are: head and body 215 mm. (type); tail 261 mm. (type, and 285 mm. in another specimen); hindfoot 51-52 mm. These tail and feet measurements exceed the normal for *mackenziei* and it seems reasonable to retain this little known race. The diastema of the type is long, 30% of the occipitonasal length.

Extralimital named forms are *R. b. latouchei* from Fukien, which seems almost certainly a synonym of the typical race, and *R. b. ferreocanus* Miller, of the Malay Peninsula. Adult skulls of the latter measure in occipitonasal length approximately 53 mm. Their bullae seem smaller proportionately than in *bowersi*.

Glover Allen thought that *mackenziei* might be based on young specimens of *bowersi*, but the large new series in the

Frost collection for *mackenziei* seems to prove conclusively that this is not the case, but there are really two races, a smaller, western, and a larger, eastern, one.

Indeed the possibility that, owing to geographical overlap with the larger race, *mackenziei* may have to be given specific rank cannot be dismissed.

(i) *Rattus bowersi bowersi* (Anderson)*

Text-fig. 37

1879. *Mus bowersi* Anderson, *Zool. Res. Yunnan*, 304.

1897. *Mus latouchei* Thomas, *Ann. Mag. nat. Hist.*, 20, 113.
(Kuatun, Fukien, China.)

Type-locality.—Hotha in Yunnan.

Range.—Specimens examined from ASSAM: Mokokchung, Naga Hills. MANIPUR, Machi. BURMA: 50 miles west of Kindat, Kindat, Nam Tisang Valley and Nam Tamai Valley, North Burma. Laos: Xieng-khouang. Tonkin: Backan, Chapa and Ngai-tio. Fukien: Kuatun.

Large race: adult skulls with the occipitonasal length not under 53 mm. Hindfoot normally 54 mm. and more.

(ii) *Rattus bowersi mackenziei* (Thomas)†

Text-fig. 38

1916. *Epimys mackenziei* Thomas, *J. Bombay nat. Hist. Soc.*, 24, 3, 410.

1921. *Rattus wellsi* Thomas, *J. Bombay nat. Hist. Soc.*, 28, 1, 26.
(Mawphlang, Khasi Hills, 5,500 ft., Assam.)

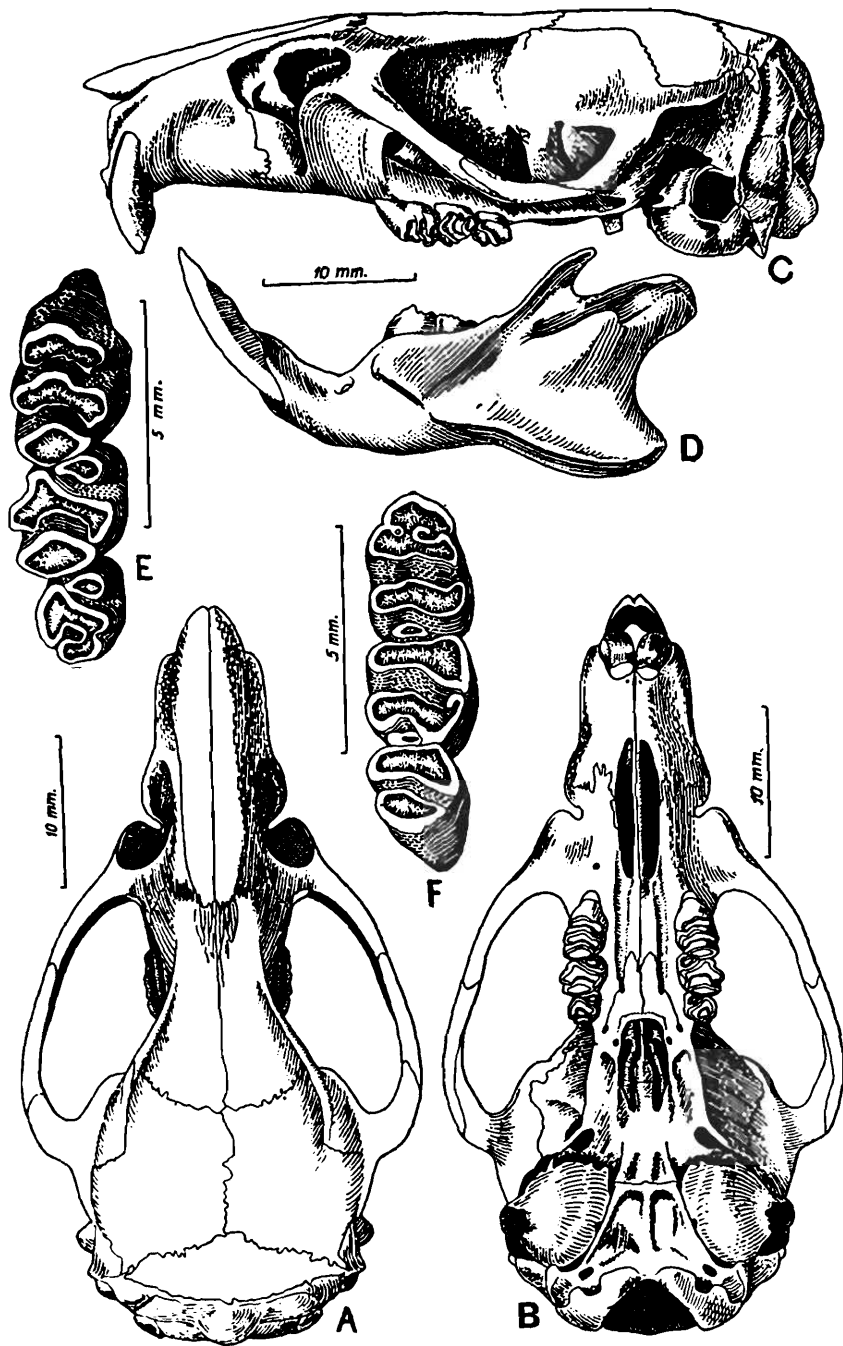
Type-locality.—Haingyan, 50 miles west of Kindat, Chin Hills, Burma.

Range.—Specimens examined from BURMA: Hills east of Nam Tisang; 50 miles west of Kindat; Haingyan. MANIPUR: Bishampur. ASSAM: Naga Hills and Khasi Hills (skin). The type-locality of '*wellsi*' is Mawphlang, Khasi Hills, Assam, 5,500 ft., whence seen.

* See Roonwal, M. L., 1950, *Rec. Indian Mus.*, Delhi, 47 (1), pp. 34-35 and Pl. IV, for skull measurements and drawings of the holotype specimen which is in the Zoological Survey of India, Calcutta.—EDITOR.

† Also see Roonwal, M. L., 1950, *Rec. Indian Mus.*, Delhi, 47 (1), pp. 32-33; 47-48 and Pl. V, for some specimens from Manipur.—EDITOR.

Smaller race: adult skulls rarely as much as 52 mm. in occipitonasal length. Hindfoot less than 50 mm. normally.



TEXT-FIG. 38. *Rattus bowersi mackenziei* (Thomas), ♂. A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. E, upper molar crowns of right side, in surface view. F, lower molar crowns of right side, in surface view. (After Roonwal, 1950, Pl. V.)

(iii) **Rattus bowersi feae** (Thomas)

1916. *Epimys mackenziei feae* Thomas, *J. Bombay nat. Hist. Soc.*,
24, 3, 412.

Type-locality.—Tnagata, Muleyit Range, Tenasserim.

The type specimen examined.

Much like *mackenziei*, but from published measurements tail actually longer. Hindfoot 51-52 mm.

Subgenus (c) **Berylmys** Ellerman

1947. *Berylmys* Ellerman, *Proc. zool. Soc. Lond.*, 117, 1, 261, 267.

Type.—*Epimys manipulus* Thomas.

Range.—ASSAM, WEST BURMA, TENASSERIM and Siam.

Rattus rats with proodont incisors, in which the diastema is lengthened, over 31% of the occipitonasal length, normally, and sometimes approaching one-third of this length. The difference between this group and *R. bowersi* (of the subgenus *Stenomys* as here understood) is not great; but there is the small difference of elongated diastema between the two present species and the whole of the rest of *Rattus* in Asia and Australia that makes me think it is reasonable to give *manipulus* and *berdmorei* subgeneric rank. *R. berdmorei* is the more extreme of the two, but is so little known and so poorly represented in our collection that I made *manipulus*, which I know well, the type of the subgenus. In these rats, the palate is long, well over half the occipitonasal length; the palatal foramina are long, about 19-21% of the occipitonasal length; the bullae vary, being very large in *R. berdmorei* (roughly 20% of the occipitonasal where ascertainable), but quite small in *manipulus* (roughly 14-15%). The lower incisor root forms quite a prominent knob on the outer side of the lower jaw. M. 1 is 5-rooted (*manipulus*). The mammae are apparently 10 (*manipulus*). The occipitonasal length of *manipulus* seems to be usually roughly 36-41 mm., occasionally a little smaller. Supra-orbital ridges weak.

Key to the species of the subgenus Berylmys

1	(2) Length of the bullae less than 6 mm. (Roughly 14-15% of the occipitonasal length)...	<i>Rattus manipulus</i>
2	(1) Length of the bullae exceeds 7 mm. (As far as ascertainable, roughly 19-20% of the occipitonasal but the material available is not representative).	<i>Rattus berdmorei</i>

86. *Rattus manipulus* (Thomas)*

The Manipur Rat

1916. *Epimys manipulus* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 3, 413.

(*Mus berdmorei*, in part, of Blanford, 1891, *Fauna Brit. India, Mamm.*, p. 410.)

Type-locality.—From 20 miles west of Kindat, Kabaw Valley, North Burma.

Remarkable for its elongated diastema and proodont incisors, and with the characters of the subgenus as above. Bullae small, less than 6 mm. in length, and about 14-15% of the occipitonasal, which is the chief distinction between this and *R. berdmorei*.

External characters.—Medium sized rats, head and body less than 200 mm. Fur rather soft. Tail not very well haired, most often rather longer than the head and body. Hand with four functional fingers, all bearing claws; fifth finger shorter than the second which is shorter, as a rule, than the middle two. Foot with five toes, all clawed; the fifth toe longer than the hallux but rather noticeably shorter than the middle three. Six plantar pads. Mammae apparently 10.

Colour.—Above, grey; feet, as a rule, whitish or light. Underparts white. Tail usually wholly pale at end; dark above, pale below basally.

External measurements.—As in Table 73, below.

TABLE 73.—*External measurements of Rattus manipulus manipulus*

		Head and body	Tail	Hind- foot	Ear
F.	6 miles west of Kindat, West Burma	148	157	34	23
	6 miles west of Kindat	171	148	34	24
	6 miles west of Kindat	185	185	35	23
M.	6 miles west of Kindat	159	163	34½	23½
M.	6 miles west of Kindat	160	175	37	24
M.	6 miles west of Kindat	180	174?	31	25
M.	10 miles SW. of Kindat	140	165	33½	23
F.	6 miles west of Kindat	157	178	35½	23½
F.	6 miles west of Kindat	158	170	35½	23½

Other skins from Hopum Thal, Manipur. One skin has mammae 3-2 = 10.

* Also see Roonwal, M. L., 1950, *Rec. Indian Mus.*, Delhi, **47** (1), pp. 28-35; 41-47 and Pl. III, for taxonomic details; and 1949, *Trans. nation. Inst. Sci. India*, Calcutta, **3** (2), pp. 100-103 and Pl. 4, Fig. 3, for biology and ecology.—EDITOR.

TABLE 73.—*External measurements of Rattus manipulus manipulus (concl'd.)*

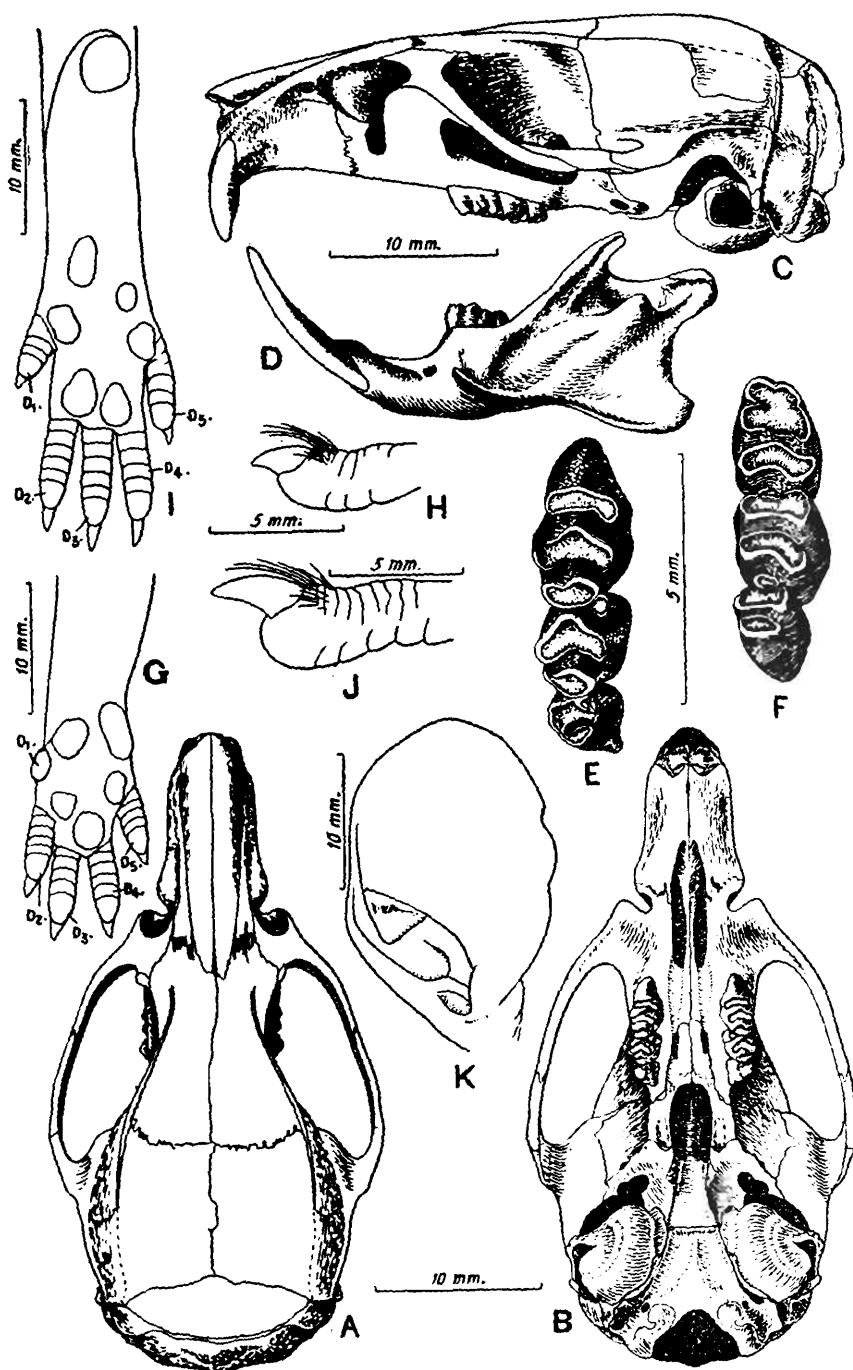
	Head and body	Tail	Hind- foot	Ear
F. Kabaw Valley, 20 miles west of Kindat. Type	182	181	37 Weight 5 oz.	24½
Frost collections—				
M. Bishampur, Manipur	180	187	34	25
F. Bishampur	145	145	32	25
F. Bishampur	150	150	33	24
F. Bishampur	155	152	33	24
M. Bishampur	165	165	30	25
M. Bishampur	135	140	30	24
M. Bishampur	146	160	34	25
M. Bishampur	150	160	35	25
M. Bishampur	145	150	33	25
M. Bishampur	140	148	34	24
M. Bishampur	140	165	35	25

Notes from skins.—Hopum Thal, Manipur, mammae 3–2 = 10. 'Dug up from near a bamboo root; stomach full of seeds (?) and an insect'

Cranial characters.—Medium size, occipitonasal roughly 36–41 mm. Rostrum moderately pointed; frontals moderately constricted; the ridges on the frontals very weak as a rule. Suture of frontals and parietals nearly straight, slightly projected forwards at sides. Interparietal wide, but rather short from before backwards. Occiput high, though not well ridged. Bullae of small medium size, roughly 14–15% of the occipitonasal length. Pterygoid fossae moderately deep. Palate long, always well over half the occipitonasal length (nearly 55% as a rule). Diastema noticeably elongated, approaching one-third of the occipitonasal length, always over 30% of it. Palatal foramina long, roughly 19% of the occipitonasal length, though not extending to the toothrows. The zygomatic plate is cut back above. Mandible with well developed coronoid process, and quite a prominent knob formed by the root of the lower incisor on its outer side, below the condylar process.

Dental characters.—Upper incisors proodont, white and usually plain (or not clearly grooved). Upper molars rather simple; M. 1 with spaces for eight cusps and M. 2 for six (the anterointernal is all that remains of the front lamina); M. 3 rather small; but evidently originally trilaminate. Lower molars biserially cuspidate and without any very marked peculiarities; terminal heel of M. 1 and M. 2 present. First upper molar is 5-rooted.

Cranial measurements.—As in Table 74, below.



TEXT-FIG. 39. *Rattus manipulus manipulus* (Thomas), ♂. A, B, C, dorsal, ventral and lateral view of skull. D, outer side view of left mandible. E, upper molar crowns of right side, in surface view. F, lower molar crowns of right side, in surface view, ♂. G, lower view of right hand. H, side view of mid-finger (D_3) of right hand. I, lower view of right hindfoot. J, side view of mid-toe (D_2) of right hindfoot. K, left ear. (After Roonwal, 1950, Pl. III.)

TABLE 74.—*Cranial measurements of Rattus manipulus manipulus*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
M.	16.3.26.69 . 10 miles SW. of Kindat, Burma	36.1	19.7	11.3	7.0	5.6	5.7
M.	16.3.26.70 6 miles west of Kindat. Old	40.8	22.5	14.2	7.8 <i>ca.</i>	5.5	5.8
M.	16.3.26.71 6 miles west of Kindat. M. 1 5-rooted	39.3	21.7	12.9	7.4	5.9	5.8
M.	16.3.26.73 . 6 miles west of Kindat	39.0	21.3	12.9	7.8	5.7	5.5
F.	16.3.26.75 6 miles west of Kindat	37.8	20.7	12.3	6.9	5.4	5.7
F.	16.3.26.76 . 6 miles west of Kindat. The foramina measurement represents the shorter side	36.1	19.8	11.4	7.0	5.8	5.8
F.	16.3.26.77 . 6 miles west of Kindat. The foramina measurement represents the shorter side	37.5	20.5	12.2	7.1	5.7	5.9

The type has the occipitonasal about 41.2 mm., the diastema 13.8 mm. Condylbasal shorter than occipitonasal length in all specimens.

Frost collections—

M.	378 Bishampur, Manipur	40.3	22.3	13.7	7.8	5.4	5.5 <i>circa</i>
F.	394 Bishampur	37.2	20.7	12.0	7.6	5.6	5.8
F.	396 Bishampur	36.7	20.3	11.6	7.0	5.5	5.8
M.	397 Bishampur. Foramina measurement = longer side	38.0	20.9	12.0	7.3	5.5	5.5
M.	437 Bishampur	37.9	20.3	11.7	6.8	5.8	5.9
M.	439 Bishampur. Foramina measurement = longer side	37.4	20.5	11.8	7.3	5.6	5.9
M.	438 Bishampur	37.9	20.9	12.0	7.2	5.6	5.8
M.	440 Bishampur. Foramina measurement = longer side	37.0	19.9	11.5	7.2	5.6	5.7
M.	400 Bishampur. Foramina measurement = longer side	34.6	19.0	11.2	6.5	5.6	5.6
F.	395 Bishampur	36.7	20.2	11.6	6.9	5.7	5.8

Dimensions of Rattus manipulus, in British Museum material.—The occipitonasal length varies between 34.6 and 41.2 mm. Toothrow 5.4–5.8 mm. The head and body length varies between 135 and 185 mm. Tail between 140 and 187 mm. Hindfoot 30–37 mm.

(i) ***Rattus manipulus manipulus*** (Thomas)*

Text-fig. 39

1916. *Epinys manipulus* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 3, 413.

Type-locality.—From 20 miles west of Kindat, Kabaw Valley, North Burma.

Range.—Specimens examined from 6 miles west of KINDAT, 10 miles SW of KINDAT. MANIPUR: Hopum Thal and Bishampur.

(ii) ***Rattus manipulus kekrimus*** Roonwal†

1948. *Rattus manipulus kekrimus* Roonwal, *Proc. nation. Inst. Sci. India*, **14**, 386.

Type-locality.—Kekrima, about 10 miles SE. of Kohima, Naga Hills district.

Roonwal (1948) separated a form occurring in Manipur as *Rattus manipulus kekrimus*, from Kekrima, circa 5,390 ft. altitude, about 10 miles SE. of Kohima, Naga Hills district, Assam, to which the under-mentioned specimens may belong. It is described as differing from the typical race in having the dorsum paler, the tail longer, the skull smaller (mean condylobasal 36.9 mm.) and the palatal foramina smaller, averaging 19.1% of the condylobasal; the length of the upper molars greater (17.1% instead of 14.9%).

A possible new race.—

In the Frost collection, there are two rats from the Naga Hills, Assam, 5,000 ft., occurring with *Rattus bowersi mackenziei*, which might represent a new race of *Rattus manipulus*. I am not entirely sure that they are adult and their diastema length is rather too short for *manipulus*. They are smaller than *bowersi mackenziei*. I refrain from naming them until more specimens come to hand. Colour much as in *manipulus*.

* Also see Roonwal, M. L., 1950, *Rec. Indian Mus.*, Delhi, **47** (1), pp. 28–35; 41–47, etc. for taxonomic details; and 1949, *Trans. nation. Inst. Sci. India*, Calcutta, **3** (2), pp. 100–103, Pl. 4, for biology and ecology.—EDITOR.

† Also see Appendix below; and Roonwal, M. L., 1950, *Rec. Indian Mus.*, Delhi, **47** (1), pp. 32–35 and 45–47, for further taxonomic details.—EDITOR.

External measurements.—

	Head and body	Tail	Hind- foot	Ear
Frost collections—				
M. 211 Naga Hills	120	154	34	22
M. 212 Naga Hills	145	150	32	23

Cranial measurements.—

	Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
Frost collections—						
M. 212 Naga Hills	34.9	19.0	10.6	6.7	5.3	5.6
M. 211 Naga Hills.	35.1	19.2	10.5	6.6	5.4	5.9
Supraorbital ridges rather weak						

87 *Rattus berdmorei* (Blyth)

The Grey Rat

1851. *Mus berdmorei* Blyth, *J. Asiat. Soc. Beng.*, **20**, 173.

Type-locality.—From Mergui, Burma.

Apparently like *R. manipulus*, but with very large bullae, which are nearly 20% of the occipitonasal length in the sole skull available for measurements, that of *R. b. magnus* Kloss, from Siam. I am not well acquainted with this species and have seen only the type of *magnus* and the type of *R. b. mullulus* Thomas, from Tenasserim, which is not fully measurable cranially, but seems to represent a smaller form than *magnus*. According to Thomas, the toothrow in typical *berdmorei* is 6.5 mm. and its locality is Mergui. In *mullulus*, the toothrow is 6 mm. and its locality is Tenasserim.

The difference in size of the bullae is sufficient to keep *R. manipulus* distinct from this species. The diastema in the type of *magnus* approximates to one-third of the occipitonasal.

External characters.—Based on one extralimital skin from Siam; fur short, crisp. Tail shorter than head and body. Digits normal, hallux clawed. Colour grey above, white below; tail bicolor. Mammae 10.

Thomas gave the following measurements for the type of *R. b. mullulus*, the sole Indian specimen? of *R. berdmorei*

in the British Museum: head and body 170 mm.; tail 140+ (c.) 5; hindfoot 33 mm.; ear 21.5 mm.

Cranial characters.—Based on two type skulls; the rostrum rather pointed and long; supraorbital ridges rather well developed, and tending to extend on the parietals. Occiput high and prominent. Bullae very large and well inflated. Pterygoid fossae deep. Palatal foramina long, approaching toothrows. Palate and diastema long. Zygomatic plate moderately cut back above. Lower jaw with strong coronoid process, well ridged lower border, and the lower incisor root forming an unusually strong knob on the outer side, just below the condylar process. The upper incisors whitish and proodont, plain. Cheekteeth of both skulls available are too worn for exact notes, but apparently without special peculiarity.

Cranial measurements.—

	Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus berdmorei mullulus</i>						
F. 16.2.16.1 .. ?	20.9	12.2	7.8	7.6	6.0	
Thagata, Tenasserim. Type. Condylbasal length about 38.6 mm.						

The only dimensions I can give for this species of measured skins and fully measurable skulls seen are those of the type of *R. b. magnus*, from Siam: head and body 210 mm., tail 182 mm., hindfoot 38½ mm. Occipitonasal about 46.7 mm. and toothrow about 6.6 mm. (crowns). It would appear that the tail is usually shorter than head and body length in this species.

According to Thomas, the three races of *berdmorei* can be keyed thus:

Upper molar series 6.0 mm.	Skull	
39 mm.	North Tenasserim.	<i>R. b. mullulus</i>
Molar series 6.5 mm.	Mergui	<i>R. b. berdmorei</i> (Mergui)
Molar series 6.8 mm.	Skull 46 mm.	<i>R. b. magnus</i> Kloss, SE. Siam

I am not acquainted with the typical race.

(i) *Rattus berdmorei mullulus* (Thomas)

1916. *Epimys berdmorei mullulus* Thomas, *J. Bombay nat. Hist. Soc.*, 24, 3, 413.

Type-locality.—Thagata, Muleyit Range, Tenasserim, The type examined (skull).

Subgenus (*d*) **Maxomys** Sody

1936. *Maxomys* Sody, *Naturk. Tidjschr. Ned. Ind.*, **96**, 55.

Based on *Mus bartelsi* Jentink, from Java.

Range.—As here understood; PUNJAB, NEPAL, ASSAM, BURMA, TENASSERIM, southern and central China, from Yunnan and Fukien northwards through Szechuan, Kansu, Shensi to Shantung and Chihli; Formosa, Indo-China, Siam, Malay States, Sumatra, Java, Borneo, Celebes and New Guinea.

This subgenus contains a large group of *Rattus* rats which have the palate short, averaging less than half the occipitonasal length, and the bullae small, averaging less than 15% of the occipitonasal length, but with the palatal foramina long, averaging more than 16% of the occipitonasal length. They form, I think, the central rather generalized branch of the genus. They differ from *Lenothrix* in having long palatal foramina; from *Stenomys* in having the palate shortened; from *Rattus* s.s. in the smaller bullae, as well as the short palate. The bullae are not so reduced as in *Leopoldamys*, the diastema is not so lengthened as in *Berylmys*, and the foramina are less enlarged than in *Cremnomys*.

The type of the subgenus is *R. bartelsi* from Java. It has less than four roots in M. 1, a very short palate and other peculiarities.

Key to the Indian species of subgenus Maxomys

1	(2)	The length of the palate exceeds 20 mm. The length of the tooth-row is about 6·8 mm. at lowest. Width of M. 1 exceeds 2 mm..	<i>Rattus coringi</i> (ander- ^[soni])	
2	(1)	The length of the palate rarely reaches 20 mm. Length of tooth-row rarely reaches 6·8 mm. Width of M. 1 generally less than 2 mm..		2
		(Most of our specimens of <i>andersoni</i> have the toothrow over 7 mm. The few specimens which have the toothrow as long as 6·8 mm., of those that follow, have the palate less than 20 mm. in length.)		
3	(4)	The tail is normally wholly dark	<i>Rattus cremoriventer</i>	
4	(3)	The tail is normally of two colours		5
5	(8)	The tail is elongated, approximating to 140% of the head and body length or exceeding it in the majority of specimens.		6

6	(7)	Occipitonasal length less than 32 mm. Palate length less than 15 mm.. .. .	<i>Rattus eha</i>
7	(6)	Occipitonasal length not less than 32.8 mm. Palate length exceeds 15 mm.. ..	<i>Rattus fulvescens</i>
8	(5)	The tail less elongated, normally less than 140% of head and body length, and in the majority of specimens less than 130%	<i>Rattus niviventer</i>

All these species occur together in part; *niviventer* and *fulvescens* extensively, *fulvescens* and *eha* through much of the range of the latter, *coxingi* and *niviventer* throughout the range of the former as here understood. *R. coxingi* is rather doubtfully included in the Indian list, on account of Anthony's record of *R. c. andersoni* from North Burma. Possibly these specimens could be *R. niviventer mentosus*, a large form of *R. niviventer*. I include figures for *R. c. andersoni* as I understand it in British Museum material in case this form is correctly recorded from North Burma.

88. *Rattus niviventer* (Hodgson)

The White-bellied Rat

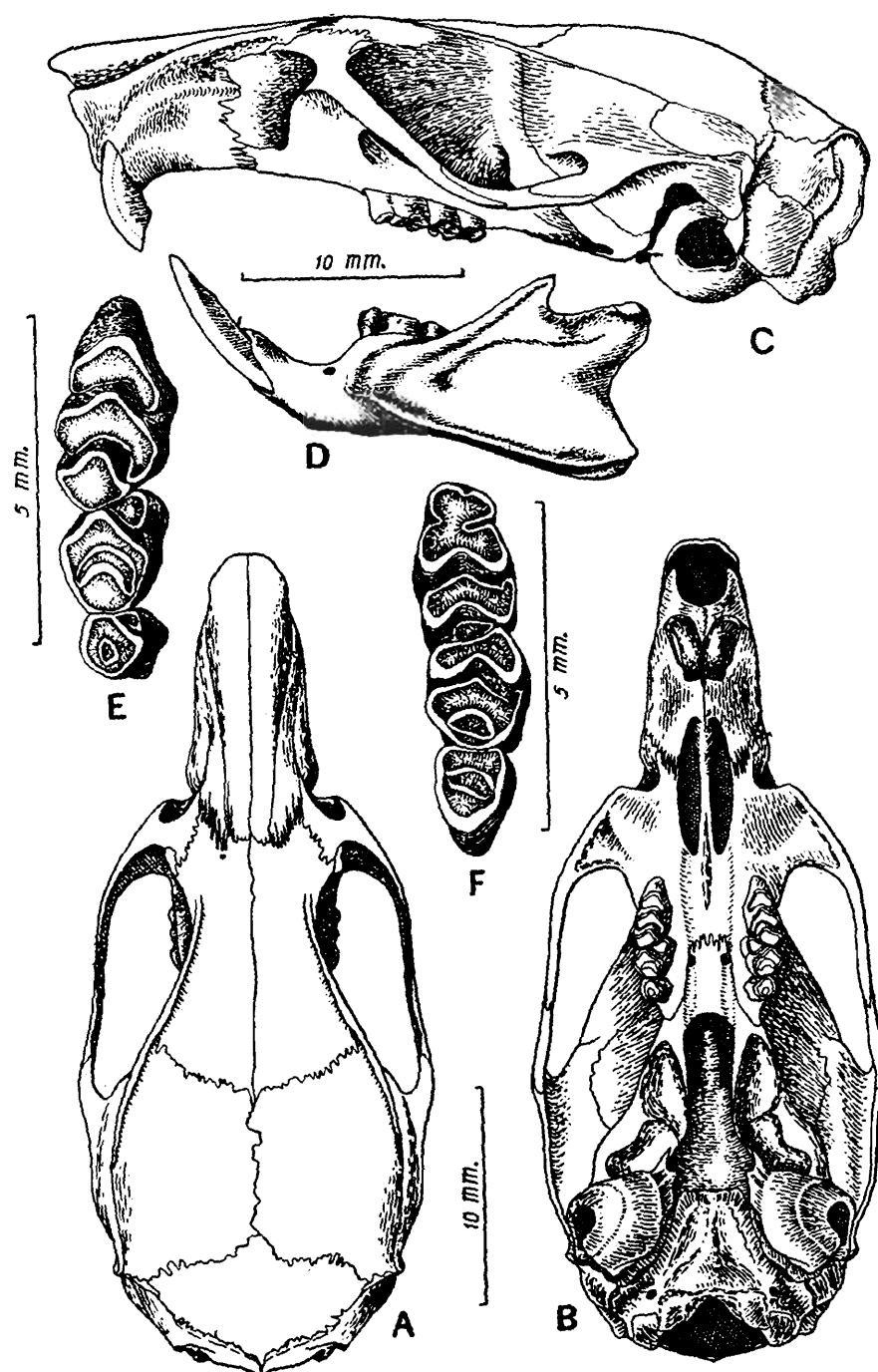
1836. *Mus (Rattus) niviventer* Hodgson, *J. Asiat. Soc. Beng.*, 5, 234.

Distribution.—As here understood; Chihli and Shantung, Shensi and Shansi, Kansu, Szechuan, and China, south of the Yangtze-kiang generally Yunnan included; Hainan, Formosa; BURMA, ASSAM, NEPAL, EAST PUNJAB, Indo-China, Siam, Malay States, Sumatra, Java and possibly Borneo.

With the characters of the subgenus, i.e. rats with short palate (less than half occipitonasal length), small bullae (less than 15% on average of the occipitonasal length), but long palatal foramina. The tail is of two colours; it is not unusually elongated, and the races have the tail on average considerably less than 140% of the head and body length, although it is normally longer than the head and body, sometimes considerably so. Usually the molars are narrow, width of M. 1 less than 2 mm., and usually the palate length is less than 20 mm.

These characters are specially drawn up to differentiate between this species and its close allies, which occur with it, like *R. fulvescens*, *R. eha* and *R. cremoriventer*. This is, however, the first name in the subgenus and one of the earliest specific names in the genus,

External characters.—The fur may be either soft, as apparently in *lepcha*, or spiny, sometimes densely so, as usually in *bukit*, and typically in *mentosus*, or in some races either soft or spiny, perhaps seasonally. Tail long but not abnormally



TEXT-FIG. 40. *Rattus niviventer niviventer* Hodgson, ♂. A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. E, upper molar crowns of right side, in surface view. F, lower molar crowns of right side, in surface view. (After Roonwal, 1950, Pl. VI.)

elongated. As a rule it is rather poorly haired. Hand with four functional clawed fingers, the outer one the shortest. Foot with five toes, all clawed; the fifth shorter than the central three, but quite long, longer than the hallux. Six plantar pads traceable in many specimens. Mammae 8 as a rule, apparently 4 in one specimen.

Colour.—Typically the colour of the back is rather cold grey, often with a certain admixture of black. *R. n. lepcha* tends to have almost a black mid-dorsal patch. Some of the Adung Valley specimens, which I refer to *mentosus*, and one or two odd specimens as Dening, Mishmi, for instance, tend to have the back more brown in colour. This individual variation to brown on the back may be met with in the Chinese *confucianus*. Toes usually white; feet vary from brownish to whitish. Underparts sharply contrasted white, lighter or darker, except in *R. n. lepcha*, which stands well apart from other races in having a dark mid-ventral streak which divides the white of the lower parts into two halves; its throat is white. This patch is absent or scarcely marked in other races. Tail quite clearly bicolor, dark above, whitish below, occasionally wholly pale at tip.

External measurements.—As in Table 75, below.

TABLE 75.—*External measurements of the Indian races of Rattus niviventer*

	Head and body	Tail	Hind- foot	Ear	
<i>Rattus niviventer niviventer</i>					
F. Dhakuri, Kumaon	139	162	26	20	
F. Dhakuri	134	166	25	20	Mammae 8
F. Dhakuri	125	155	25	18	Mammae 8
F. Thankot, Nepal	122	165	25	21	Mammae 8
M. Thankot	115	?	27	21	
F. Lwarkhet, Nepal	127	149	25	18	Mammae 8
Satthar, Gorkha	112	169	28	20	
F. Satthar, Gorkha	99	156	26	20	

The last two are probably immature.

F. 25 miles N. of Myitkyina, Burma (' <i>confucianus</i> ')	140	170	30	25

The type skin from Katmandu. Other skins from Mt. Imaw Bum, North Burma, and from Simla.

Rattus niviventer lepcha

M. Chuntang, Sikkim	115	150	28	21
F. Chuntang	120	?	29	21

TABLE 75.—*External measurements of Rattus niviventer (contd.)*

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus niviventer lepcha</i> (concl'd.)						
M.	Chuntang	114	157	28	21	Mammae 8
F.	Chuntang	131	169	28	22	
F.	Lachen, Sikkim	119	159	27	21	
F.	Lachen	122	164	28	21	
	Chuntang. Type	133	170	28	22	
<i>Rattus niviventer bukit</i>						
M.	Bankachon, Tenasserim	136	168	29	18	
	Bankachon	144	178	28	20½	
<i>Rattus niviventer mentosus</i>						
M.	Adung Valley, N. Burma	160	195	34	25	
F.	Adung Valley	170	230	33	25	
M.	Adung Valley	155	195	35	25	
M.	Adung Valley	170	215	35	24	
M.	Adung Valley	160	200	35	25	
F.	Adung Valley	145	200	33	23	
M.	Adung Valley	162	210	34	24	
F.	Adung Valley	160	215	33	24	
M.	Adung Valley	140	170	32	22	
M.	Adung Valley	142	200	35	23	
M.	Adung Valley	173	231	39	24	
M.	Nam Nat Valley, Burma	135	186	30	25	
M.	50 miles east of Fort Hartz	140	150	30	23	
M.	Hkamti, Burma	162	214	33	24	
M.	Hkamti	167	156	31	22½	
F.	Hkamti	159	206	31	22·25	
	Hkamti	159	180	31·25	25	
F.	Hkamti	138	177	31	24·25	
M.	Hkamti	164	225	33·25	24	
F.	Hkamti	153	185	30	24	
M.	50 miles west of Kindat	154	192	28½	21	
F.	50 miles west of Kindat	133	171	26½	20	
M.	Mode Forest, Mansi, Upper Burma	135	180	30	22·25	
	Hkamti. Type	155	196	32	23½	
The following skins may also belong here :						
F.	20.6.7.33	166	176	26	21	Mammae 2 pairs
	Digboi, Lakhimpur, North Assam					
F.	20.6.7.35	132	167	28	20	
	Dibong, Sadiya					
M.	21.7.6.20	155	205	30·7	23	
	Mokokchung, Naga Hills					
M.	23.1.7.31	163	215	32	20	
	Dreyi, Mishmi					
M.	23.1.7.27	156	197	32	21	
	Dening, Mishmi					

TABLE 75.—*External measurements of Rattus niviventer (concl'd.)*

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus niviventer mentosus (concl'd.)</i>						
F.	23.1.7.28	157	174	28	23	
	Dening					
F.	20.6.7.32	160	181	29	24	Mammae 8
	Near Digboi, N. Assam					

Notes from skins.—*R. n. niviventer*: Dhakuri, Kumaon, mammae 8: 3 oz. and $2\frac{1}{4}$ oz.; mammae 8: $3\frac{1}{4}$ oz. North of Myitkyina ('*confucianus*'), trapped in jungle, on bank of stream. Lwarkhet, mammae 8: $2\frac{1}{4}$ oz.

R. n. lepcha: Chuntang, mammae 8: $1\frac{7}{8}$ oz., $1\frac{3}{4}$ oz. and $1\frac{1}{2}$ oz. Lachen, $1\frac{3}{4}$ oz. and $1\frac{5}{8}$ oz.

R. n. mentosus: Adung Valley, trapped in scrub, common; in hollow log, above stream; on bank, above stream; by river, common; in jungle. Nam Tisang, trapped in jungle; trapped by small stream. Near Digboi, Lakhimpur, mammae 2-2 = 8. Nam Nat Valley, trapped in jungle, common. Dibong, Sadiya, mammae 2 pairs, inguinal. Hkamti, $4\frac{1}{8}$ oz. and $4\frac{1}{4}$ oz. Digboi, Lakhimpur, mammae 2-2 = 8.

There is a juvenile specimen of *R. n. niviventer* in the British Museum, 'caught in house', from Gharial, Punjab, but I do not know if it is a correct identification.

A series of skins from Chamba, Punjab, labelled '*fulvescens*', seem to have the tail too short for that form and could represent *R. n. mentosus*. Their dorsal coloration tends to be rather browner than is usual in *niviventer*.

Cranial characters.—Size smallish to medium, the occipito-nasal length varying between $31\frac{1}{2}$ and 42 mm. The typical race tends in India to be rather smaller than the others, *lepcha* excepted; but it comes very close to *confucianus* from China, which at extreme development may be as large as the larger southern Indian forms like *mentosus*. Supra-orbital ridges are present and tend to be heavier in *mentosus* and *bukit* than in *niviventer* and *lepcha*. The braincase is rather broad and the interparietal is large. Rostrum rather long. Bullae rather small, varying on average from 12 to 14% of the occipitonasal length. Pterygoid fossae rather shallow or medium. Palate short, less than half the occipito-nasal length. Palatal foramina long, averaging 16-19% of the occipitonasal in different races. Zygomatic plate slightly cut back above. Coronoid process of mandible well developed.

Dental characters.—Upper incisors narrow, yellow or red and plain. M. 1 is 5-rooted. Molars not very heavily cuspidate and rather narrow; M. 3 rather small. Spaces for eight cusps in M. 1 and apparently six in M. 2 (no antero-external cusp). M. 3 is like M. 2 but considerably smaller than that tooth. M. 1 is not particularly enlarged, compared, for instance, with *Mus*. There seems to be some dental simplification in this species, as compared with many other species of *Rattus*. Lower molars as usual; three laminae and terminal heel to M. 1, two laminae and terminal heel to M. 2; M. 3 with two laminae, the hindmost one single; the other laminae biserially cuspidate.

Cranial measurements.—As in Table 76, below.

TABLE 76.—*Cranial measurements of the Indian races of Rattus niviventer*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus niviventer niviventer</i>							
F.	14.7.0.153 Dhakuri, Kumaon. Old	33.5	16.2	8.3	6.4	4.5	4.7
M.	23.11.5.34 Satthar, Gorkha, Nepal	32.6	15.7	7.9	6.0	4.7	5.0
F.	23.11.3.35 Satthar, Gorkha, Nepal	31.7	15.5	7.6	5.9	4.5	5.1
<i>Rattus niviventer lepcha</i>							
M.	15.9.1.182 Chuntang, Sikkim. The foramina measurement = shorter side	32.4	15.2	7.4	5.6	4.7	5.1
M.	15.9.1.183 Chuntang. M. 1 is 5-rooted	33.1	15.9	7.9	5.7	4.7	5.0
F.	15.9.1.186 Chuntang	34.5	16.3	8.0	5.9	4.8	5.1
F.	15.9.1.187 Lachen, Sikkim	34.9	16.2	8.2	5.9	4.6	5.2
F.	15.9.1.188 Lachen	33.5	16.0	8.0	6.0	4.7	5.1
The type is rather larger than these specimens, with an occipitonasal length of 36.8 mm.							
<i>Rattus niviventer mentosus</i>							
M.	14.6.18.6 Mode Forest, 15 miles NW. of Mansi, North Burma	36.8	17.5	9.0	6.3	5.1	5.6
M.	15.5.5.230 Hkamti, Burma	40.5	19.5	10.1	7.2	5.1	5.9
M.	15.5.5.231 Hkamti. Old	40.9	20.3	10.6	7.5	5.2	6.0

TABLE 76.—Cranial measurements of *Rattus niviventer* (concl'd.)

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus niviventer mentosus</i> (concl'd.)							
M.	15.5.5.233 Hkamti. M. 1 5-rooted	39.3	19.0	10.1	7.0	4.8	6.1
F.	15.5.5.234 Hkamti	40.5	19.2	10.2	7.0	5.1	5.6
F.	15.5.5.235 Hkamti. Old	38.0	18.6	9.7	6.6	4.9	5.7
F.	15.5.5.236 Hkamti	37.1	17.8	9.5	6.6	5.1	?
F.	15.5.5.237 Chindwin, Burma. The foramina measurement = shorter side	38.6	18.4	10.0	6.7	5.1	5.4
M.	20.6.6.23 Mokokchung, Naga Hills, Assam	38.5	18.2	9.6	6.7	4.8	5.6
M.	16.3.26.60 Chin Hills, Burma	36.3	17.4	8.6	6.3	4.7	?
F.	20.6.7.35 Dibong, Sadiya, Assam	35.3	16.8	8.2	5.5	4.2	5.5
M.	23.1.7.27 Dening, Mishmi	38.2	18.3	9.0	6.1	5.0	6.2
F.	23.1.7.28 Dening, Mishmi	37.4	18.3	9.2	7.0	4.9	5.5
M.	23.1.7.31 Dreyi, Mishmi	39.1	18.4	9.3	6.7	4.9	5.8
M.	23.1.7.32 Dreyi	39.9	19.3	9.8	7.5	5.0	6.5
M.	32.11.1.92 Adung Valley, North Burma	36.9	17.8	9.1	6.7	5.0	6.0
M.	32.11.1.95 Adung Valley	42.5	20.5	10.7	7.7	5.0	6.5
M.	32.11.1.96 Adung Valley	39.8	19.4	9.7	7.0	5.2	6.9
M.	32.11.1.101 Adung Valley	41.8	20.6	11.0	7.7	5.1	6.7
F.	32.11.1.105 Adung Valley	41.3	20.1	10.7	7.5	5.1	6.5
F.	32.11.1.106 Adung Valley	41.0	19.3	9.5	7.3	4.9	6.7
F.	32.11.1.107 Adung Valley. M. 1 is 5-rooted	41.0	20.4	10.7	6.9	5.1	6.5
(Skins of the next two not traced.)							
F.	20.6.7.32 Digboi, Lakhimpur	37.9	19.2	10.2	6.8	4.9	6.0
M.	20.6.7.31 Near Digboi, Lakhimpur	36.0	17.5	8.8	6.6	5.0	5.7
The type has the occipitonasal length about 38.7 mm.							
<i>Rattus niviventer bukit</i>							
F.	14.11.8.209 Bankachon, Tenasserim	36.3	17.3	8.7	6.0	4.4	5.5

Dimensions of Rattus niviventer, in British Museum material, all subspecies included.—The head and body length varies between 99 and 178 mm. The tail between 125 and 247 mm. The hindfoot 23–39 mm. The occipitonasal length varies between 31.5 and 42.5 mm. Upper toothrow 4.7–6.9 mm.

Key to the Indian subspecies of Rattus niviventer

1	(2) The underparts with a clear dark mid-ventral stripe or patch	<i>R. n. lepcha</i>	
2	(1) The underparts lack the dark mid-ventral stripe.		2
3	(4) The bullae exceed 13% of the occipitonasal length. The occipitonasal length appears not to exceed 33.5 mm.	<i>R. n. niviventer</i>	
4	(3) The bullae are most often below 13% of the occipitonasal length, which exceeds 34 mm. in length		5
5	(6) Skull averages smaller; nine extralimital specimens average 36 mm. in occipitonasal length	<i>R. n. bukit</i>	
6	(5) Skull averages larger; twenty-four specimens average 38 mm. in occipitonasal length. . . .	<i>R. n. mentosus</i>	

The bullae of *lepcha* are proportionately large, as in *niviventer*, in size.

Four quite well marked subspecies occur in Indian territory and there are many others outside India. One of the earliest names is *R. n. confucianus* Milne-Edwards, from southern China. This is so like typical *niviventer* that it would not surprise me if it had to be regarded merely as a synonym of it. The northern Chinese race, *R. n. sacer*, is also very closely allied to *niviventer*.

In general, the southern races have average smaller bullae than the northern ones. Moderately represented races in London material include *R. n. culturatus* Thomas, from Formosa, which seems near large specimens of *confucianus*, but possibly with larger teeth, and *R. n. treubi* Robinson and Kloss, from Java, which is near *bukit* but seems to have a proportionately longer tail. There are several other named races represented by only the type or a very few specimens, and it is possible that one of the Bornean forms as *rapit* Bonhote, or *kina* Bonhote, represents this species.

(i) ***Rattus niviventer niviventer* (Hodgson)***

Text-fig. 40

1836. *Mus (Rattus) niviventer* Hodgson, *J. Asiat. Soc. Beng.*, **5**, 234.1941. *Rattus confucianus* Anthony, *Field Mus. Publ. Zool.*, **27**, 106. (Perhaps not of Milne-Edwards, 1872.)*Type-locality*.—Katmandu, Nepal.*Range*.—Specimens examined from NEPAL: Katmandu, Lwarkhet, Satthar (Gorkha) and Thankot. PUNJAB: Simla. KUMAON: Dhakuri. UPPER BURMA: Mount Imaw Bum. Twenty-five miles north of Myitkyina. Mogaung.

A smallish race apparently, but I have only three unbroken skulls; occipitonasal length 31.7–33.5 mm. Bullae moderately large for this species, more than 13% of the occipitonasal length. Underparts white, lacking mid-ventral stripe.

(ii) ***Rattus niviventer lepcha* (Wroughton)**1916. *Epinys lepcha* Wroughton, *J. Bombay nat. Hist. Soc.*, **24**, 429.*Type-locality*.—Chuntang, Sikkim, 5,350 ft.*Range*.—Specimens examined from SIKKIM: Chuntang and Lachen.Similar to *niviventer* in most respects; occipitonasal length 32.4–36.8 mm. Bullae average more than 13% of the occipitonasal length. Differing from other races in having the underparts with a clear dark mid-ventral portion, which when present elsewhere is much less well marked and is most often absent.(iii) ***Rattus niviventer bukit* (Bonhote)**1903. *Mus bukit* Bonhote, *Ann. Mag. nat. Hist.*, **11**, 125.1913. *Epinys lepidus* Miller, *Smithson. misc. Coll.*, **61**, 20. (Bok Pyin, southern Tenasserim.)*Type-locality*.—Bukit Besar, Jalor, Malay Peninsula, 2,500 ft.*Range*.—Specimens examined from JALOR, Bukit Besar; PERAK, Maxwells Hill; TRANG, Chong and Lamra. Siam:

* Also see Roonwal, M. L., 1950. *Rec. Indian Mus.*, Delhi, **47** (1), pp. 33–35; 48–49; and Pl. VI, for further taxonomic details.—EDITOR.

Doi Sritepe, Chiengmai. TENASSERIM: Bankachon (Nos. 14.12.8.208 and 209).

The occipitonasal length in extralimital specimens, nine in number, varies between 34.3 and 38.9 mm., but only once exceeds 36.6 mm. The bullae are proportionately smaller than in the northern races, normally less than 13% of the occipitonasal length. Underparts without dark mid-ventral stripe, normally.

(iv) ***Rattus niviventer mentosus* Thomas†**

Text-fig. 41

1916. *Rattus mentosus* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 4, 643.

Type-locality.—Hkamti, Upper Chindwin, 500 ft., Burma.

Range.—Specimens examined from BURMA: Hkamti; 50 miles west of Kindat; Mode Forest, Mansi; Adung Valley; Nam Nat Valley; 50 miles east of Fort Hartz. ASSAM: Dibong, Sadiya; near Digboi, Lakhimpur; Mokokchung in Naga Hills. MISHMI: Dening and Dreyi.

Very like *R. n. bukit* but with an average larger skull. Occipitonasal varying between 35.3 and 42.5 mm., but only once under 36 mm. in 25 specimens.

89. ***Rattus coxingi* (Swinhoe)**

Swinhoe's Rat

1864. *Mus coninga* Swinhoe, *Proc. zool. Soc. Lond.*, 185, 382.

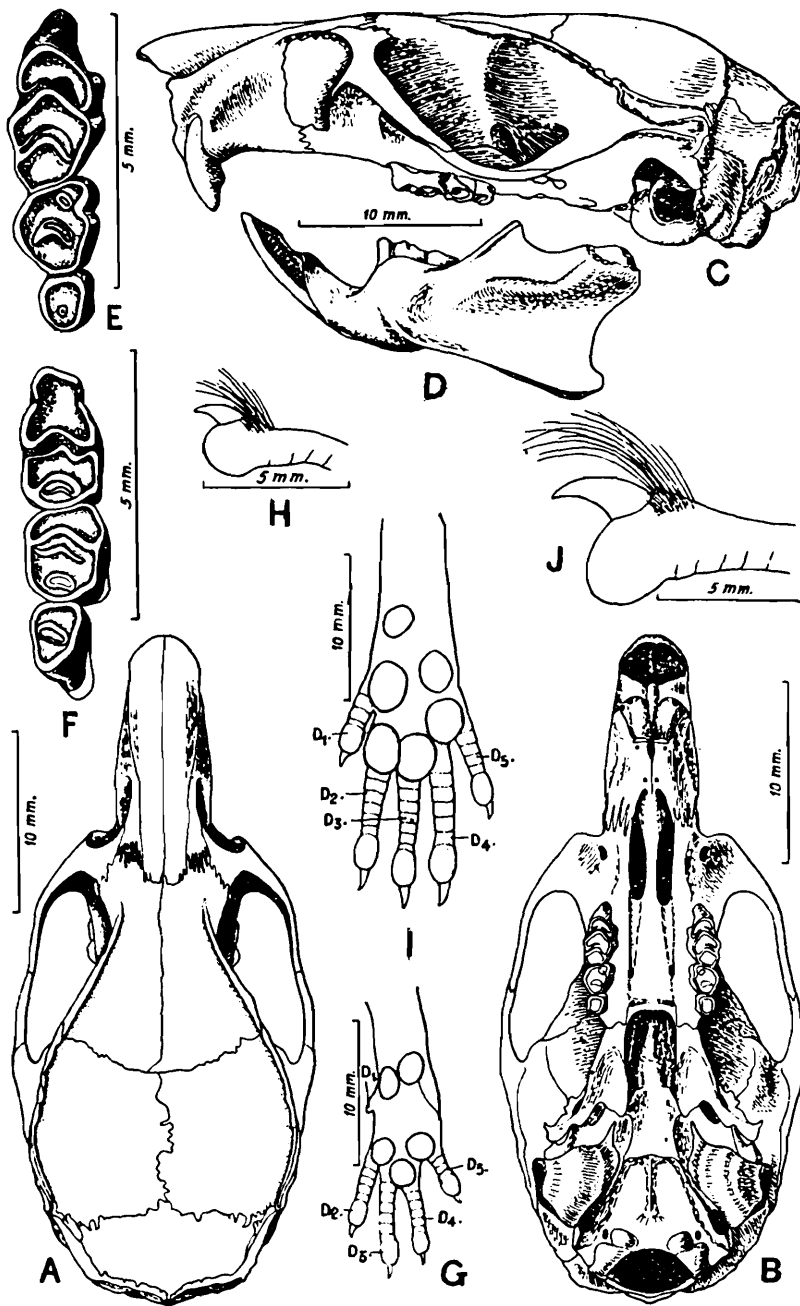
1870. *Mus coxingi* Swinhoe, *Proc. zool. Soc. Lond.*, 636. Thomas, 1892, *Ann. Mus. Genova*, **10**, 939 (footnote).

Type-locality.—Formosa.

Distribution.—As here understood; Formosa, Szechuan, Yunnan, also said to occur in south Shensi, and NORTH BURMA, Indo-China.

Apparently essentially similar to *Rattus niviventer* but larger, as a general rule, and with wider molars; width of M. 1 approximates to or exceeds 2 mm., length of the palate exceeds 20 mm. These two characters not, apparently, combined in the large forms of *niviventer*.

† Also see Roonwal, M. L., 1949. *Trans. nation. Inst. Sci. India*, Calcutta, **3** (2), pp. 103–105; and Pl. VI, Fig. 4, for biology and ecology; and 1950, *Rec. Indian Mus.*, Delhi, **47** (1), pp. 36–39; 49–51; and Pl. VII, for taxonomy.—EDITOR.



TEXT-FIG. 41. *Rattus niviventer mentosus* Thomas, ♀ A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. E, upper molar crowns of right side, in surface view. F, lower molar crowns of right side, in surface view, ♂. G, lower view of right hand. H, side view of mid-finger (D_3) of right hand. I, lower view of right hindfoot. J, side view of mid-toe (D_3) of right hindfoot. (After Roonwal, 1950, Pl. VII.)

Our material for *coxingi* is fragmentary and I have no fully measurable skulls for it. But I have suggested that as two forms occur apparently with races of *niviventer*, both in Formosa (true *coxingi*) and Yunnan-Szechuan—? North Burma (*andersoni*), it may be possible to unite these two distinct forms as races of a species as defined above, and occurring with *niviventer* throughout its range; *R. c. andersoni* seems to have the tail strongly elongated and could almost be a form of *R. fulvescens*, but its large general size and heavy teeth suggest *coxingi*. I also think that the form *moi* Robinson and Kloss, from Annam, belongs to this species. But until more specimens come to hand for true *coxingi* it is difficult to define the present species.

I have no Indian material for this species but Anthony has recorded *Rattus andersoni* from North Burma.

External characters.—Largish or medium sized rats, head and body length 135–178 mm. in our material; fur soft (in true *coxingi* from Formosa it is spiny). Tail very long, about 140% of head and body in our specimens, apparently averaging slightly shorter in specimens which Glover Allen gave measurements in his work on Mammals of China and Mongolia, the largest of which exceeds ours (198 head and body length). The tail is not very well haired. Hand with four clawed fingers. Foot with five toes, all clawed; six plantar pads evidently; the fifth toe noticeably longer than the hallux. Colour rather dull brownish above, pure white below; the feet brown, dark and the tail sharply bi-color for most of its length, wholly white at end. Toes white.

I have seen no Burmese specimens but Anthony recorded several localities for this species in North Burma.

Cranial characters.—Our somewhat limited material suggests that this is essentially like largest forms of *R. niviventer* (as for instance, *mentosus*) but with heavier molars. Palate length in adult exceeds 20 mm. Width of M. 1 exceeds 2 mm. Supraorbital ridges not very strong in proportion to the size of the animal. Nasals rather wide in front, narrow behind. Interparietal well developed. Bullae small, roughly 12% of the occipitonasal length. Palate less than half the length of the occipitonasal. Palatal foramina very long, about 19% of the occipitonasal length. Zygomatic plate nearly straight anteriorly. Coronoid process of mandible very large.

Dental characters.—Upper incisors wide, red and plain. Molars heavy and rather angularly cuspidate. Apparently eight cusps in M. 1 and six in M. 2. M. 3 markedly smaller

than M. 2. Lower molars angularly cuspidate but without peculiarity of elements.

Dimensions of Rattus coxingi, in *British Museum material*.—(Based mostly on *andersoni*, as our material for the typical race is fragmentary as regards skulls and mostly unmeasured as regards skins, and the form *moi*, which could belong here, is only known by the type): The head and body length varies between 135 and 178 mm. The tail between 160 and 268 mm. Hindfoot 30–40 mm. Occipito-nasal length varies between 41.4 and 43.3 mm. Upper tooth-row 6.8–7.5 mm. (or about 6.3 mm. in the type of *R. c. moi*).

(i) **Rattus coxingi andersoni** (Thomas)

Anderson's Rat

1911. *Epimys andersoni* Thomas, *Abstr. Proc. zool. Soc. Lond.*, 4; *Proc. zool. Soc. Lond.*, 171.

Type-locality.—Omi-san, Szechuan, China.

Range.—Specimens examined from Szechuan: Omi-san. Yunnan: Mekong Valley, and Mekong-Yangtze Divide.

According to Allen, the form described by him as *Epimys zappeyi* in 1912 from Szechuan (Washan) is the same.

Differing from the typical race in having soft (instead of spiny) fur, ? more elongated tail (I have no accurate measurements for the typical race) and wider molars, width of M. 1 apparently 2.1–2.2 mm.

90. **Rattus fulvescens** (Gray)

The Chestnut Rat

1847. *Mus fulvescens* Gray, *Cat. Hodgson Coll.*, 18. (Published 9 January, 1847, Sherborn.)

Distribution.—As here understood; NEPAL, ASSAM, BURMA, Indo-China, Malay States, Sumatra and Java.

Essentially like *Rattus niviventer*, but occurring with it extensively and distinguishable by the unusually elongated tail, which is on average more than 140% of the head and body length. Occipitonasal length not less than 32.8 mm. Palate length exceeds 15 mm. (Compare *R. eha*.) Very occasionally the tail may be wholly dark, but this appears to be individual. Blanford thought there were two forms, one dark-tailed and the other bicolor tailed (*jerdoni*) in the Himalayas, but Wroughton and subsequent authors have considered the two as one.

One or two of these very long-tailed rats have been named from extralimital countries, such as *orbis* Robinson and Kloss, Siamese Malaya, and *fraternus* Robinson and Kloss, Sumatra, but in addition to the two races occurring in India, the only well known and long standing form which I refer to this species is the Javanese *R. f. lepturus* Jentink. This seems to have a longer tail even than *R. f. brahma*, to which it shows resemblance in its relatively large teeth. It appears to be the second valid name in the species.

Key to the Indian subspecies of Rattus fulvescens

1	(2)	Upper toothrow length 6.3–6.8 mm.	<i>R. f. brahma</i>
2	(1)	Upper toothrow length less than 6.3 mm. (This measurement reached once only in about 37 skulls).	... <i>R. f. fulvescens</i>

External characters.—The fur is soft in many specimens, but many others have a certain mixture of spines in the back. Possibly this is a seasonal character. The ear is moderately large. Hand with four fingers, bearing claws. The outer one is the shortest. Foot with five toes, all clawed; the fifth is shorter than the central three, but longer than the hallux. Apparently six plantar pads are present, as can be seen in several specimens. Mammae usually 8, but said to be 6 in the type of *brahma*, and evidently 4 in one specimen. Tail very elongated, normally exceeding 140% of the head and body, poorly to moderately haired, occasionally tufted terminally.

Colour.—The upper parts vary from brown to grey, sometimes almost reddish brown. (Reddish and grey specimens are included in the Garo Hills series, so evidently the reddest specimens are merely individual variations.) The Adung Valley series (*brahma*) are deep brown in colour, rather darker on the middle of the back. Feet, as a rule, brown with white toes. Underparts in the typical race white, rarely dirty white, generally pure. In the Adung *brahma* series, the underparts are grey, usually with a white throat. Tail normally bicolor (poorly so in the Adung Valley skins), rarely all pale at end. Occasionally wholly dark-tailed specimens may be met with, as 15.9.1.176, Lachen; 15.9.1.172, Chuntang; 15.9.1.179, Batasia, and one or two very old skins from Sikkim. On this account Blanford thought that *fulvescens* represented a dark-tailed species, and used the name *jerdoni* for the common, bicolor tailed type. It seems, however, that Wroughton was more likely correct, and that

the black-tailed specimens, only about four in over fifty, are abnormalities. Their very long tail should be sufficient to distinguish them from *R. cremoriventer indosinicus*, and the specimens quoted are browner in colour than that.

Although in a sense *R. fulvescens* strikes one as being a 'brown' species and *R. niviventer* a 'grey' species, no line on colour can be drawn between the two; intermediates exist in many forms; particularly in *R. n. bukit*, different specimens of which may be quite cold grey, as in *mentosus*, which approaches true *niviventer*, or quite as reddy brown as more typical specimens of *fulvescens*.

External measurements.—As in Table 77, below.

TABLE 77.—*External measurements of Indian races of Rattus fulvescens*

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus fulvescens brahma</i>						
M.	Adung Valley, N. Burma	150	237	32	25	
M.	Adung Valley	142	225	32	25	
M.	Adung Valley	140	215	31	24	
M.	Adung Valley	155	240	32	25	
M.	Adung Valley	145	225	30	24	
F.	Anzong Valley, Mishmi.	145	218	28	25	
	Type					
<i>Rattus fulvescens fulvescens</i>						
M.	Pashok, Sikkim	132	202	30	21	
F.	Pashok	135	195	29	20	
M.	Pashok	135	195	30	20	
M.	Pashok	141	217	31	20	
M.	Pashok	140	222	30	21	
M.	Pashok	129	185	30	25	
F.	Pashok	140	200	28	21	
M.	Pashok	135	200	30	20	
F.	Pashok	133	190	28	21	
F.	Pashok	113	175	28	19	
F.	Ghoom, Darjeeling	130	198	27	20	Mammae 8
M.	Ghoom	129	199	28	19	
M.	Gopaldhara, Darjeeling	149	215	30	22	
F.	Gopaldhara	130	205	29	22	
F.	Narbong, Darjeeling	138	188	26	20	Mammae 8
M.	Chuntang, Sikkim	140	214	29	21	
F.	Chuntang	132	204	28	21	
M.	Gopaldhara, Darjeeling	133	205	30	21	
M.	Chuntang, Sikkim	141	212	29	22	
M.	Lachen, Sikkim	127	171	27	19	
F.	Batasia, Sikkim	125	185	26	20	
F.	Batasia	137	212	28	21	Mammae 8

TABLE 77.—*External measurements of Rattus fulvescens (concl'd.)*

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus fulvescens fulvescens</i> (concl'd.)						
F.	Chalna Khall, Nepal	118	180	27	22	
M.	Hathibun, Nepal	135	212	30	22	
	Chalna Khall, Nepal	118	192	28	22	
M.	Bouzini, Nepal	126	185	30	21	
F.	Apoon Hill, Gorkha, Nepal	114	178	27	20	
F.	Khati, Kumaon	127	187	28	19	
F.	Khati, Kumaon	129	193	28	19	Mammae 8
M.	Tura, Garo Hills, Assam	133	200	29	20	
F.	Tura, Garo Hills	154	218	29	22	
F.	Tura, Garo Hills	130	184	26	23	Mammae 1-1 =4
F.	Dening, Mishmi	145	223	30	23	
M.	Dreyi, Mishmi	150	211	32	23	
M.	Dreyi	162	230	32	22	
	Kaing Reserve (? Burma)	125	168	?	24	
	Hills east of Nam Tisang, Burma	118	172	28	20	
M.	Nam Tisang, N. Burma	115	173	28	23	
M.	Pyaunggaung, Shan States, Burma	142	200	29	22½	
M.	Dhakuri, Kumaon	135	179	29	20	
F.	Khati, Kumaon	129	183	28	19	
M.	Duragiri, Garo Hills	146	190	30	20	
M.	Tura, Garo Hills	155	215	30	20	
M.	Tura	145	199	29	22	
F.	Tura	140	183	28	24	
M.	Tura	149	193	31	25	
F.	Tura	150	189	29	25	
M.	Tura	152	200	30	24	

Rattus fulvescens ?fulvescens

M.	Chalan Tissa, Chamba, Punjab	133	174	29	20
F.	Chalan Tissa	129	169	30½	19½
M.	Deolah, Chamba	160	200	31	21
	Deolah	127	176	28	20
	Chalan, Chamba	141	194	31	21
M.	Chatri, Chamba	146	191	29	20
M.	Chalan, Chamba	143	183	29	21

These may perhaps represent *Rattus niviventer mentosus*.

Notes from skins.—*R. f. fulvescens*: Tura, Garo Hills, weight 2.5 oz. and 2.25 oz. Duragiri, weight 3.5 oz., mammae 2-2 = 8, weight 3.25 oz. Chuntang, weight 2½ oz.;

mammae 8, also 3 oz. Dhakuri, Kumaon, weight $2\frac{3}{4}$ oz.; mammae 8: $2\frac{1}{2}$ oz. Dreyi, weight 4 oz. Khati, Kumaon, shot at 10 a.m. on rocks near water, mammae 8, weight 2 oz.; mammae 8: $2\frac{1}{2}$ oz. Batasia, mammae 8: $2\frac{3}{4}$ oz. and 2 oz., mammae 8. Dening, Mishmi, mammae 2-2 = 8. Deolah, Chamba, mammae 2-2 = 8. Ghoom, mammae 8: 2 oz. and $2\frac{1}{4}$ oz. Tura, weight 3.25 oz., mammae 2-2 = 8: 3 oz.; mammae 1-1 = 4: 1.75 oz. Lachen, weight $2\frac{1}{4}$ oz. Narbong, mammae 8: 3 oz. Pyaunggaung, weight $2\frac{3}{4}$ oz. Gopaldhara, ? mammae 4.

R. f. brahma: Adung Valley, trapped in jungle.

Five specimens, from the Adung Valley, North Burma, are clearly a form of *R. fulvescens*, owing to the length of their tail, and resemble *brahma* in their very large teeth. I provisionally allocate them to that race.

The specimens of *fulvescens* from Tura, Garo Hills, are not typical in tail length and could perhaps represent *R. niviventer mentosus*. The specimens labelled *fulvescens* from the East Punjab (Chamba) seem more likely on account of their tail proportions to be an outlying form of *niviventer*. It is, of course, possible that they represent *R. n. mentosus*.

Cranial characters.—Much like *R. niviventer*. Occipitonasal length varying between about 32 and 41 mm., though evidently not reaching 40 mm. in Indian races. Rostrum rather heavy and pointed. Frontals but little constricted as a rule and supraorbital ridges strong and powerful. Braincase wide and interparietal large and broad. Bullae small, roughly 12-13% of the occipitonasal length. Pterygoid fossae of medium depth. Palate short, less than half occipitonasal length. Palatal foramina long, roughly 16-19% of the occipitonasal length. The zygomatic plate is only slightly cut back above, or nearly straight sometimes. Coronoid process of mandible quite well developed.

Dental characters.—Upper incisors narrow, red or yellow, and plain. Molars quite like those of *R. niviventer*; eight cusp spaces in M. 1 (lacking only the posterointernal cusp); six spaces in M. 2 (lacking the posterointernal and the anteroexternal); M. 3 like M. 2, but considerably smaller than that tooth. Five roots to M. 1. Lower molars as usual and without peculiarity.

Cranial measurements.—As in Table 78, below.

Dimensions of Rattus fulvescens, in British Museum material, all races included.—The head and body length varies between 100 and 162 mm. The tail between 138 and 240 mm. Hindfoot 23-34 mm. The occipitonasal length varies between 32.8 and 41 mm. Toothrow 5.2-6.8 mm.

TABLE 78.—*Cranial measurements of the Indian races of Rattus fulvescens*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus fulvescens fulvescens</i>							
M.	14.7.8.60 Pyaunggaung, Shan States, Burma	37.3	17.9	8.9	6.5	4.7	5.6
M.	14.7.10.157 Dhakuri, Kumaon	34.9	16.6	7.8	6.2	4.6	5.5
F.	14.7.10.158 Dhakuri	35.2	16.4	8.1	6.2	4.7	5.5
F.	14.7.10.159 Khati, Kumaon	34.7	16.5	7.8	5.7	?	5.7
M.	15.9.1.172 Chuntang, Sikkim	35.8	16.9	8.7	6.3	4.7	5.5
M.	15.9.1.173 Chuntang. Old	35.5	17.1	8.4	6.8	4.2	5.5
F.	15.9.1.175 Chuntang. Foramina measurement = shorter side	34.3	16.4	8.3	6.1	4.6	5.5
F.	15.9.1.178 Ghoom, Darjeeling. Foramina measurement = shorter side	33.9	16.2	8.2	6.1	4.3	5.2
F.	15.9.1.180 Batasia, Sikkim	32.8	15.7	7.3	5.9	4.4	5.4
F.	15.9.1.179 Batasia	35.5	17.3	8.2	6.7	4.7	5.5
F.	15.9.1.181 Narbong, Darjeeling. Old	35.8	17.0	8.7	6.2	4.7	?
M.	16.3.25.89 Gopaldhara, Darjeeling. M. 1 5-rooted	37.3	17.5	9.0	6.0	4.6	5.4
M.	16.3.25.90 Gopaldhara. M. 1 5-rooted. Old	38.3	17.5	9.0	5.7	4.7	5.5
M.	16.3.25.91 Pashok, Sikkim	34.9	16.3	8.1	5.5	4.5	5.5
M.	16.3.25.92 Pashok. Old	38.5	17.8	9.3	6.5	4.6	5.6
M.	16.3.25.93 Pashok. Old	37.5	17.7	8.9	6.0	4.6	?
F.	16.3.25.94 Pashok	32.9	15.5	7.8	5.3	4.5	5.2
F.	16.3.25.95 Pashok. M. 1 5-rooted	35.8	16.7	8.2	5.6	4.4	5.4
F.	16.3.25.96 Pashok. Foramina measurement = shorter side	37.3	17.6	9.2	5.9	4.5	5.2
M.	17.7.2.49 Pashok. M. 1 5-rooted	35.3	16.8	8.5	5.8	4.6	5.7
M.	17.7.2.50 Pashok. Foramina measurement = shorter side	36.4	17.0	8.7	5.6	4.7	5.5
M.	17.7.2.51 Pashok	37.7	16.8	8.5	5.9	4.7	5.6
F.	17.7.2.52 Pashok. Old	37.4	17.8	9.0	6.4	4.6	5.6

TABLE 78.—*Cranial measurements of Rattus fulvescens (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus fulvescens fulvescens</i> (concl'd.)							
M.	20.11.1.58 Tura, Garo Hills, Assam	38.1	18.5	9.4	6.6	4.7	5.7
M.	20.11.1.59 Tura	36.8	17.6	9.3	6.5	4.6	5.3
M.	20.11.1.60 Tura	35.2	16.4	7.8	5.8	4.5	5.5
M.	20.11.1.61 Tura. Foramina measurement = shorter side	39.7	19.2	10.2	7.2	4.9	5.7
F.	20.11.1.63 Tura. Old. Teeth worn out	38.7	17.7	9.1	6.4	4.4	?
F.	20.11.1.64 Tura	38.6	18.5	9.3	6.8	4.9	6.3
F.	20.11.1.65 Tura	37.0	18.0	9.0	6.2	4.8	5.8
F.	20.11.1.66 Tura	35.0	16.7	8.5	6.2	4.7	5.4
M.	20.11.1.67 Duragiri, Garo Hills, Assam. Old. Foramina measurement = shorter side	37.2	17.4	8.5	5.5	4.6	5.3
F.	23.1.7.29 Dening, Mishmi	37.2	17.6	8.7	6.3	4.5	5.8
F.	23.11.5.32 Apoon Hill, Gorkha, Nepal. Foramina measurement = shorter side	33.1	15.5	7.7	5.6	4.4	5.3
	20.11.1.57 Tura, Assam	38.6	18.8	9.9	6.9	5.1	5.7
(The skins to the following not traced)							
M.	80.11.11.58 Darjeeling. 5 roots M. 1	38.7	17.8	8.9	6.2	—	—
F.	20.11.1.62 Tura, Assam	39.2	18.4	9.2	6.4	4.7	6.1
F.	20.11.1.68 Duragiri, Assam. 5 roots M. 1	39.6	18.6	?	6.6	4.9	?
M.	15.9.1.174 Chuntang, Sikkim	35.6	16.8	8.6	6.5	4.5	5.6
F.	88.12.1.56 Top of Mt. Muleyit, Tenasserim (' <i>gracilis</i> ') Foramina measurement = shorter side	35.9	16.9	8.4	6.3	4.4	5.5
M.	88.12.1.55 Top of Mt. Muleyit (' <i>gracilis</i> ')	37.6	16.9	8.6	6.2	4.8	5.5
<i>Rattus fulvescens brahma</i>							
F.	14.6.24.2 Anzong Valley, Mishmi. Type	35.7	17.4	8.9	6.9	4.7	6.3

TABLE 78.—*Cranial measurements of Rattus fulvescens (concl'd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus fulvescens brahma</i> (concl'd.)							
M.	32.11.1.114 Adung Valley, N. Burma	38.0	18.1	9.0	7.3	4.9	6.8
F.	32.11.1.115 Adung Valley	37.8	18.5	9.3	7.2	5.2	6.8
	32.11.1.112 Adung Valley	38.0	18.1	9.5	6.7	5.0	6.4

Rattus fulvescens ? subsp. ?

M.	23.9.1.80 Chamba Valley, Punjab	39.0	18.4	9.2	6.7	4.9	5.9
M.	23.9.1.81 Chamba Valley	36.3	17.4	8.7	6.3	4.4	5.5

Possibly these represent a form of *R. niviventer*.

Further measurements of skulls of *Rattus fulvescens* or subsp.
from the Punjab

M.	23.9.1.75 Chalan Tissa, Chamba, Punjab	37.6	17.5	8.6	6.4	4.7	5.7
M.	23.9.1.76	35.7	17.0	8.1	6.3	4.6	5.7

circa

Chalan Tissa. Foramina measurement = longer side; the other side is malformed and very short

M.	23.9.1.77 Chalan Tissa	37.8	17.9	8.5	6.4	4.7	5.7
M.	23.9.1.79 Chalan Tissa	37.1	17.5	8.6	6.6	4.7	5.7
M.	23.9.1.80 Chalan Tissa	39.1	18.5	8.8	6.9	4.9	5.8
F.	23.9.1.81	36.1	17.4	8.6	6.4	4.4	5.6

(i) ***Rattus fulvescens brahma* (Thomas)**

1914. *Epimys brahma* Thomas, *J. Bombay nat. Hist. Soc.*, **23**, 2, 232.

Type-locality.—Anzong Valley, Mishmi Hills, 6,000 ft.

Range.—Specimens examined from MISHMI: Anzong Valley. UPPER BURMA, Adung Valley.

Large-toothed race; upper toothrow 6.3–6.8 mm. Mammæ said to be 1–2 = 6. The Adung Valley series have the underparts rather dark in colour but the type of *brahma* has a whitish belly.

(ii) **Rattus fulvescens fulvescens** (Gray)

1847. *Mus fulvescens* Gray, *Cat. Hodgson Coll.*, 18.
 1849. *Mus caudatior* Hodgson, *Ann. Mag. nat. Hist.*, 3, 203.
 (Nepal.)
 1863. *Leggada jerdoni* Blyth, *J. Asiat. Soc. Beng.*, 32, 350.
 (Sikkim.)
 1863. *Mus octomammis* Gray, *Cat. Hodgson Coll.*, 2nd ed., 10.
 1913. *Epimys gracilis* Miller, *Smithson. misc. Coll.*, 61, 21. (Mt. Muleyit, Tenasserim.)
 1926. *Rattus hung vulpicolor* G. Allen, *Amer. Mus. Novit.*, 217, 14.
 (Namting River, Yunnan-Burma border.)

Type-locality.—Nepal.

Range.—Specimens examined from ASSAM: Khasi Hills, Naga Hills, Duragiri and Tura in Garo Hills. BURMA: Pyaunggaung, Shan States; hills east of Nam Tisang. SIKKIM: Batasia, Chuntang, Ghoom, Lachen, Gopaldhara, Narbong and Pashok. NEPAL: Bouzini, Apoon Hill (Gorkha), Chalna Khall, Hathibun. MISHMI: Dening, Dreyi. KUMAON: Dhakuri, Khati.

Specimens bearing this name from PUNJAB: Chalan Tissa, Chatri and Deolah, all Chamba, are in proportions more like a form of *R. niviventer*. Also from Annam, Langbian Peaks, and Tonkin, Chapa. TENASSERIM: Mount Muleyit (skulls).

Small-toothed race; upper toothrow less than 6.3 mm., with one exception in about 37 skulls.

Some of the Indo-Chinese specimens just quoted might be wrongly identified. I have not as yet been able to examine their skulls but the skins seem too small for true *fulvescens*, if they are adult, although the tail proportions are as in *fulvescens*.

The name *jerdoni* is currently synonymized with this species. The measurements in the original description: head and body about 4 inches = roughly 100 mm., tail $3\frac{1}{2}$ inches suggest that this name may have been based on a form of *Mus*.

91. **Rattus eha** (Wroughton)

The Little Himalayan Rat

1916. *Epimys eha* Wroughton, *J. Bombay nat. Hist. Soc.*, 24, 428.

Distribution.—NEPAL, SIKKIM, BURMA and Yunnan.

Very similar to *Rattus fulvescens*, but smaller, the occipito-nasal length less than 32 mm. in length; the palate less than 15 mm. in length. The supraorbital ridges tend to be

proportionately weak. The underparts are grey in colour. Tail normally very elongated, as in *fulvescens*. In size, one of the smallest members of the genus *Rattus*.

Two subspecies are known. Both occur in India.

Key to the subspecies of Rattus eha

1	(2) The tail roughly 160% of the head and body length.	<i>R. e. eha</i>
2	(1) The tail mostly under 150% of the head and body length.	<i>R. e. ninus</i>

External characters.—Small, head and body 92–141 mm., with very thick and soft fur, rather large ear and very long tail, which is moderately hairy and tends to be slightly tufted at end. Hand with four clawed fingers. Foot with five toes, all clawed. Apparently six plantar pads; the fifth toe noticeably longer than the hallux.

Colour.—Above brown, almost reddish brown in the typical race, distinctly duller in *ninus*; dorsal fur dark basally; a blackish ring round eye, most marked in the typical race, and the ear rather dark. Feet tend to be brown. Belly light grey, almost blue grey, sharply contrasted with the back. Tail clearly bicolor, dark above and whitish below, rarely with the extreme tip white.

External measurements.—As in Table 79, below.

TABLE 79.—*External measurements of the Indian races of Rattus eha*

	Head and body	Tail	Hind- foot	Ear
<i>Rattus eha eha</i>				
F. Lachen, Sikkim	98	158	25	20
F. Lachen	102	168	25	19
M. Sukiapohkri, Darjeeling	98	168	26	19
M. Thangu, Sikkim	100	170	27	20
M. Ghoom, Darjeeling	103	169	25	20
Apoon Sottidanda, Gorkha	98	160	27	20
Lachen. Type	115	186	26	20
<i>Rattus eha ninus</i>				
M. Adung Valley, North Burma	112	165	27	20
M. Adung Valley	141	197	29	23
M. Adung Valley	140	172	26	20
F. Mount Imaw Bum	119	180	28	22½

Notes from skins.—*R. e. ninus*: Adung Valley, 10,000 ft., 'trapped in jungle'

R. e. eha: Sukiapohkri, weight $1\frac{1}{4}$ oz. Ghoom, weight $1\frac{1}{8}$ oz. Lachen, weight $1\frac{1}{4}$ oz. and 1 oz. Thangu, weight $1\frac{1}{8}$ oz.

Cranial characters.—Small rats, the occipitonasal length about 29–31.9 mm. Supraorbital ridges most often almost absent or scarcely developed, but quite strong in one specimen out of eleven; this specimen is from Yunnan. Rostrum apparently not very long. Braincase wide and interparietal large and well developed. Bullae rather small, about 13–14% of the occipitonasal length. Pterygoid fossae rather shallow. Palate less than half the occipitonasal length. Palatal foramina long, usually reaching the toothrows, about 17–18% of the occipitonasal. Zygomatic plate about straight anteriorly.

Dental characters.—Upper incisors narrow, yellow and plain. Upper molars much like immediately allied species; M. 1 with eight cusps, M. 2 with six (lacking the antero-external and the postero-internal). M. 3 small and reduced. M. 1 not particularly enlarged; it has five roots. Lower molars well cusped, with strong terminal heel to M. 1 and M. 2, and the usual elements present. Coronoid process of mandible well developed.

Cranial measurements.—As in Table 80, below.

TABLE 80. *Cranial measurements of the Indian races of Rattus eha*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus eha eha</i>							
F.	15.9.1.190	29.4	13.6	6.9	5.4	4.2	4.7
	Lachen, Sikkim. M. 1 5-rooted						
F.	15.9.1.191	30.2	14.3	6.8	5.1	4.1	5.0
	Lachen						
M.	15.9.1.192	29.3	14.0	7.1	5.6	4.1	4.9
	Thangu, Sikkim						
M.	15.9.1.193	29.5	13.5	6.6	5.2	4.3	4.8
	Ghoom, Darjeeling						
M.	15.9.1.194	29.4	13.7	6.7	5.1	4.1	4.6
	Sukiapohkri, Darjeeling						

The type has the occipitonasal length about 31.4 mm.

<i>Rattus eha ninus</i>							
F.	20.8.7.9	31.7	14.7	7.3	5.6	4.2	5.0
		circa					
	Mount Imaw Bum, North Burma. M. 1 5-rooted						
M.	32.11.1.87	31.0	14.3	7.1	5.7	4.3	5.2
	Adung Valley, North Burma						

Dimensions of Rattus eha, in British Museum material, all specimens included.—The head and body length varies between 92 and 141 mm. The tail between 132 and 197 mm. Hindfoot 25–29 mm. The occipitonasal length varies between 28·3 and 31·9 mm. Toothrow 4·5–5·2 mm.

(i) **Rattus eha eha** (Wroughton)

1916. *Epimys eha* Wroughton, *J. Bombay nat. Hist. Soc.*, **24**, 428.

Type-locality.—Lachen, Sikkim, 8,800 ft.

Range.—Specimens examined from SIKKIM and district: Lachen, Ghoom, Sukiapohkri and Thangu. NEPAL: Apoon Sottidanda (Gorkha).

Relatively longer tailed and colour above more with a reddish tinge, compared with the next.

(ii) **Rattus eha ninus** Thomas

1922. *Rattus eha ninus* Thomas, *Ann. Mag. nat. Hist.*, **10**, 404.

Type-locality.—Kiukiang-Salween Divide, Yunnan, 28° N., 11,000 ft.

Range.—Specimens examined from UPPER BURMA: Mount Imaw Bum; Adung Valley. Yunnan: Mekong Valley; Kiukiang-Salween Divide.

Duller in colour as a rule than the last and with a proportionately shorter tail. Indian skulls larger than true *eha*, but this distinction is not constant when Yunnan skulls are examined.

92. **Rattus cremoriventer** (Miller)

The Dark-tailed Rat

Text-fig. 42

1900. *Mus cremoriventer* Miller, *Proc. biol. Soc. Wash.*, **13**, 144.

Type-locality.—Trang, Siamese Malaya.

Distribution.—ASSAM, TENASSERIM, Indo-China, Malay States, Sumatra, Java, possibly Borneo.

This species appears to be nearly allied to *Rattus niviventer*, but it occurs with it and seems to differ only in having the tail wholly dark. The tail is normally not extremely elongated, but two types representing two little-known races seem to have the tail as long as in some forms of *fulvescens*.

External characters.—The fur is spiny in the typical race *tenaster* (according to Thomas) and *indosinicus*. (Typically, the specimen from 50 miles west of Kindat has soft fur above. I cannot trace its skull and it might, of course, be a wrong identification.) Tail longer than head and body but in Indian races not extremely so; 130% in the type of *tenaster*, averaging less than this in *indosinicus*. It is rather well haired and slightly tufted at the end and wholly dark. Hand with four clawed fingers. Foot rather broad, with five-clawed toes, that of the hallux in the typical race rather reduced. D. 5 rather noticeably long. The foot is arboreal in form and both the Indian *indosinicus* specimens, quoted above, seem in foot structure essentially like the typical race. Possibly this race is spiny seasonally. The Burmese skin was taken in April; the Assam one and a specimen from Tonkin in November-December. Mammae 8 (*indosinicus*). I have seen no skins for *tenaster*. The type is apparently in spirit. It was described as 'buffy or ochraceous with sharply defined under-surface and the tail similarly well-haired, uniformly brown'

Colour.—Rather light ochraceous dorsally in the typical race, tending to be more greyish brown in *indosinicus*. Feet usually pale brown. Belly white (or may be yellowish white in the typical race). Tail wholly brown or black.

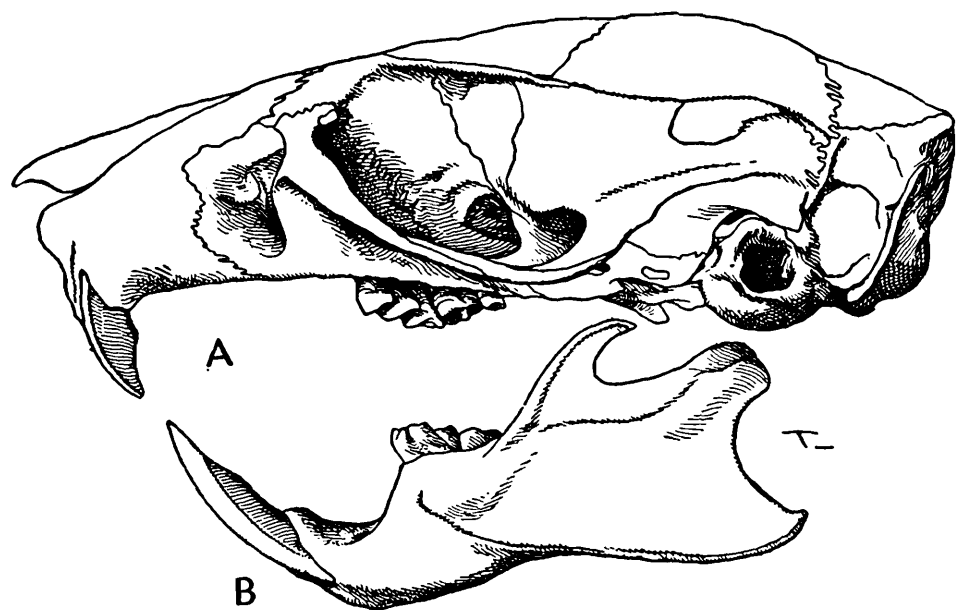
External measurements.—

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus cremoriventer indosinicus</i>						
F.	Margherita, Naga Hills, Assam	140	148	24	20	Mammae 8
M.	50 miles west of Kindat, West Burma	133	177	26	23	
	Type of <i>R. c. tenaster</i> , Mt. Muleyit, Tenasserim (from Thomas)	160	208	33.3	24	

Notes from skins.—Margherita, Naga Hills, 'mammae 2-2 = 8'

Cranial characters.—Occipitonasal length varies between 32 and 41 mm. but below 40 mm. in British Museum material, *tenaster* excepted. Supraorbital ridges very strong; in *tenaster* extending back well on to the parietals. Frontals very wide in *tenaster* and the typical race; not particularly widened in *indosinicus*. Interparietal large. Bullae small, about 12-13% of the occipitonasal length. Pterygoid fossae

rather flat. Palate less than half the occipitonasal length. Palatal foramina long, roughly 16-17% of the occipitonasal length. Zygomatic plate nearly straight anteriorly. Coronoid process of mandible well developed.



TEXT-FIG. 42. *Rattus cremoriventer* (Miller). A, lateral view of the skull. B, lower jaw of the same. (x7).

Dental characters.—Upper incisors yellow and plain. The typical race has a 5-rooted M. 1. Molars as in the related species; eight cusps in M. 1 and six in M. 2. M. 3 small and reduced. Lower molars normal.

Cranial measurements.—

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus cremoriventer tenaster</i>							
	88.12.1.54	41.3	19.7	10.3	7.3	5.5	6.1
	Top of Mt. Muleyit, Tenasserim. Old.	Frontals width 6.8 mm.					
M.	88.12.1.53	41.8	19.8	10.7	6.9	5.6	6.3
	Mount Muleyit. Type.	Frontals width 6.5 mm.					
<i>Rattus cremoriventer indosinicus</i>							
F.	20.7.6.34	35.7	16.7	7.8	6.3	4.9	5.8
	Margherita, Naga Hills, Assam.	Foramina measurement = shorter side. Frontals width 5.4 mm.					

12B

Dimensions of Rattus cremoriventer, in British Museum material, all specimens and races included.—The occipitonasal length varies between 32.1 and 41.8 mm. Toothrow 4.8–6.3 mm. The head and body length varies between 125 and 150 mm., the tail between 137 and 216 mm., the hindfoot 22–29 mm. (but according to Thomas, these measurements are exceeded in the type of *tenaster* as regards head and body (160 mm.) and hindfoot (33 mm.)).

Key to the Indian races of Rattus cremoriventer

- 1 (2) Occipitonasal length exceeds 41 mm. *R. c. tenaster*
- 2 (1) Occipitonasal length apparently less than 36 mm. *R. c. indosinicus*

The typical race has, according to our material, the skull considerably smaller than the Tenasserim race and the frontals actually wider than the form occurring in Assam, which incidentally is very poorly known. This species seems rare in India. Two names, *cretaceiventer* from Java and *langbianis* from Annam, antedate *indosinicus*, the form which occurs in Assam; and both of these have the tail, in their type specimens, more elongated than in typical *cremoriventer* and in *indosinicus*.

The Tenasserim race, *tenaster*, is little known but differs from the other races available to me in considerably larger size.

(i) **Rattus cremoriventer tenaster** (Thomas)

1916. *Epimys tenaster* Thomas, *Ann. Mag. nat. Hist.*, 17, 425.

Type-locality.—Mount Muleyit, Tenasserim, 5–6,000 ft.

Range.—Specimens examined from TENASSERIM: Mount Muleyit.

Like the typical race, but considerably larger, the occipitonasal length exceeds 41 mm.

(ii) **Rattus cremoriventer indosinicus** Osgood

1932. *Rattus indosinicus* Osgood, *Field Mus. Publ. Zool.*, 18, 307.

Type-locality.—Chapa, Tonkin.

Range.—Specimens examined from TONKIN, Chapa; ASSAM: Margherita in Naga Hills; BURMA: 50 miles west of Kindat.

Size as in the typical race (occipitonasal length about 35 mm.), from which apparently it differs chiefly in having the frontals not particularly widened.

Subgenus (e) **Lenothrix** Miller

1903. *Lenothrix* Miller, *Proc. U.S. nat. Mus.*, **26**, 466.

Type-species.—*Lenothrix canus* Miller, from Tuangku Island, west of Sumatra.

Distribution of subgenus as here understood.—Philippine Islands, Celebes, Borneo, Java, Sumatra (and numerous small adjacent islands), Malay States, Siam, Indo-China, TENASSERIM and CEYLON. More southern in general distribution than subgenus *Maxomys*, of which the present group might be a derivative with shortened palatal foramina. Very common in the Malayasian region.

Rats in which the palate is short, less than half the length of the occipitonasal length; and in which the bullae are small, less than 15% of the occipitonasal length; and in which the palatal foramina have become reduced, at highest 15% of the occipitonasal length. These three characters are all in contrast to the type-species of *Rattus*, which has a long palate, large bullae and long palatal foramina.

The first names in this highly specialized group of *Rattus* are from Celebes: *R. musschenbroeki* and *R. hellwaldi*, both of Jentink, 1879. The former (if *whiteheadi* is merged with it which seems possible) reaches mainland Asia in the Malay States. It is smaller in size than the *raja*-*surifer* rats which occur in Tenasserim. *R. hellwaldi* differs from the last named in dental details, probably more rings to the 10 mm. on the tail and apparently in its shorter palate.

Two Indian species referable to this group are *R. raja*, Tenasserim, and *R. ohiensis*, Ceylon. The latter is a very isolated form, not closely related to any of the others.

Key to the species of the subgenus Lenothrix in India

1	(2) Length of the upper toothrow 5.4 mm. and more, usually more. (It is only once as low as this measurement in nearly 190 skulls measured for this group.) Occi- pitonasal length usually over 40 mm. Supraorbital ridges very strong. Fur spiny. . .	<i>Rattus raja</i>
2	(1) Length of the upper toothrow 5.2 mm. and less, usually less. Occipitonasal length not reaching 40 mm. Supraorbital ridges weak. Fur soft.	<i>Rattus ohiensis</i>

93. *Rattus rajah* (Thomas)

The Malayan Spiny Rat

1894. *Mus rajah* Thomas, *Ann. Mag. nat. Hist.*, **14**, 451. Mt. Batu Song, Sarawak, Borneo.

Type-locality.—Mt. Batu Song, Sarawak, Borneo.

Distribution.—TENASSERIM, Malay States, Sumatra, ? Java, Borneo, Palawan; Siam, Indo-China.

It is customary (e.g. Chasen, 1940) to divide this species into two, *R. rajah* and *R. surifer*, because of the occurrence of two forms together in the Malay States (*surifer* and *pellax*, Miller, 1900) and possibly Borneo (*rajah* and *bandahara*) (the two Sumatran forms occur at different altitudes). However, I am unable to define characters to separate these two supposed species. There is a possibility that *pellax* and *surifer* are synonymous, in which case *pellax* takes priority. *R. rajah* has a short palate, shortened palatal foramina, which are wider behind than in front, very small bullae, most often but not always 11% of the occipitonasal length; shortish toothrow which does not normally reach 7 mm. in the whole group, immensely heavily ridged skull, with wide braincase; usually spiny fur, and the fifth toe rather shortened for a member of the present genus. Tail either a little longer or a little shorter than head and body; size medium. Evidently this species was not known by Blanford.

In size, the hindfoot is rarely under 35 mm. and the occipitonasal in the *rajah* group varies between 38 and 52 mm. but is nearly always under 50 and over 40 mm.

External characters.—Medium largish rats, with the fur very harsh, bristly or spiny. The tail is scaly, but with a certain rather scanty growth of hair throughout its length. In mainland specimens the tail is usually a little longer than the head and body, but in the insular specimens it is almost always a little shorter. Throughout this large group of rats there is a certain tendency towards shortening of the tail, most marked, as a general rule, in insular forms, and not apparently present in races which occur on the mainland. Hand with four functional fingers, all bearing claws. The two middle fingers slightly longer, as a rule, than the second digit, which is longer than the fifth. Hindfoot narrowish. The three middle toes are considerably longer than the fifth toe, which barely reaches past the base of D. 4, although it is slightly longer than the hallux. All the toes clawed, hallux included. Six plantar pads apparently.

Ear apparently quite large, more than one-tenth of head and body length.

Colour.—The back is usually light or yellowish brown, but always mixed with a large number of black-tipped spiny hairs, giving a sort of mottled effect and often tending to be more dark in the centre of the back than on the sides. Feet, as a rule, rather pale brown; underparts white (pure white to rather dirty or drab). Tail sharply bicolor, dark above, white below; sometimes wholly white at end.

External measurements.—As in Table 81, below.

TABLE 81.—*External measurements of Rattus rajah surifer*

	Head and body	Tail	Hind- foot	Ear
F. Taok Village, Tenasserim	149	192	39	24
F. Taok Plateau, Tenasserim	159	193	41	24
F. Taok Plateau	178	198	41	22
M. Maliwun, Tenasserim	173	204	40½	22
F. Maliwun	183	195	29	23
M. Bankachon, Tenasserim	181	197	41	23
M. Bankachon	178	191	38½	22
F. Bankachon	196	190	38½	23
M. Bankachon	177	185	38½	23½
M. Bankachon	198	231	41	25
M. Thaget, Tenasserim	210	244	46	24
F. Thaget	182	196	41½	23
M. Victoria Island, Tenasserim	187	184	43	23
M. Victoria Island	202	199	43½	24½
F. Victoria Point, Tenasserim	188	179	38½	23½
F. Victoria Point	173	179	40	?
M. Victoria Point	176	187	40	22½
M. Tavoy Island, Tenasserim	213	?	44	24
F. King Island, Tenasserim	190	155	39	23
F. Sullivan Island, Tenasserim	188	155	37	25
M. Kisseraing Island, Tenasserim	205	174	39	22
M. Victoria Point, Tenasserim	170	187	40	23
F. Victoria Point	180	177	39	23
F. Sir John Hayes Island	155	155	38	23
F. Sir John Hayes Island	175	150	39	24
F. Sir John Hayes Island	175	152	40	24
F. Sir John Hayes Island	172	178	32	24
M. Hastings Island, Mergui	224	186	41	24
M. Tavoy Island, Mergui	225	215	45	24
F. Tavoy Island	180	170	40	24
M. Tavoy Island	200	180	40	24
F. Tavoy Island	182	167	41	24
M. Ross Island, Mergui	162	160	39	22
M. Ross Island	203	167	41	25
M. Malcolm Island	175	160	39	22
M. Malcolm Island	193	154	39	21
M. King Island, Mergui	192	160	38	23

TABLE 81.—*External measurements of Rattus rajah surifer (concl'd.)*

	Head and body	Tail	Hind- foot	Ear
F. King Island	175	156	40	21
F. King Island	180	156	39	23
F. King Island	189	160	35	23
M. King Island	171	159	40	23
M. Kisseraing Island	186	163	40	24
M. Kisseraing Island	220	175	39	24
M. Kisseraing Island	188	173	39	22

Notes from skins.—Victoria Island, Tenasserim, weight $6\frac{3}{4}$ oz. and 8 oz. Victoria Point, 4 oz. Victoria Island, $4\frac{1}{4}$ oz. Thaget, $7\frac{1}{4}$ oz. Bankachon, $6\frac{7}{8}$ oz.

Cranial characters.—Medium size; occipitonasal roughly 38–49 mm. in the Indian race. The skull of this species is characteristic; the rostrum is pointed, with the nasals long and distinctly narrower behind than in front; the frontals are wide, very little constricted, and are immensely heavily ridged; these ridges spread outwards to the frontoparietal suture (which is often nearly straight) and in old specimens tend to form a sort of postorbital projection at that point; the ridges then continue backwards over the sides of the very wide parietals to a greater or lesser extent, but usually to the front edges of the interparietal, which is large and wide. Occiput strong and well ridged. Bullae small and flat, showing a good part of the periotic each side and on average 11% of the occipitonasal length. Individual specimens, however, may have them only 10%. The antero-internal corner of the bullae forms a narrow process projected forward towards the hamulars. Pterygoid fossae elongated, rather shallow. Palate short, always considerably less than half the occipitonasal length, although not so strongly shortened as in some Malayasian species of the same subgenus. Palatal foramina short and of rather characteristic shape; they are narrow in front but considerably widened behind. They approximate to 14% of the occipitonasal length, as a rule. Zygomatic plate nearly straight anteriorly, slanting slightly backwards from lower to upper border. Mandible with well-developed coronoid process. The lower incisor root is not apparent on the jaws outer side.

Dental characters.—Upper incisors narrow, red, plain and slightly recurved. Roots of M. 1 reduced, usually to three (or three main roots). Molars not heavily cuspidate; M. 1 with eight cusp spaces; the front lamina of M. 1 rather

narrow, the anteroexternal cusp reduced and the antero-internal one tends to be turned inwards. M. 2 with six cusp spaces, the anterointernal, a wide tricuspidate second lamina and a narrow bicuspidate third lamina. M. 3 medium, consisting of an anterointernal cusp and two lamina behind it (the hindmost one rather reduced). M. 2 may occasionally have traces of a minute anteroexternal cusp (in one specimen this cusp is quite clear). Lower molars biserially cuspidate; the laminae 3-2-2 as usual; M. 1 and M. 2 with clear terminal heel.

Cranial measurements.—As in Table 82, below.

TABLE 82.—*Cranial measurements of Rattus rajah surifer*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
M.	14.12.8.192 Thaget, Tenasserim. Old	47.6	22.2	12.7	6.6	5.2	6.6
F.	14.12.8.193 Thaget. M. 1 3-rooted	44.1	20.7	11.5	6.6	5.1	6.3
F.	14.12.8.195 Maliwun, Tenasserim. M. 1 3-rooted	42.7	20.3	11.5	6.4	?	5.9
M.	14.12.8.196 Victoria Island, Tenasserim	49.2	22.5	12.8	6.2	5.2	6.7
F.	14.12.8.198 Victoria Island	42.3	19.5	10.5	5.8	4.8	6.5
M.	14.12.8.199 Victoria Point, Tenasserim. Three main roots in M. 1	42.1	19.6	10.7	6.3	4.5	?
F.	14.12.8.202 Victoria Point	43.2	20.3	11.5	6.7	4.7	6.4
M.	14.12.8.203 Bankachon, Tenasserim	46.5	21.3	12.2	6.7	4.9	6.1
M.	14.12.8.204 Bankachon. (Note unusually small toothrow)	43.0	19.6	11.7	6.2	4.8	5.4
M.	14.12.8.205 Bankachon	43.6	20.6	11.4	6.5	4.7	6.1
M.	14.12.8.206 Bankachon. The foramina measurement represents the shorter side	43.1	19.6	11.1	6.4	4.7	6.0
F.	14.12.8.207 Bankachon. Old. The foramina measurement represents the shorter side	45.0	21.3	12.0	6.4	5.0	6.2
F.	88.12.1.51 Thagata, Tenasserim. The foramina measurement represents the shorter side	43.4	20.5	11.4	6.4	5.1	6.2
F.	88.12.1.52 Thagata	43.2	20.6	11.4	7.0	5.0	6.1
M.	14.12.8.194 Maliwun, Tenasserim	40.9	19.2	10.7	5.8	4.7	6.6

Dimensions of Rattus rajah, in British Museum material.—The occipitonasal length varies apparently between 38.2 and 51.2 mm. The toothrow 5.4–7.2 mm. (only reaching 7 mm. once in well over 100 skulls). The head and body varies between 145 and 225 mm., the tail between 140 and 244 mm., hindfoot 29–47 mm. These measurements must be taken as approximate.

(i) **Rattus rajah surifer** (Miller)

1900. *Mus surifer* Miller, *Proc. biol. Soc. Wash.*, 13, 148.

Type-locality.—Trang, Lower Siam.

Range.—Specimens examined from TENASSERIM: Bankachon, Maliwun, Thaget, Taok Plateau, Victoria Island, Victoria Point. MERGUI PENINSULA: Sir John Hayes Island, Hastings Island, King Island, Kisseraing Island, Malcolm Island, Ross Island, Sullivan Island and Tavoy Island. PERAK: Maxwells Hill and Gunong Ijan. JOHORE: South Lebam, Pulau, Pelapak and Si Karang. SELANGOR: Cheras. TRANG: Aokhan, Chong and Lamra. SW Siam: Maprit Patinju and Biserat. Tioman Island.

It is probable that the rats from the small islands of the Mergui Archipelago are racially distinct from true *surifer* on account of their short tails. Some authors doubtless would make a race for each island, and Miller has already named several races from various small islands. Perhaps one of these names might be used for the Mergui specimens. I do not personally believe it is either necessary or possible to have a definable race from each island. I cannot see that the skins from the various islands differ appreciably from the typical or each other in colour.

We have very few measurable specimens for typical *Rattus rajah*. The few we have, indicate that possibly this is a longer tailed form than *surifer* and it also seems to have rather long nasals. *R. r. ? pellax* from Trang will also differ, if at all, from *surifer* in slightly longer nasals.

94. **Rattus ohiensis** Phillips

Ohiya Rat

1929. *Rattus ohiensis* Phillips, *Ceylon J. Sci., Sec. B*, 15, 167.

Type-locality.—West Haputale, Ohiya, Ceylon.

Range.—Specimens seen from CEYLON: West Haputale.

This somewhat extraordinary species is not closely allied to other species referred to subgenus *Lenothrix* and is widely separated from them geographically. Nevertheless, it has the three characters, short palate, short foramina and small bullae, characteristic of that group as here understood. It differs from all others except the Bornean *R. baeodon* in its unusually short toothrow. From *baeodon* it differs in much weaker supraorbital ridges, longer palate and the shape of the palatal foramina, which are narrow behind as well as in front. From *rajah* it differs in weaker supraorbital ridges, the shape of the palatal foramina and in its shorter toothrow. Besides this, the skull is rather smaller. It is curiously isolated in Ceylon and it is difficult to say what is really its nearest ally.

External characters.—Medium sized, soft furred rats with the tail longer than head and body (usually a little under 120%). The tail not very well haired. Four fingers present, all clawed; five toes, all clawed; the fifth toe longer than the hallux but shorter than the centre three. Six plantar pads. I do not know the mammary formula.

Colour.—Above dark, almost blackish brown. Feet whitish. Underparts white. Tail usually sharply bicolor, blackish above, white below; rarely all white terminally.

External measurements.—

	Head and body	Tail	Hind- foot	Ear
F. West Haputale, Ceylon	125	148	28	19
M. West Haputale	152	190	32	18
M. West Haputale	161	182	33	?
M. West Haputale	149	178	32	21
M. West Haputale	147	174	31	20
M. West Haputale. Type	150	187	33	22

Notes from skins.—‘Trapped in jungle.’

Cranial characters.—Medium size, occipitonasal length about 38-39 mm. Supraorbital ridges very weak in proportion to the size of the animal. Frontals little constricted and braincase broad. Suture of frontals and parietals nearly straight. Interparietal large. Bullae small, reduced and rather flat, about 12% of the occipitonasal length. Pterygoid fossae shallow. Palate short, less than half the occipitonasal length. Palatal foramina strongly shortened, situated about half-way between incisors and molars, and approximating to 14% of the occipitonasal length. Molars extremely small, only about 12% of the occipitonasal as a rule, which is an extremely low percentage for the present genus. (It is

shared by *R. baeodon* of Borneo, in the present subgenus.) The width of M. 1 is about 1.5–1.6 mm. Coronoid process of mandible medium in size.

Dental characters.—Upper incisors narrow, rather pale and plain. Molars of the few available skulls rather worn; apparently M. 1 has eight cusp spaces and M. 2 six; M. 3 appears rather reduced in size. Lower molars apparently normal.

Cranial measurements.—

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
M.	35.10.6.7	39.3	18.5	10.6	5.5	4.9	5.2
	West Haputale, Ceylon	<i>circa</i>					
M.	35.10.6.8	38.3	18.3	10.2	5.6	4.4	4.9
	West Haputale. The foramina measurement represents the shorter side						
M.	29.1.30.1	39.8	18.8	10.2	5.9	4.9	4.8
	West Haputale. Type					<i>circa</i>	

Dimensions of Rattus ohiensis, in British Museum material.—The occipitonasal length varies between 38.3 and 39.6 mm. The toothrow 4.8–5.2 mm. The head and body length varies between 125 and 161 mm. Tail between 148 and 190 mm. Hindfoot 28–33 mm.

Subgenus (*f*) **Leopoldamys** Ellerman

1947. *Leopoldamys* Ellerman, *Proc. zool. Soc. Lond.*, **117**, 1, 261, 267.

Type.—*Mus sabanus* Thomas.

Range.—SIKKIM, ASSAM, BURMA, southern China east to Fukien, north to Szechuan, Indo-China, Siam, Malay Peninsula, Sumatra, Java, Borneo and various adjacent small islands.

This group contains large rats, with unusually small bullae, which are only 10% of the occipitonasal length at highest, sometimes as low as 9% or even lower. The occipitonasal length normally exceeds 50 mm. and the toothrow is more than 8 mm. in length. Usually there is root reduction in M. 1 and only four roots in this tooth. The palate is not much elongated and may be a little shorter or a little longer than half the occipitonasal length, varying in the different races. The palatal foramina are usually medium in length, varying from about 13% to about 16% in the various races. I think it is reasonable to separate the two

species, *R. sabanus* and *R. edwardsi*, subgenerically from the rest of *Rattus*. The unusually small bullae recall *Dacnomys* (which has longer teeth) and certain Australian genera as *Uromys* (which has a very long palate) and *Macruromys* (which has unusually small molars).

The two species grouped here, *R. edwardsi* and *R. sabanus*, do not prove very easy to define. But it appears that wherever they occur together, they differ in size; *edwardsi* is always larger on average than *sabanus*. If, after measuring all skulls available in the London collection, we take 56 mm. as an average length for the races of *edwardsi*, and 55 mm. or less as average for *sabanus*, the two species can be defined. True *sabanus*, from Borneo, tends to become large in skull length, and a difficulty is raised by drawing this somewhat arbitrary line in that the Indian forms *listeri* and *garonum*, which have hitherto been considered as near allies and one species, fall into different sides of the dividing line. In other words, *garonum* becomes a race of *sabanus*, whereas *listeri* remains in *edwardsi*. It is, however, conceivable that this is correct. Races of *sabanus* and *edwardsi*, differing in size just as do *listeri* and *garonum*, are found together in Annam, the Malay States and Sumatra, and it is possible that something similar occurs in Assam-Sikkim region, the home of *listeri* and *garonum*.

The form '*listeri*' does not seem separable from true *edwardsi*. The two species here retained occur in the same general neighbourhood as each other rather than actually from the same localities, so far as British Museum material shows. It is not impossible that the whole of the present subgenus could be referred to one species, in which case *edwardsi* is the prior name.

Key to the species of the subgenus Leopoldamys

1	(2) The occipitonasal length most often exceeds 56 mm. . . .	<i>Rattus edwardsi</i>
2	(1) The occipitonasal length is most often less than 56 mm. (less than 55 mm. in Indian races).	<i>Rattus sabanus</i>

95. *Rattus edwardsi* (Thomas)

Edwards's Rat

1882. *Mus edwardsi* Thomas, *Proc. zool. Soc. Lond.*, 587.

Type-locality.—The mountains of western Fukien (probably Kuatun), China.

Distribution.—Szechuan, Fukien, Kwantung, Indo-China, Malay States, BURMA, ASSAM, SIKKIM (or its vicinity), Sumatra, and Sipora Island, west of Sumatra.

A large species, with the characters of the subgenus above. Occipitonasal length most often exceeds 56 mm. (possibly excepting the Malay States race, *ciliatus*, which has a black tail). The tail is longer than head and body but not abnormally elongated, averaging below 140% of head and body length, normally. Usually it is of two colours, but may be wholly dark. The supraorbital ridges are quite well developed on the skull and the very small bullae will distinguish this species from all but *R. sabanus*, and occasionally rats of the *rajah* branch, which have much smaller teeth, apart from other peculiarities. Mammae 8 (*listeri*).

External characters.—Large rats, head and body length usually more than 200 mm. Tail longer than head and body in all races available to me. Ear quite large, over one-tenth head and body length in Indian specimens. Fur short and harsh, but apparently not spiny. Tail not very well haired. Four functional fingers, all clawed. Foot with five toes, all clawed; fifth toe longer than hallux, shorter than the middle three; six plantar pads. Mammae 8 (*listeri*).

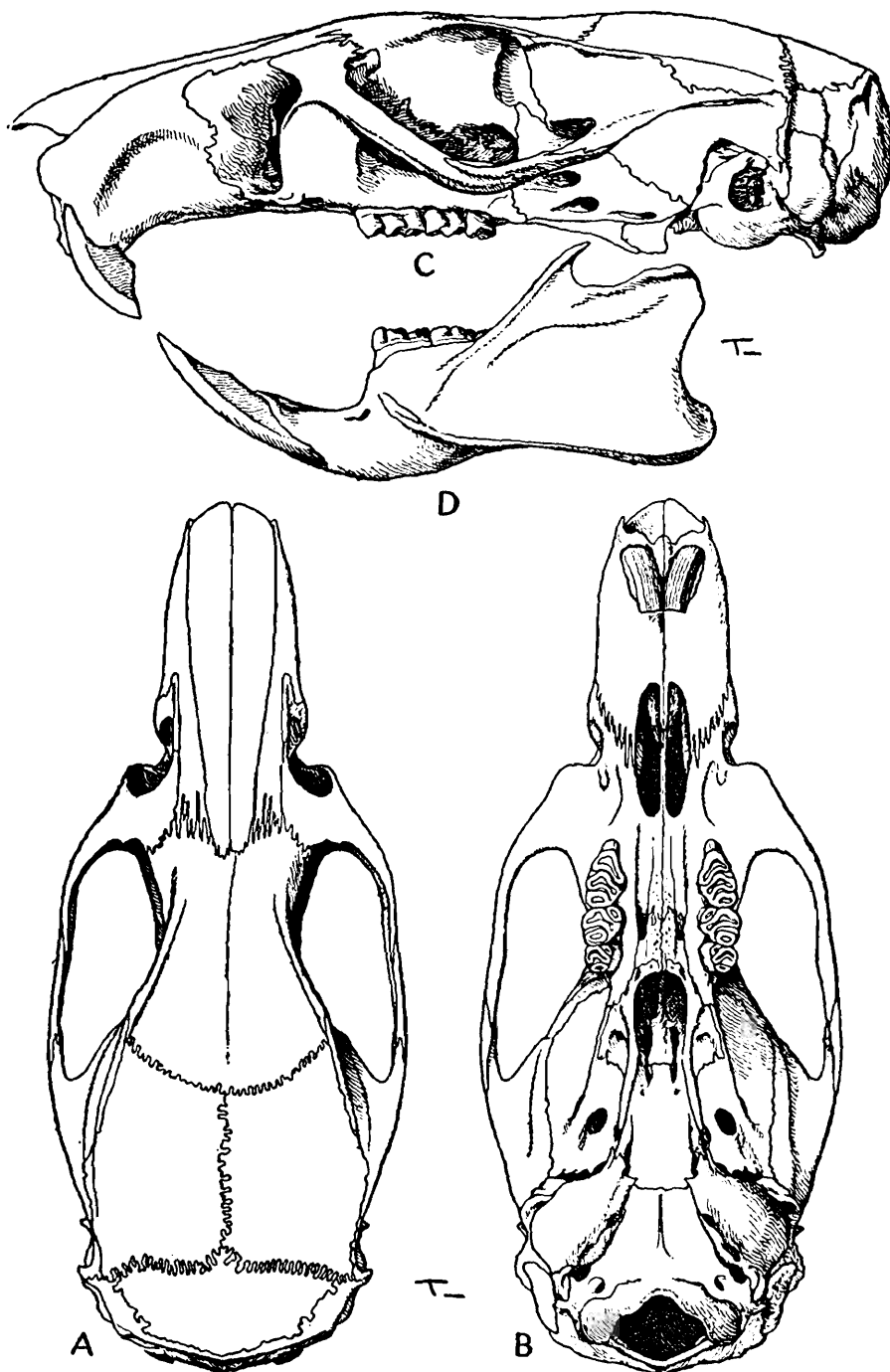
Colour.—Back brown, sometimes slightly darker in the middle than at the sides; the underparts white. Colour of feet variable, often dark, sometimes tending to be whitish (both types present in the small series for *listeri*). Tail poorly to clearly bicolor (dark above, pale below); sometimes its end can be pale above, in some cases for quite a distance along the surface of the tail, but this is not a constant character.

External measurements.—

	Head and body	Tail	Hind- foot	Ear
<i>Rattus edwardsi edwardsi</i>				
M. Adung Valley, N. Burma, 28.10° N. 97.40° E.	240	295	48	30
<i>Rattus edwardsi edwardsi</i> (' <i>listeri</i> ')				
M. Dening, Mishmi	256	297	48½	31
M. Dreyi, Mishmi	258	293	48	32
F. Dreyi ..	235	289	42	34 Mammae 2-2 = 8
Also seen from Mokokchung in Naga Hills, Assam.				
Pashok, Sikkim. Type	210	293	47	30

Notes from skins.—‘*Listeri*’: Dreyi, Mishmi, weight 15 oz., mammae 2-2 = 8, contained two foetuses. Dening, weight 13 oz.

Cranial characters.—Large rats; occipitonasal length in Indian specimens about 55-61 mm. in length. (53-61 mm.



TEXT-FIG. 43. *Rattus edwardsi edwardsi* (Thomas). A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. ($\times 4$).

approximately when all races are taken into account.) Rostrum rather prominent. Little marked interorbital constriction is present; supraorbital ridges present and strong on the frontals and sometimes suggested on the parietals. Suture of frontals and parietals about straight; parietals rather wide; interparietal wide and prominent. Occiput quite strong. Bullae unusually reduced, small and flat, 10% at highest of occipitonasal length, but often only 9%. Pterygoid fossae rather long and flat. The palate of medium length; sometimes a little longer than half the occipitonasal length, often a little shorter than half this length. Palatal foramina moderately short; roughly 14–16% of the occipitonasal length. Teeth rather heavy, the length of the tooth-row exceeds 8 mm. (about 16% of the occipitonasal). Zygomatic plate slightly cut back above. Mandible with the lower incisor root scarcely showing on its outer side and with well ridged lower border and well developed coronoid process.

Dental characters.—Upper incisors opisthodont, reddish and plain; only moderately powerful in proportion to the size of the animal. Roots of M. 1 reduced apparently to four (by the fusion of the two inner roots). M. 1 with eight cusps; M. 2 with six (the anterointernal being the only clear cusp of the original front lamina); M. 3 not very strongly reduced; trilaminate apparently. Lower molars biserially cuspidate as usual; with quite well marked terminal heel in M. 1 and M. 2.

Cranial measurements.—

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus edwardsi edwardsi</i>							
M.	32.11.1.84	61.2	29.9	16.0	10 0	5.7	9.8
	Adung Valley, North Burma						
M.	20.8.8.9	58.8	29.1	15.0	9.3	?	10.1
	Kachin, North Burma						
<i>Rattus edwardsi edwardsi</i> (' <i>listeri</i> ') <i>circa</i>							
F.	20.6.6.18	57.3	28.4	14.7	7.8	6.0	8.7
	Mokokchung, Naga Hills, Assam.			<i>circa</i>			<i>circa</i>
M.	21.12.5.87	56.5	28.0	14.2	9 0	?	9.2
	Dening, Mishmi						
M.	21.12.5.88	57.6	28.9	14.3	9.4	5.8	9.8
	Dreyi, Mishmi						
M.	16.3.25.97	55.3	27.3	13.5	8.0	5.7	8.9
	Pashok, Sikkim, type						

Dimensions of Rattus edwardsi, in British Museum material, all available races included.—The occipitonasal length varies between 54.1 and 61.5 mm. The toothrow 8.5–10.5 mm. The head and body length varies between 195 and 292 mm. Tail between 235 and 352 mm. Hindfoot 42–56 mm.

The subspecies of Rattus edwardsi.—

In this species there seem to me to be two rather distinct groups of races; the one, containing *R. e. ciliatus* of Malaya and *R. e. setiger* of Sumatra, with the tail apparently normally wholly dark; and the other, containing the Indian races and *R. e. siporanus*, an unusually large form from Sipora Island, West Sumatra, with the tail of two colours in the majority. Although in my measurements *listeri* has the skull a little smaller than Indian *edwardsi*, this is not the case when numerous *edwardsi* skulls from China and Indo-China are taken into account. In fact, these two forms hardly differ at all.

It seems the describer overlooked *edwardsi* when *listeri* was described.

I can see no difference in the colour between *listeri* and *edwardsi*, nor can I find constant cranial distinctions between the two, and I therefore come to the conclusion that *listeri* is a synonym of *edwardsi*.

(i) **Rattus edwardsi edwardsi** (Thomas)

Text-fig. 43

1882. *Mus edwardsi* Thomas, *Proc. zool. Soc. Lond.*, 587.

1916. *Epimys listeri* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 3, 406.

Type-locality.—Of *edwardsi*, Kuatun, Fukien, S. China, and of *listeri*, Pashok, 3,500 ft., Darjeeling.

Range.—Specimens examined from DARJEELING district: Pashok. MISHMI: Dening, Dreyi. ASSAM: Mokokchung in Naga Hills. UPPER BURMA: Adung Valley; Kachin, 28° N., 97° E.; Fukien, Kuatun. Tonkin, Backan, Chapa, Ngai-tio. Laos, Nape and Xieng-khouang.

Anthony, 1941, has recorded a specimen of *Rattus edwardsi gigas* Satunin (1903, *Ann. Mus. Zool. St. Petersbourg*, **7**, 562) (type-locality near Lunganfu, Szechuan) from Hpare, North Burma. It is said by Glover Allen to have softer fur than the typical race. I have never seen a specimen.

96. *Rattus sabanus* (Thomas)

The Noisy Rat

1887. *Mus sabanus* Thomas, *Ann. Mag. nat. Hist.*, 20, 269.

Type-locality.—Mt. Kina Balu, Borneo.

Distribution.—ASSAM, TENASSERIM, Indo-China, Siam, Malay States, Sumatra, Java, Borneo and small adjacent islands. The typical race is from Borneo.

Essentially like *Rattus edwardsi*, but occurring with it and averaging smaller in occipitonasal length, which is most often less than 55 mm. in length, perhaps excepting the typical race. Apart from this, it is not easy to distinguish this species from *R. edwardsi*. Sometimes in *sabanus* the tail becomes unusually elongated but this is not a constant character.

Neither the present species nor *edwardsi* were known to occur in India in Blanford's day. In the race *garonum*, there are 8 mammae.

External characters.—Large rats; head and body length normally 200 mm. at least. Tail in all races known to me longer than head and body, sometimes extremely so. Ear more than one-tenth head and body length in Indian specimens. Fur apparently moderately soft in *garonum*, harsh and more or less bristly or near spiny in *vociferans*. Tail very poorly haired in the latter, not well haired in the former. Hand with four functional fingers bearing claws. Foot with five toes, all clawed, their proportions about as in *R. edwardsi*; six plantar pads. Mammae 8, so far as known.

Colour.—Above light, almost tawny, brown, sometimes tending to be darker centrally; duller brown in *garonum* than in *vociferans*. Feet pale brown, usually with white toes in Indian specimens. The tail is bicolor, dark above, white below, but usually seems to be wholly pale terminally above. Underparts white (lighter or darker; pure white in *garonum*; brown in one aberrant individual from Kisseraing Island).

External measurements.—As in Table 83, below.

Notes from skins.—*garonum*: weight 11 oz., Tura.

vociferans: Kisseraing Island, weight $11\frac{1}{2}$ oz. Victoria Island, 12 oz. and mammae 8: $10\frac{3}{4}$ oz. Bankachon, 11 oz.

Cranial characters.—Essentially similar to those of *Rattus edwardsi* but (particularly where the two occur together) always averaging smaller. Occipitonasal length less than 55 mm. in Indian material (but not under 53 mm.). In *vociferans*, the palate is usually rather more than half the occipitonasal length, but this is not the case in *garonum*.

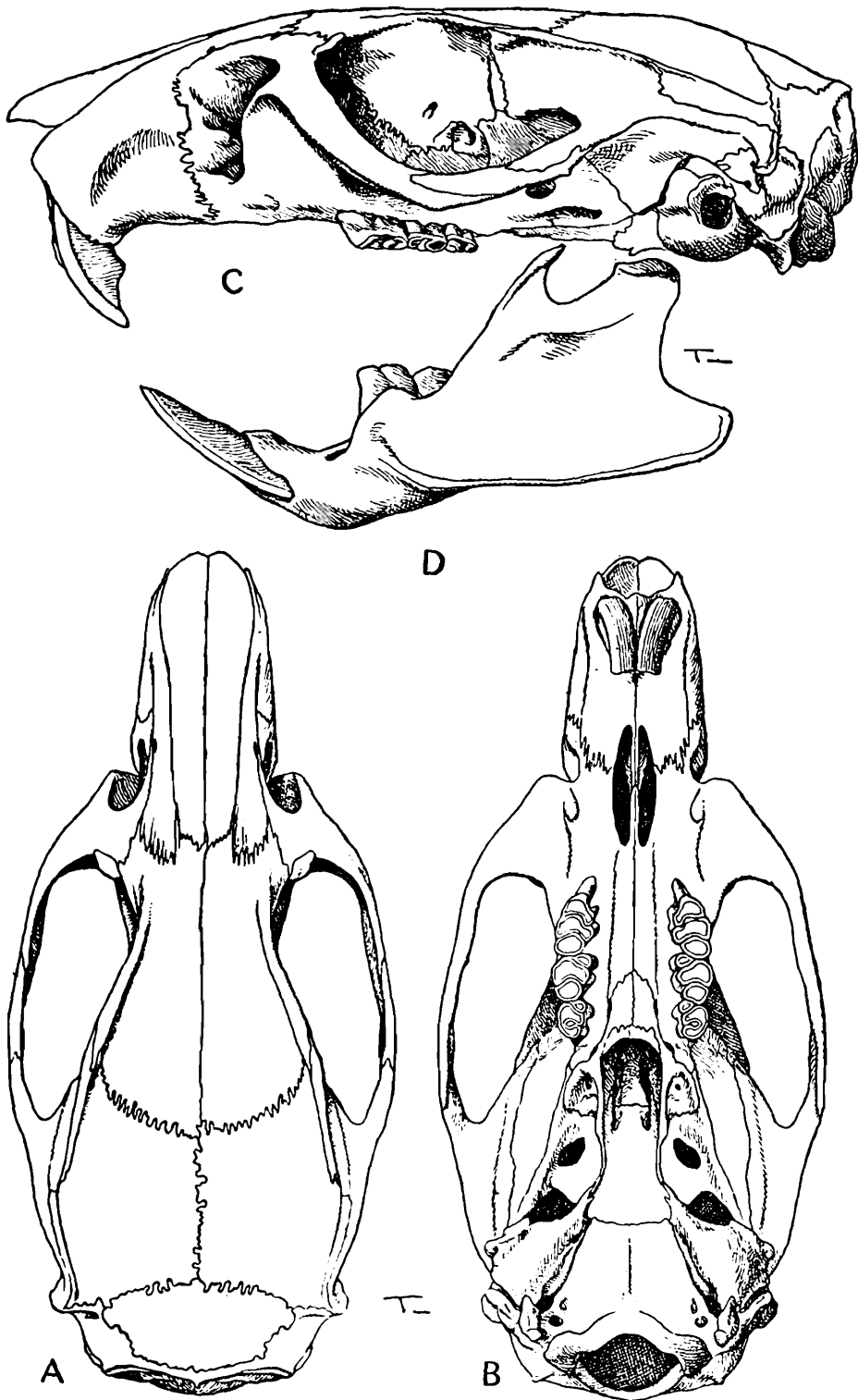
TABLE 83.—*External measurements of the Indian races of Rattus sabanus*

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus sabanus garonum</i>						
F.	Tura, Garo Hills, Assam. Type	232	305	46	30	Mammae 2-2 = 8
M.	Tura, Garo Hills	229	295	45	28	
M.	Tura, Garo Hills	245	315	47	30	
<i>Rattus sabanus vociferans</i>						
F.	Victoria Island, Tenasserim	225	320	45	25	Mammae 8
F.	Tavoy Island, Tenasserim	230	340	42	27	
M.	King Island, Tenasserim	250	350	50	26	
M.	Victoria Island, Tenasserim	226	332	46½	26	
M.	Bankachon, Tenasserim	218	360	47	25	
F.	Tavoy Island	223	350	44	26	
M.	Ross Island, Mergui	247	336	46	26	
M.	Kisseraing Island	246	337	45	27	
F.	Kisseraing Island	253	360	43	?	
F.	King Island	230	310	45	28	

Dental characters.—Essentially as in the related species.
Cranial measurements.—As in Table 84, below.

TABLE 84.—*Cranial measurements of the Indian races of Rattus sabanus*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus sabanus vociferans</i>							
M.	14.12.8.211 Victoria Island, Tenasserim	53.5	27.6	13.2	7.7	5.4	8.7
F.	14.12.8.212 Victoria Island	53.0	27.5	13.6	7.9	5.7	8.6
F.	23.1.6.69 Tavoy Island, Mergui Archipelago.	53.1	26.9	13.7 <i>circa</i>	8.1	5.3	8.3 <i>circa</i>
M. 1 4-rooted.							
<i>Rattus sabanus garonum</i>							
M.	20.11.1.53 Tura, Garo Hills, Assam	54.1	27.0	13.5	8.3	5.7	9.3
M.	20.11.1.54 Tura, Garo Hills. The shorter side	54.8	27.0	13.5	9.1	5.5	9.2
F.	20.11.1.55 Tura, Garo Hills. Type	54.7	27.2	13.5	8.8	5.7	9.1



TEXT-FIG. 44. *Rattus sabanus vociferans* (Miller). A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. ($\times 4$).

Dimensions of Rattus sabanus, in British Museum material, all races included.—The occipitonasal length varies between 49.7 and 58.7 mm. The toothrow 8.3–9.8 mm. The head and body length varies between 200 and 271 mm. Tail between 270 and 400 mm. Hindfoot 38–50 mm.

Key to the Indian races of Rattus sabanus

1	(2) Length of the tail (in Indian specimens) is normally 320 mm. and more; over 140% of the head and body length normally. Palate usually more than half occipitonasal length... .	<i>R. s. vociferans</i>
2	(1) Length of the tail 315 mm. and less than 140% of the head and body. Palate less than half the occipitonasal length.	<i>R. s. garonum</i>

So far as I can see in British Museum material, there are two rather sharply divided groups of races in this species; one having the tail unusually elongated and the other having the tail not so elongated.

The typical race, from Borneo, has, so far as I can tell, the tail less than 130% of the head and body length. The second name, *vociferans*, which occurs in India, has the tail over 140% of the head and body. All races, except one from Java, which I have examined and which antedate *garonum* have the tail percentage agreeing with *vociferans*, except the typical. The Javanese race seems to have (judging by its type) unusually small bullae. The typical race averages larger than *garonum* in skull length and the palate is actually longer in all skulls I have measured.

(i) ***Rattus sabanus vociferans* (Miller)**

Text-fig. 44

1900. *Mus vociferans* Miller, *Proc. biol. Soc. Wash.*, **13**, 138.

Type-locality.—Trang, Siamese Malaya.

Range.—Specimens examined from TENASSERIM: Bankachon, Victoria Island; Islands of Mergui Archipelago; King Island, Ross Island, Tavoy Island, Kisseraing Island. Selangor: Gintang Bidei. Perak: Maxwells Hill, Gunong Ijan and Taiping. JOHORE: Pulai and Si Karang. Pangkor Bezar Island. Trang: Lamra and Chong. Maprit Patinju, Siamese Malaya.

Tail usually exceeds 140% of head and body length. Palate usually exceeds half occipitonasal length.

(ii) ***Rattus sabanus garonum* Thomas**

1921. *Rattus listeri garonum* Thomas, *J. Bombay nat. Hist. Soc.*, 28, 1, 27.

Type-locality.—Tura, Garo Hills, 1,400 ft., Assam.

Range.—Specimens examined from ASSAM: Tura in Garo Hills.

Tail less than 140% of head and body length. Palate less than half occipitonasal length.

R. s. sabanus, the largest race of the species as judged by length of skull, has a bicolor tail, thereby differing from the smallest race of *edwardsi*, *R. e. ciliatus*, which has a dark tail.

Subgenus (*g*) ***Cremnomys* Wroughton**

1912. *Cremnomys* Wroughton, *J. Bombay nat. Hist. Soc.*, 21, 340.

Type.—*Cremnomys cutchicus* Wroughton.

Distribution.—CUTCH, KATHIAWAR, BIHAR and SOUTHERN INDIA (Mysore, Bellary, Eastern Ghats).

This contains two isolated Indian species, with unusually long palatal foramina, which are well over one-fifth of the occipitonasal length; in *R. cutchicus* they average 22% or usually more of the occipitonasal length; the type of *R. elvira* has them 22% of that length, but a second specimen, which may be an abnormality, has them rather shorter. In this subgenus the palate is less than half the occipitonasal length, thereby differing from the species of typical *Rattus* which have the longest palatal foramina; also in *Cremnomys* the bullae are smaller than in the forms of typical *Rattus* just mentioned. Other characters for *Cremnomys* are a tendency to reduction of the coronoid process, a tendency to reduction of the number of roots in M. 1, and six mammae so far as known. The short palate and the structure of the hindfoot (with six plantar pads and rather long fifth toe) separates the group from *Millardia*. The character of the unusually long palatal foramina resembles the majority of African species of *Rattus*; indeed this species is by no means easy to separate from a South African species, *R. namaquensis*, which antedates it by many years, and merely seems to differ in colour details. Parallel evolution rather than close relationship may be indicated here.

Key to the species of subgenus *Cremnomys*

- 1

(2) Occipitonasal length not more than 35.7 mm.

Rattus cutchicus
- 2

(1) Occipitonasal length not less than 38.2 mm.

Rattus elvira

97 ***Rattus cutchicus*** (Wroughton)

The Cutch Rock-Rat

1912. *Cremnomys cutchicus* Wroughton, *J. Bombay nat. Hist. Soc.*,
21, 340.

Characters and distribution as in the subgenus above; smaller species, occipitonasal length 35.7 mm. at highest.

Thomas divided this species into three species, but on working through the British Museum material it becomes fairly clear that there is only one valid species among the smaller forms, and all the named forms are closely related. The species was not discovered in Blanford's day.

External characters.—Medium sized, long tailed rats, with soft fur. The tail is quite well haired for a member of the present genus. Hand with four functional clawed digits. Foot with five toes, all clawed; the fifth toe shorter than the central three, but rather noticeably long; hallux very much shorter than the fifth toe. Apparently six plantar pads. Mammae 6.

Colour.—Above varying from drab grey to drab brown; the hairs darker basally. Hands and feet usually whitish. Tail either wholly dark or more often poorly bicolor (slightly darker above, paler below). Belly varying from pure white to white mixed with grey (slaty), or sometimes dull greyish. The belly is fairly consistently whiter in *australis* than other races, and darkest (greyest) in *medius*. Other races are intermediate.

External measurements.—As in Table 85, below.

TABLE 85.—*External measurements of the Indian races of Rattus cutchicus*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus cutchicus cutchicus</i>					
F.	Rhodamotha, Cutch	104	150	24	18
F.	Padampur, Cutch	119	147	25	19
F.	Padampur	119	147	23	?

TABLE 85.—*External measurements of Rattus cutchicus (contd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Rattus cutchicus cutchicus</i> (concl'd.)					
M.	Poiwadi, Cutch	117	143	24	20
M.	Dhonsa, Cutch	105	145	23	?
M.	Chalwar, Cutch	120	147	25	20
F.	Chalwar	106	155	25	20
M.	Chalwar	112	148	25	20
M.	Chalwar	110	147	24	20
M.	Nokania, Cutch	100	132	25	16
M.	Dhonsa, Cutch. Type	117	141	24	?
<i>R. c. cutchicus</i> ? Identification provisional					
	Tirthemalai, Salem district	105	158	26	19
M.	Kurumbapatti, Salem district	106	152	27	18
F.	Tirthemalai, Salem district	110	157	26	17
F.	Tirthemalai	117	167	26	18
F.	Tirthemalai	108	155	25	18
F.	Tirthemalai	108	147	27	18
M.	Kurumbapatti, Salem district	115	150	25	19
<i>Rattus cutchicus siva</i>					
F.	French Rocks, South Mysore	133	152	27½	19
M.	French Rocks	136	158	28	18
F.	French Rocks	131	148	26	17
F.	Sivasamudram, South Mysore	134	167	27	?
M.	Sivasamudram	147	164	28	18½
F.	Sivasamudram	135	160	29	19
M.	Sivasamudram. Type	149	159	29	19
<i>Rattus cutchicus australis</i>					
F.	Kolar, Mysore	140	145	26½	?
F.	Kolar	131	149	25½	19
M.	Kolar	145	141	27	19
	Kolar	147	141	28	19
F.	Kolar	130	144	25½	18½
F.	Kolar Town	140	152	26	?
F.	Vijayanagar, Bellary	130	180	28	17½
M.	Vijayanagar	137	166	26½	19
M.	Vijayanagar	141	166	27	20
M.	Vijayanagar	132	167	28	18
F.	Vijayanagar. Type	127	169	27	18½

TABLE 85.—*External measurements of Rattus cutchicus (concl'd.)*

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus cutchicus medius</i>						
F.	Kudia, Junagadh, Kathi- awar	124	151	26	?	Mammae 6
M.	Kudia, Junagadh	126	?	27	18	
M.	Kudia, Junagadh	114	153	26	18	
F.	Kudia, Junagadh	121	150	26	19	Mammae 6
M.	Kudia, Junagadh	116	139	26	18	
M.	Kudia, Junagadh	121	145	26	18	
F.	Kudia, Junagadh	122	160	25	?	Mammae 6
M.	Kudia, Junagadh	124	153	27	19	
F.	Kudia, Junagadh	119	156	27	18	Mammae 6
F.	Kudia, Junagadh	119	142	27	18	Mammae 6
M.	Danta, Gujerat	125	157	27	20	
M.	Danta, Gujerat	132	161	27	20	
F.	Kudia, Junagadh. Type	124	148	27	20	Mammae 6
<i>Rattus cutchicus medius</i> ('caenosus')						
F.	Singar, Gaya, Bihar	126	161	27	20	Mammae 6
F.	Singar, Gaya	125	146	25	?	Mammae 6
M.	Singar, Gaya	118	?	25	19	
M.	Gajhundi, Hazaribagh	121	148	27	?	
M.	Gajhundi	129	154	26	21	
M.	Singar, Gaya. Type	125	157	28	21	
<i>Rattus cutchicus rajput</i>						
M.	Mount Abu, Rajputana	117	?	27	21	
M.	Mt. Abu	126	154	28	19	
M.	Mt. Abu	127	162	28	19	
F.	Mt. Abu	125	153	27	21	Mammae 6
F.	Mt. Abu	118	148	26	20	Mammae 6
F.	Mt. Abu	127	157	27	?	Mammae 6
F.	Mt. Abu	124	153	25½	?	Mammae 6
M.	Mt. Abu	125	151	26	19	
F.	Mt. Abu	125	145	27	20	Mammae 6
F.	Mt. Abu. Type	126	166	27	20	Mammae 6

Notes from skins.—*R. c. cutchicus*: Dhonsa, trapped among rocks, 1¾ oz. Poiwadi, among rocks, no water, 2 oz. Nokania, 2 oz. and 1 oz. Padampur, on hill among rocks, 1¾ oz. and 2 oz. Charwa, among rocks, 1¾ oz., 2¼ oz. and 2 oz., six hindfoot pads, rocks and grass.

R. c. australis: Vijayanagar, 2¼ oz.

R. c. medius: Kudia, rocks, 2¾ oz. and 3 oz., mammae 6: 2 oz., 3½ oz. and 2¼ oz.; mammae 6: 2½ oz. Singar, Gaya, 2 oz. and mammae 6: 2½ oz. and 2¼ oz., mammae 6. Gajhundi, 2¼ oz.

R. c. rajput: Mt. Abu, 2½ oz., 2⅝ oz., 2¼ oz. and 2¾ oz., mammae 6: 2⅜ oz.

Cranial characters.—Medium size, occipitonasal length about 31–35 mm. The rostrum is rather prominent and pointed; there is moderate interorbital constriction, and supraorbital ridges are present and quite strong in old specimens. Parietals wider than frontals; interparietal large and prominent. Occiput rather low. Bullae of medium size, usually about 14–15% of the occipitonasal length. Pterygoid fossae rather shallow. Palate extending only to about back of toothrows, short, apparently always below half the occipitonasal length. Palatal foramina immensely elongated, penetrating well between toothrows, and almost always exceeding 22% of the occipitonasal length. Zygomatic plate slightly cut back above. Mandible with the coronoid process tending to be rather weak and reduced; lower incisor root not obviously appearing on its outer side.

Dental characters.—Upper incisors opisthodont, narrow, yellow and plain. Upper molars rather wide and well cuspidate. M. 1 has eight cusps (lacking the posterointernal only); its front lamina narrower than the middle one; M. 2 originally with seven cusp spaces (an anterointernal and a minute anteroexternal on the front lamina; three on the second, two on the third lamina); M. 3 but little reduced, with anterointernal cusp, and evidently two laminae behind it, the posterior one small, and sometimes fusing into the main one in front of it. Usually, but apparently not always, the two inner roots of M. 1 tend to become fused so that there are less than five roots in this tooth. Lower molars in two rows of cusps as usual; three laminae in M. 1, two in M. 2, two in M. 3 (its hindmost one single). Terminal heel in M. 1 and M. 2 and subsidiary outer cusplets on these teeth are traceable in young specimens.

Cranial measurements.—As in Table 86, below.

TABLE 86.—*Cranial measurements of the Indian races of Rattus cutchicus*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus cutchicus cutchicus</i>							
M.	12.10.4.74	32.8	16.0	7.9	7.2	4.8	5.1
	Charwar, Cutch			<i>circa</i>			
	12.10.4.75	32.5	15.6	7.4	7.6	4.8	5.5
	Charwar						

TABLE 86.—*Cranial measurements of Rattus cutchicus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus cutchicus cutchicus</i> (concl'd.)							
M.	12.10.4.76	31.4	15.4	7.3	7.3	4.9	5.0
	Charwar. Four main roots in M. 1			<i>circa</i>			<i>circa</i>
F.	12.10.4.77	32.4	15.9	7.7	7.3	4.7	5.4
	Charwar. Old						
F.	12.10.4.78	33.6	16.4	8.0	7.4	5.0	5.5
	Padampur, Cutch						
F.	12.10.4.82	31.6	15.5	7.0	7.5	5.1	5.5
	Rhodamotha, Cutch						

The type has the occipitonasal length about 32.5 mm. (Dhonsa, Cutch).

<i>Rattus cutchicus medius</i>							
M.	13.9.18.42	34.3	16.8	8.2	8.2	5.2	5.3
				<i>circa</i>			<i>circa</i>
	Danta, Gujerat. Four main roots in M. 1						
M.	15.5.27.8	34.1	15.4	7.4	7.7	5.1	5.4
	Kathiawar						
F.	13.8.8.129	34.2	16.3	7.8	7.9	?	5.2
	Kudia, Junagadh						
M.	15.5.27.6	33.9	15.9	8.0	7.8	?	5.3
	Kathiawar						

<i>Rattus cutchicus medius</i> ('caenosus')							
	15.5.27.13	33.6	16.1	7.7	7.4	4.9	4.9
	Bihar and Orissa. M. 1 4-rooted						
M.	15.5.27.14	34.4	16.7	8.2	7.8	5.4	5.5
	Hazaribagh. M. 1 5-rooted apparently						
M.	15.4.3.136	33.5	16.6	8.3	7.7	5.1	5.6
	Hazaribagh						
	15.4.3.138	33.4	16.1	7.9	7.9	4.9	5.3
	Hazaribagh. M. 1 4-rooted						
F.	15.4.3.139	33.7	16.0	7.9	8.0	5.5	5.3
	Gaya, Bihar						

The type has the occipitonasal length about 34.5 mm.

<i>Rattus cutchicus rajput</i>							
	13.9.18.38	33.2	16.5	7.8	7.8	4.9	5.5
	Mount Abu, Rajputana. M. 1 with 5 roots						
M.	13.9.18.39	34.6	16.8	8.1	8.3	5.2	5.7
	Mount Abu						
F.	15.5.27.17	33.7	16.4	8.4	7.8	4.9	5.3
	Mount Abu						
M.	13.9.18.41	34.2	16.4	7.8	8.3	5.0	5.5
	Mount Abu					<i>circa</i>	

The type has the occipitonasal length about 34.8 mm.

TABLE 86.—*Cranial measurements of Rattus cutchicus (concl'd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus cutchicus australis</i>							
M.	13.4.10.52	33.3	16.0	8.3	8.0	4.3	5.0
	Vijayanagar, Bellary				<i>circa</i>		
M.	13.4.10.55	32.5	15.8	7.5	7.5	4.6	5.2
	Vijayanagar						
F.	13.4.10.56	32.8	16.0	7.8	7.4	4.7	5.3
	Vijayanagar						
M.	13.4.11.71	34.4	16.9	8.4	8.2	4.8	5.4
	Kolar Town, Mysore						
M.	13.4.11.72	35.5	17.7	8.8	8.2	5.0	?
	Kolar Town. M. 1 is 4-rooted				<i>circa</i>		
F.	13.4.11.73	34.1	16.6	8.2	8.1	4.8	5.2
	Kolar Town						
F.	13.4.11.74	33.7	16.1	7.9	7.5	5.0	5.4
	Kolar Town						
F.	13.4.11.75	34.1	16.6	8.0	8.0	5.0	5.5
	Kolar Town						
F.	13.4.11.76	33.1	16.4	7.8	7.8	5.0	5.5
	Kolar Town						

The type has the occipitonasal about 33.9 mm.

Rattus cutchicus siva

M.	13.4.11.77	34.0	16.7	8.7	7.9	5.0	5.2
	Sivasamudram, South Mysore					<i>circa</i>	
F.	13.4.11.81	32.6	15.7	7.5	7.7	5.2	5.2
	Sivasamudram. M. 1 is 4-rooted			<i>circa</i>			
M.	15.5.27.3	34.0	16.1	8.0	7.9	5.0	5.0
	South Mysore						

The type has the occipitonasal about 34.6 mm.

Rattus cutchicus ?cutchicus

(Specimens identified as *siva*, from the Eastern Ghats, but with the very long tail of true *cutchicus*)

F.	30.5.24.185	32.8	15.5	7.3	7.5	4.8	4.9
	Tirthemalai, Salem district, Eastern Ghats						
F.	30.5.24.188	33.1	16.3	8.1	7.5	5.0	5.0
	Tirthemalai, Salem district						
	30.5.24.184	35.7	17.0	8.3	8.2	5.2	5.4
	Salem district						

Dimensions of Rattus cutchicus, in British Museum material.—The occipitonasal length varies between 31.4 and 35.7 mm. Toothrow 4.8–5.7 mm. The head and body length

varies between 100 and 149 mm., the tail between 132 and 180 mm., hindfoot 23–29 mm.

Provisional key to the races of Rattus cutchicus

1	(4) Average larger in head and body length; all specimens but one exceed 130 mm. in this measurement		2
2	(3) Underparts near pure white...	<i>R. c. australis</i>	
3	(2) Underparts darker, greyish white.	<i>R. c. siva</i>	
4	(1) Average smaller in head and body length; all specimens but one are less than 130 mm. in this measurement.		5
5	(6) Tail most often more than 130% of head and body length; occipito-nasal length usually below 33 mm.	<i>R. c. cutchicus</i>	
6	(5) Tail most often less than 130% of head and body length; occipito-nasal length usually exceeds 33 mm..		7
7	(8) A buffy patch on neck. Underparts most often but not always less dark.	<i>R. c. rajput</i>	
	Normally no buffy patch on neck. Underparts most often, not always, darker.	<i>R. c. medius</i> (with 'caenosus')	

The colour characters separating the last two forms are somewhat doubtful, and I cannot see that 'caenosus' differs from *medius* in colour characters. *R. c. australis* (with *siva*) has the tail averaging a little shorter than the allied races; its distribution is southern, and it is just possible that it is a valid species. In the Eastern Ghats there appear to be two forms of the subgenus living together, one with the long tail of true *cutchicus* (but possibly subspecifically separable from that) and the other unusually large, larger than any other *Cremnomys* skulls that I have seen, which I have made the type of *R. elvira*.

(i) ***Rattus cutchicus cutchicus*** (Wroughton)

1912. *Cremnomys cutchicus* Wroughton, *J. Bombay nat. Hist. Soc.*, 21, 340.

Type-locality.—Dhonsa, Cutch.

Range.—Specimens examined from CUTCH: Charwar, Dhonsa, Nokania, Padampur, Poiwadi, Rhodamotha.

A closely allied form from EASTERN GHATS, Tirthemalai and Kurumbapatti, Salem district.

Rather a small race, the occipitonasal length most often less than 33 mm., the hindfoot 25 mm. and less in the typical series, but can be larger in the Eastern Ghats series. Tail long, on average more than 130% of head and body, which does not reach 130 mm.

(ii) ***Rattus cutchicus siva*** (Thomas)

1916. *Cremnomys australis siva* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 2, 242.

Type-locality.—Sivasamudram, South Mysore, 2,500 ft.

Range.—Specimens examined from MYSORE: Sivasamudram and French Rocks.

As compared with the typical, rather larger, occipitonasal length mostly over 33 mm.; hindfoot 26 mm. at lowest. Tail relatively short, averaging less than 120% of head and body. Nearest *australis*, but the colour of the belly averages darker, white mixed with grey. Head and body exceeds 130 mm.

(iii) ***Rattus cutchicus australis*** (Thomas)

1916. *Cremnomys australis* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 2, 242.

Type-locality.—Vijayanagar, Bellary, 1,500 ft.

Essentially like *siva*, but with the underparts near pure white, the whitest of the genus.

Specimens examined from MYSORE: Kolar Town, and BELLARY: Vijayanagar.

(iv) ***Rattus cutchicus medius*** (Thomas)

1916. *Cremnomys medius* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 2, 240.

1916. *Cremnomys medius caenosus* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 2, 241.

Type-locality.—Of *medius*, Kudia, Junagadh, Kathiawar, 2,500 ft., and of '*caenosus*', Singar, Gaya, Bihar and Orissa, 1,400 ft.

Range.—Specimens examined from KATHIAWAR: Kudia. GUJERAT: Danta. BIHAR: Singar, Gaya; Gajhundi, Hazaribagh.

Hindfoot usually more than 25 mm. Occipitonasal length over 33 mm. Tail on average more than 120% of head and body, less than 130% or shorter than *cutchicus* and *elvira*, longer than in *australis* and *siva*. Generally with the belly

dark, rather dark grey and generally with no buffy patch on the nape. Head and body not reaching 130 mm. (one exception).

(v) ***Rattus cutchicus rajput*** (Thomas)

1916. *Cremnomys medius rajput* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 2, 241.

Type-locality.—Mount Abu, Rajputana, 4,300 ft.

Range.—Specimens examined from RAJPUTANA: Mount Abu.

Very doubtfully distinct from *medius*, but usually distinguishable by the presence of a buffy patch on the nape and sometimes, but not always, by having the belly less dark.

98. *Rattus elvira* Ellerman

1947. *Rattus (Cremnomys) elvira* Ellerman, *Ann. Mag. nat. Hist.*, **13**, 207. (For March, 1946.)

Type No. 30.5.24.183 from Kurumbapatti, Salem district, Eastern Ghats, collected by N. A. Baptista. No. 30.5.24.182 from the same locality is another specimen.

Type-locality.—Kurumbapatti, Salem district, Eastern Ghats (no altitude on skin labels).

Range.—Specimens seen from EASTERN GHATS: Kurumbapatti.

Only known from the type-locality. Much like *R. cutchicus*, but considerably larger; hindfoot 30–32 mm. Occipitonasal length of skull about 38–41 mm.

External characters.—Fur soft; tail average about 136% of head and body; foot with five toes; apparently six plantar pads; fifth toe rather long, much longer than hallux; hand with four functional fingers. Colour: above brownish grey; feet white; underparts greyish white; tail very poorly bicolor in the type, more clearly so in the second specimen.

External measurements.—

		Head and body	Tail	Hind- foot	Ear
F.	30.5.24.183	149	196	32	21
	Kurumbapatti, Salem district. Type				
F.	30.5.24.182	126	180	30	22
	Kurumbapatti				

Cranial characters.—The skull is markedly larger throughout than *R. cutchicus*. The frontals are little constricted

and strong supraorbital ridges are present. Rostrum rather pointed. Interparietal large. Suture of frontals and parietals nearly straight, only slanting forward slightly at sides. Bullae of medium size, about 14% of the occipitonasal length. Pterygoid fossae of medium depth. Palatal foramina very long, extending between toothrows. Palate slightly less than half the occipitonasal length. Zygomatic plate cut back above. Mandible with moderately low coronoid process. The lower incisor root can be seen on the outer side of the jaw.

Dental characters.—Upper incisors yellow and ungrooved. Upper and lower molars apparently much like those of *R. cutchicus*.

Cranial measurements.—

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
F.	30.5.24.183	41.2	20.5	10.8	9.1	5.9	6.1
	Kurumbapatti, Salem district.	Type					
F.	30.5.24.182	38.2	18.9	9.5	7.9	5.6	5.9
	Kurumbapatti						

Dimensions of Rattus elvira.—Occipitonasal 38.2–41.2 mm. Toothrow 5.9–6.1 mm. Head and body 126–149 mm. Tail 180–196 mm. Hindfoot 30–32 mm.

Subgenus (*h*) **Millardia** Thomas

1911. *Millardia* Thomas, *J. Bombay nat. Hist. Soc.*, 20, 4, 998.
 1911. *Grypomys* Thomas, *J. Bombay nat. Hist. Soc.*, 20, 4, 999.
 (*Mus gleadowi* Murray.)
 1917. *Guyia* Thomas, *J. Bombay nat. Hist. Soc.*, 25, 2, 201.
 (*Millardia kathleenae* Thomas.)

Type-species.—*Golunda meltada* Gray.

Distribution.—From CEYLON northwards to the PUNJAB, Waziristan and NEPAL Terai; west to West SIND; Mount Poppa district of BURMA. Not known outside Indian territory.

This subgenus differs from *Cremnomys* in its long palate and specialized hindfoot, with short fifth toe and, so far as is known, reduced number of plantar pads, which are less than six. The palatal foramina average 23% or more of the occipitonasal length. Hitherto I regarded it as a full genus but certain African species which I now refer to *Rattus*

resemble it so closely that I do not think it can be maintained as other than a subgenus of *Rattus*.

Three quite distinct species are referable to *Millardia*. Originally *M. meltada*, the type, was referred to *Golunda* by Gray, but for no apparent reason as it is not in the least like that genus. In Blanford's day, the two long-standing species *M. meltada* and *M. gleadowi* were referred to *Mus*, which in those days included *Rattus* and other genera. Subsequently the present species would have been referred to *Rattus* and were then separated from that by Thomas under the names *Millardia* and *Grypomys*. Later *Guyia* was founded for *Millardia kathleenae*. There is not the least reason, however, to recognize three monotypic genera when one will perfectly suffice. '*Pyromys priestlyi*' was founded, apparently, on a skull of *Millardia gleadowi* accidentally mixed up with a *Mus platythrix* skin.

Key to the species of subgenus Millardia

1 (2)	Small species, the occipitonasal length not exceeding 27.3 mm. Length of the toothrow 4.6 mm. and less. The ear is very large, about as large as length of hind-foot, more than one-fifth of head and body length. Mammae 6. (Bullae usually more than one-fifth of the occipitonasal length). . . .	<i>Rattus gleadowi</i>
2 (1)	Larger species, the occipitonasal length is not less than 28 mm. Length of the toothrow 4.8 mm. and more (very rarely under 5 mm.). The ear is more moderate, shorter than the hindfoot (with few exceptions, in which it is less than one-fifth of head and body length, as usual). . . .	3
3 (4)	The length of the bullae is usually 6.8 mm. and more; they are often as much as one-fifth of the occipitonasal length. Occipitonasal length 34 mm. and more (with one exception). Mammae 4, so far as known, the pectoral pair suppressed. . . .	<i>Rattus kathleenae</i>
4 (3)	The length of the bullae is rarely more than 6.5 mm. They are not as much as one-fifth of the occipitonasal length, which is most often below 34 mm. (about 11 exceptions out of 48 specimens). Mammae, so far as known, 8, the pectoral pair present.	<i>Rattus meltada</i>

99. *Rattus meltada* (Gray)

The Soft-furred Field-Rat or Metad

1837. *Golunda meltada* Gray, *Mag. nat. Hist.*, 1, 586.*Vernacular names.*—Mettad, Mettangandu—*Wadari*.*Distribution.*—Ceylon, the Peninsula of India, Cutch, Kathiawar and adjacent district, Sind, Nepal Terai and the Punjab.

With the characters of the subgenus, this species, which is the first named, is larger in size than *M. gleadowi*, occipito-nasal length 28.0 mm. at lowest (a youngish specimen), head and body length very rarely under 100 mm. The bullae seem smaller than in the two allied species, and the mammary formula, so far as known, is 2-2 = 8, the most generalized in the genus. The ear is not specially enlarged.

External characters.—Head and body length usually over 100 mm. and up to 156 mm. Tail usually a little shorter than head and body. Ear shorter than hindfoot. Fur soft. Tail moderately to poorly haired. Hand with four clawed fingers, the outer one the shortest. Foot with five clawed toes, the two outer ones sub-equal and considerably shorter than the central three. Sole with four or five plantar pads, the posterior ones much reduced (compared, for instance, with *Rattus* species). Mammae 8.

Colour.—Above dark brownish or greyish, varying in northern specimens to pallid or paler grey. Feet usually white or lighter than back, not always so. Underparts vary from dark grey to greyish white, tending to average whiter in *pallidior* than in the typical race. Tail usually clearly bi-color; dark above, pale below.

External measurements.—As in Table 87, below.TABLE 87.—*External measurements of the Indian races of Rattus meltada*

	Head and body	Tail	Hind- foot	Ear
<i>Rattus meltada meltada</i>				
M. Ceylon	138	127	24	20
M. Welligatta, Ceylon	135	135	27½	22
F. Hambantota, Ceylon	130	115	25	19
F. Hambantota	124	135	27	22
F. Hambantota	132	145	25	18

TABLE 87.—*External measurements of Rattus meltada (contd.)*

		Head and body	Tail	Hind- foot	Ear	
<i>Rattus meltada meltada</i> (concl'd.)						
M.	Wellawaya, Uva, Ceylon	127	130	27	22	
	Ootacamund, Nilgiris	127	118	28	?	
F.	Ootacamund	120	116	24	21	
F.	Ootacamund	115	123	25	20	
M.	Ootacamund	97	110	26	18	
M.	Ootacamund	123	92	27	20	
M.	Nasik	141	?	25	21	
F.	Nasik	122	104	22	22	
F.	Nasik	119	105	21	20	
M.	Poona	110	110	24	21	
F.	Gadag, Mahratta	136	124	23	20½	
M.	Poona	100	110	25	21	
M.	Gadag, Mahratta	128	?	24	22	
M.	Chanda	118	115	24	?	
M.	Chanda	115	110	25	19	
	Chettiri Range, Salem, Eastern Ghats	97	112	25	?	
	Chettiri Range	125	131	27	21	
M.	Sakot, Hoshangabad	146	?	27	25	
F.	Sakot, Hoshangabad	130	?	24	22	
F.	Dharwar	116	118	24	21	
M.	Dharwar	145	122	29	24	
M.	Ganoor, Nimar	108	94	25	20	
F.	Ganoor, Nimar	111	99	23	20	
	Balgourie, Barhanga dis- trict ?	107	112	23	20	
F.	Paresanth, Bihar	126	132	25	22	Mammae 8
F.	Mundra, Sangor	130	125	25	22	Mammae 8
M.	Kutta, South Coorg	145	117	27	22	
M.	Konkan ('listoni')	141	116	25	18	
F.	Nasik. Type of 'comberi'	120	105	20	20	
F.	Konkan. Type of 'listoni'	132	103	23	18	

Also seen from Ahmednagar.

Rattus meltada pallidior

	Umankot, Sind	115	112	23	19	
F.	Lunwa, Palanpur	130	116	23	19	Mammae 8
F.	Lunwa	129	120	24	20	Mammae 8
M.	Lunwa	135	136	26	23	
M.	Lunwa	146	144	28	21	
F.	Nokania, Cutch	120	109	24	17	
F.	Nokania	114	108	24	?	
M.	Dhrangadhra, Kathiawar.	130	135	26	22	
M.	Muli, Kathiawar	120	122	26	23	
M.	Rajkot, Kathiawar	136	132	25	18½	
	Bairia, Patheghatta, Nepal Terai	83	103	23	20	
	Damthal, Kangra district	156	129	25	21	

TABLE 87.—*External measurements of Rattus meltada (concl'd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Rattus meltada pallidior</i> (concl'd.)					
M. Damthal, Kangra	133	110	26	22	
M. Pathankot, Punjab	128	121	26	22	
M. Pathankot, Punjab	123	118	25	21	
M. Deesa, Palanpur	125	125	24	19	Weight 2½ oz.
<i>Rattus meltada pallidior</i> ('dunni')					
M. Handisera, Punjab, type	114	99	22	21	

Notes from skins.—*R. m. meltada*: Hambantota, Ceylon, got in live trap in open; on open hill by sea; in bushes; trapped alive on hill; palm jungle. Sakot, Hoshangabad, 4½ oz., trapped in jewari field; 2¾ oz., in hedge. Guna, trapped in tilli crops. Kutta, S. Coorg, five pads on each foot. Chanda, 1½ oz., trapped in hedge; and 2 oz. Ganoor, Nimar, trapped under bush; 1½ oz., trapped in grass. Rothiai, Gwalior, trapped in jungle at edge of cultivation. Paresnath, mammae 8: 2¾ oz. Mundra, Sangor, trapped in hedge, mammae 8: 2½ oz. Ootacamund, this species always verminous, caught in bank. Binaganj, Gwalior, trapped in small garden with meat bait. Welligatta, Ceylon, got alive in jungle. Konkan, caught in rice bands. Nasik, open fields.

R. m. pallidior: Lunwa, 3¼ oz., 2¾ oz.; mammae 8: 3½ oz.; mammae 8: 2½ oz. Satapur, Kathiawar, 3¼ oz. Nokania, Cutch, 1½ oz., 1¾ oz., mammae 8. Rajkot, 3¼ oz. Pathankot, Punjab, 1.65 oz. Muli, 2½ oz.

Cranial characters.—Rather small rats, occipitonasal about 28–36 mm. in length. Nasals long, tending to be rather narrowed behind. Frontals moderately constricted, their outer edges bearing well-marked supraorbital ridges, which tend to extend over the front part of the parietals. Suture of frontals and parietals usually broadly U-shaped. Interparietal large and well developed. Bullae large and well inflated, but less enlarged than in the two allied species; averaging 17–18% of the occipitonasal length. Pterygoid fossae rather deep. Palate long, more than half the occipitonasal length. Palatal foramina very long, well over one-fifth of the occipitonasal length and penetrating between the toothrows. The zygomatic plate is projected forward

and well cut back above. Coronoid process of mandible well developed.

Dental characters.—Upper incisors yellow, rather narrow and plain. The molars are rather angularly cuspidate. M. 1 has eight cusps, M. 2 has seven (the anteroexternal one very small); M. 3 has the anterointernal, three cusps on the middle lamina, originally two on the last lamina, and is rather large, though smaller than M. 2. Lower molars biserially cuspidate, as usual; three laminae on M. 1, two on the other teeth (the hindmost one single); a well-marked terminal heel in M. 1 and M. 2.

Cranial measurements.—As in Table 88, below.

TABLE 88.—*Cranial measurements of the Indian races of Rattus meltada*

			Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus meltada meltada</i>								
M.	7.1.7.1	.	33.8	17.8	8.5	7.9	6.3	6.0
	Nasik, Bombay							
F.	7.1.7.2		31.6	16.6	7.8	7.7	5.4	6.0
	Nasik							
	7.1.7.4	.	31.5	16.5	7.8	7.6	5.7	5.7
	Nasik							
	7.1.7.5		33.7	17.6	8.7	8.0	5.4	5.3
	Konkan, Bombay							
M.	12.6.28.34		29.8	15.1	7.8	7.4	5.5	5.3
	Asirgarh, Nimar							
F.	12.6.29.35		29.4	15.0	7.0	7.5	5.7	5.4
	Asirgarh, Nimar.	Young						
M.	12.6.29.105		34.1	17.7	9.1	8.7	6.2	6.2
	Dharwar district							
F.	12.6.29.106		31.9	16.7	8.5	7.9	5.6	5.5
	Dharwar district							
F.	12.6.29.107		31.8	17.2	8.8	8.1	5.5	5.7
	Dharwar district							
F.	12.6.29.108		33.0	17.5	8.7	8.4	5.9	5.9
	Dharwar district							
F.	12.11.29.160		31.7	16.4	8.1	8.0	6.0	5.5
	Chanda, C.P.							
M.	12.11.29.161		36.3	18.7	9.9	8.9	6.4	5.9
	Chanda, C.P. Old							
	12.11.29.162		33.1	17.5	8.8	7.9	5.8	5.4
	Sakot, Hoshangabad.	Old						
F.	12.11.29.163		32.8	17.2	8.4	8.3	5.7	5.5
	Mundra, Sangor							
M.	13.8.22.29		34.3	17.9	8.8	8.2	6.0	5.9
	Kutta, Coorg						<i>circa</i>	

TABLE 88.—*Cranial measurements of Rattus meltada (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus meltada meltada</i> (concl'd.)							
M.	15.3.1.232	35.8	19.0	9.7	8.4	5.9	5.9
	Welligatta, Ceylon.	The foramina measurement = the longer side					
M.	15.3.1.234	31.4	15.9	7.8	7.4	5.5	5.4
	Welligatta, Ceylon						
M.	19.6.2.54	28.0	14.8	7.5	6.8	5.2	5.2
	Ootacamund, South India.	Young					
F.	19.6.2.55	31.5	16.9	8.7	7.7	5.7	5.2
	Ootacamund						
M.	19.6.2.62	32.2	17.3	9.0	7.7	5.5	5.5
	Ootacamund						
M.	19.6.2.63	30.7	16.3	8.4	7.7	5.7	5.6
	Ootacamund						
M.	19.6.3.72	31.1	16.0	8.2	7.7	5.8	5.3
	Poona						
M.	19.6.3.73	31.9	16.6	8.2	8.2	5.7	5.5
	Poona						
M.	23.4.7.2	30.9	16.0	7.8	7.6	5.7	5.7
	Guna, Gwalior						
F.	23.4.7.3	34.3	18.6	9.9	8.2	6.7	5.6
	Guna, Gwalior						
M.	23.4.7.7	31.4	16.0	7.9	7.6	6.2	5.6
	Binaganj, Gwalior						
	67.11.4.5	32.5	17.5	8.7	7.7	5.5	5.3
	Madras						
M.	91.11.1.45	34.7	17.8	9.1	8.4	5.6	5.8
	Ahmednagar						
	405g.	32.2	17.3	8.5	8.4	?	5.9
	'India'						

The type of '*listoni*', Konkan, has the occipitonasal length about 32.5 mm., the toothrow about 5.4 mm.

A type of *meltada* has the occipitonasal about 30.9 mm.

<i>Rattus meltada pallidior</i>							
F.	12.10.4.73	31.3	16.6	8.0	7.7	6.0	5.4
	Nokania, Cutch						
F.	12.10.4.72	31.8	16.8	8.5	7.8	6.0	5.3
	Nokania, Cutch						
M.	13.8.8.72	32.8	17.0	8.0	7.8	5.4	5.9
	Muli, Kathiawar						
M.	13.8.8.73	34.2	18.0	8.8	7.7	6.4	5.7
	Dhrangadhra, Kathiawar	<i>circa</i>					
M.	22.5.16.37	28.5	15.1	7.2	7.3	5.4	5.4
	Bairia, Patheghatta, Nepal						
M.	23.4.6.1	31.4	16.1	8.2	8.1	5.9	5.2
	Damthal, Kangra, Punjab						

TABLE 88.—*Cranial measurements of Rattus meltada (concl'd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
<i>Rattus meltada pallidior</i> (concl'd.)							
M.	23.4.6.2 Damthal, Kangra. Old	36.1	18.7	9.5	8.7	6.5	5.8
F.	23.4.6.4 Damthal, Kangra	32.6	17.1	8.7	7.9	6.1	5.2
	83.4.23.4 Sakhlal, Lower Sind	32.6	17.0	8.8	7.9	5.5	5.4
M.	25.6.10.35 Bhattu Hissar	34.3	17.8	9.3	8.2	6.1	5.4
F.	Frost Coll. 121 Umankot, Sind	29.8	15.4	7.5	6.9	5.8	5.2
	13.9.18.52 Lunwa, Palanpur	34.5	18.1	9.2	7.8	6.3	5.4
M.	13.9.18.53 Lunwa, Palanpur	35.9	18.6	8.9	8.1	6.5	5.9
F.	13.9.18.54 Lunwa, Palanpur	32.0	16.8	8.0	7.5	6.2	5.7
F.	13.9.18.55 Lunwa, Palanpur	32.4	16.8	8.7	8.2	5.3	5.4

The type has the occipitonasal length about 32.1 mm.

Rattus meltada pallidior ('dunni')

M.	8.3.3.5 Handisera, Punjab. Type	31.3	16.3	8.3	7.2	5.8	4.8

Dimensions of Rattus meltada, in British Museum material.—The occipitonasal length varies between 28.0 and 36.1 mm. Toothrow between 4.8 and 6.2 mm. The head and body length varies between 83 and 156 mm. (very rarely under 100); the tail between 92 and 145 mm. (rarely under 100); hindfoot 20–29 mm.

Between the two more represented and better-known races, *meltada* and *pallidior*, there is an average (not absolute) colour difference. Some Kathiawar skins and others appear intermediate.

Key to the races of Rattus meltada

1	(2) Back averages paler, more pallid grey	<i>R. m. pallidior</i>
2	(1) Back averages darker, more grey brown or brownish	<i>R. m. meltada</i>

Subspecies.—Thomas and Wroughton recognized four races, but I cannot credit that it is necessary to retain more than

two; '*listoni*', supposed to be darker than *meltada*, and according to Wroughton's key with shorter teeth; but several specimens from the Nilgiris and elsewhere seem just as dark as the Kolaba specimens for '*listoni*', and tooththrow measurements given by Wroughton are overlapped many times in my list above; '*dunni*', based apparently on a single specimen, said to differ from *pallidior* by its more buffy coloration and shorter tail. The tail measurement, however, is overlapped in the typical race and more specimens should be seen before this form is accepted as a race.

(i) *Rattus meltada meltada* (Gray)

1837. *Golunda meltada* Gray, *Mag. nat. Hist.*, **1**, 586.
 1839. *Mus lanuginosus* Elliot, *Madras J. Litt. Sci.*, **10**, 212.
 1907. *Mus listoni* Wroughton, *J. Bombay nat. Hist. Soc.*, **17**, 998.
 1907. *Mus comberi* Wroughton, *J. Bombay nat. Hist. Soc.*, **17**, 999.

Type-locality.—Of *meltada*, Dharwar, of *comberi*, Nasik, Bombay, and of *listoni*, Kolaba district, Konkan.

Range.—Specimens examined from CEYLON: Hambantota, Welligatta, Wellawaya; MADRAS. NILGIRIS, Ootacamund. COORG, Kutta. DHARWAR DISTRICT: Dharwar and Gadag. BOMBAY STATE: Nasik, Poona, Ahmednagar, Konkan. EASTERN GHATS: Chettiri Range, Salem. CENTRAL PROVINCES: Mundra, Sangor. Chanda. Ganoor and Asirgarh, Nimar. Sakot, Hoshangabad. BIHAR: Paresnath, Hazaribagh. GWALIOR: Binaganj, Guna and Agar Malwa. Also South Coimbatore. Darbhanga district (perhaps *pallidior*).

(ii) *Rattus meltada pallidior* (Ryley)

1914. *Millardia meltada pallidior* Ryley, *J. Bombay nat. Hist. Soc.*, **22**, 659.
 1917. *Millardia meltada dunni* Thomas, *J. Bombay nat. Hist. Soc.*, **25**, 202.

Type-locality.—Of *pallidior*, Lunwa, Palanpur, Gujerat, 150 ft., and of *dunni*, Handisera, Ambala, Punjab.

Range.—Specimens examined from PALANPUR, Lunwa, Deesa. CUTCH, Nokania. KATHIAWAR: Dhrangadhra, Muli, Satapur, Rajkot. SIND: Sakhlata and Umankot. NEPAL TERAI: Bairia, Patheghatta. PUNJAB: Dhamtal, Kangra, Pathankot. Handisera, Ambala. Bhattu Hissar.

Colour of back averages paler than in the typical race.

100. **Rattus kathleenae** (Thomas)

Miss Ryley's Soft-furred Field-Rat

1914. *Millardia kathleenae* Thomas, *J. Bombay nat. Hist. Soc.*, **23**, 1, 29.

Type-locality.—Pagan, Burma.
Range.—Specimens examined from BURMA: Pagan, Mount Poppa, Pyawbye.

This species is very closely allied to *Millardia meltada* and may well prove to be a specialized eastern race of it. However, as far as is known, the mammary formula is reduced to $0-2 = 4$, and as also the skull is distinctly larger on average than *M. meltada*, and the bullae are markedly larger proportionately, I retain it as a species. The bullae in this species approach or approximate to or sometimes exceed 20% of the occipitonasal length.

External characters.—Medium-sized rats, head and body length about 130–166 mm. Tail averages a little shorter than head and body. Ear shorter than hindfoot. Mammae $0-2 = 4$. Fur soft but rather short and poor. Tail moderately to poorly haired. Hand with four clawed fingers, the outer one the shortest. Foot with five toes, as usual; the outer ones shorter than the central three; D. 5 scarcely reaching past base of D. 4, and only a little longer than hallux. Apparently four plantar pads.

Colour.—Back varying from light brown to greyish; hands and feet white. Underparts white or pale greyish white. Tail bicolor, dark above, whitish below; sometimes with a white tip.

External measurements.—

		Head and body	Tail	Hind- foot	Ear		
M.	Pagan, Burma	144	140	28	21.75		
M.	Pagan	150	147	28	21		
F.	Pagan	143	134	27½	21		
F.	Pagan	139	131	27½	21		
M.	Pagan	148	145	28	21.25		
F.	Pagan	157	155	28	?		
M.	Pagan	145	?	28	21.25		
F.	Pagan	136	141	27	19½		
M.	Pagan	139	134	28.75	21		
F.	Pagan	159	150	28	21½		
F.	Mount Poppa, Burma	146	114	28½	22	Mammae 4	
M.	Mount Poppa	166	139	30	23		

	Head and body	Tail	Hind- foot	Ear	
F. Pyawbye, Burma	129½	121	25½	23	Mammae 0-2 = 4
F. Pagan. Type	145	148	27	21	4 plantar pads Weight 2½ oz.

Notes from skins.—Pagan, weight 3¼ oz., 3 oz., 2⅞ oz. Mount Poppa, mammae 4, all ventral, among scrubby hedges and stones around cultivation. Pyawbye taken from a short burrow in very hard ground; pregnant, containing three young; mammae 0-2 = 4. Four plantar pads.

Cranial characters.—Much like *R. meltada*, but tending to be larger, occipitonasal length most often exceeding 34 mm., and up to 36.3 mm.

Frontals possibly a little less constricted than in *meltada*, well ridged. Interparietal well developed and occiput rather strong and ridged. Bullae large, often as much as 20% of the occipitonasal length and larger than in *meltada*. Palatal foramina very long, well over one-fifth of the occipitonasal length and penetrating between the toothrows. Palate long, more than half occipitonasal length. Pterygoid fossae rather deep. Zygomatic plate strongly cut back above. Coronoid process well developed.

Dental characters.—Upper incisors narrow, yellow and plain. Molars apparently much as in *meltada*; M. 1 with the front lamina rather tending to be narrow, its anterointernal cusp rather turned backwards as in *Mus*. M. 3 moderate in size, smaller than M. 2 but not extremely reduced. Lower molars about as in *R. meltada*.

Cranial measurements.—

	Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
M. 14.11.31.2 Pyawbye, Burma.	34.0	18.0	9.0	7.8	6.8	5.7
M. 14.7.19.217 Pagan, Burma	35.8	18.9	9.8	8.5	7.0	5.8
M. 14.7.19.218 Pagan	35.5	18.3	9.0	8.3	7.2	5.3
M. 14.7.19.219 Pagan	35.5	18.6	9.3	8.1	7.1	5.8
M. 14.7.19.220 Pagan	34.5	17.8	8.7	8.0	6.8	5.7
M. 14.7.19.221 Pagan	35.0	18.2	9.3	8.3	7.0	5.7

The foramina measurement = the longer side
circa

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
F.	14.7.19.222	35.1	18.3	?	8.5	6.9	5.5
	Pagan. 5 roots to M. 1						
F.	14.7.19.223	33.6	17.3	8.3	8.2	6.8	5.5
	Pagan						
F.	14.7.19.224	36.1	18.5	9.3	8.4	7.4	6.0
	Pagan. Old						
F.	14.7.19.225	34.4	17.8	8.7	7.8	6.6	5.7
	Pagan					<i>circa</i>	
M.	14.7.19.227	36.3	18.7	9.6	8.4	7.2	5.6
	Mount Poppa, Burma						

The type has the occipitonasal length about 34.8 mm.

Dimensions of Rattus kathleenae.—The occipitonasal length varies between 33.6 and 36.3 mm. Toothrow 5.3–6.0 mm. The head and body length varies between 129 and 166 mm. Tail between 114 and 155 mm. Hindfoot 25–30 mm.

101. *Rattus gleadowi* (Murray)

The Sand-coloured Rat

1885. *Mus gleadowi* Murray, *Proc. zool. Soc. Lond.*, 809.

Type-locality.—Clifton Plain, Karachi, western Sind.

Range.—Specimens examined from KATHIAWAR: Dhrangadhra, Muli and Rajkot. PALANPUR, Lunwa. SIND: Karachi and Thar and Parkar. NW FRONTIER: Kirgi Bridge, South Waziristan.

A small species, head and body length 97 mm. and less; occipitonasal length 27.3 mm. at highest. The bullae enlarged, usually more than one-fifth of the occipitonasal length. The posterior part of the palate as a rule somewhat narrowed. The toothrow 4.6 mm. at highest, actually smaller than in the two allied species, as is the occipitonasal length. Externally remarkable for its enlarged ear, which is about equal to the hindfoot length, and more than one-fifth of head and body length. Mammae 1–2 = 6. This little mouse is a rather specialized offshoot, apparently adapted for life in the deserts. Its posterior palate suggests a start towards the specialized type found in *Acomys*, and the equality of length between hindfoot and ear is another character usual in *Acomys*, rather unusual in many Murinae.

External characters.—Small soft-furred mice, head and body length 97 mm. at highest in our collection. Tail shorter than

head and body, in the majority, or more rarely approximating to head and body length, and rather well haired. Ear very large, about as large as hindfoot; both these measurements slightly over one-fifth of head and body length. Hand rather small, with four clawed fingers. Foot with three middle toes considerably longer than the outer pair; the fifth toe scarcely longer than the hallux, or only very little so. All the toes clawed. Four plantar pads only. Mammae 6.

Colour.—Back pale sandy brown (darker or lighter), the under-fur darker than the terminal brown portion. Hands, feet, cheeks and underparts white. Tail usually bicolor (dark above, whiter below); wholly pale or nearly so in specimens from Lunwa.

The specimens from Kirgi Bridge, South Waziristan, are smaller, cranially, than the more southern specimens and may well represent a new race, so far not named. Their skins are not in good condition.

External measurements.—

	Head and body	Tail	Hind- foot	Ear	
M. Rajkot, Kathiawar	90	93	20	20	
M. Rajkot, Kathiawar	87	86	19	18½	
M. Rajkot, Kathiawar	90	90	19½	19	
F. Rajkot, Kathiawar	92	87	20	21	Mammae 6
F. Rajkot, Kathiawar	85	76	19½	19	Mammae 6
F. Rajkot, Kathiawar	86	84	19	18	Mammae 6
M. Dhrangadhra, Kathiawar	87	75	19	18	
M. Muli, Kathiawar	80	77	18	18	
Thar and Parkar, Sind	97	76	20	20½	
F. Lunwa, Palanpur	87	86	18	19	Mammae 6
F. Lunwa, Palanpur	93	84	19½	20	Mammae 6

Notes from skins.—Muli, weight $\frac{5}{8}$ oz. Rajkot, weight $1\frac{1}{8}$ oz. and mammae 6; weight 1 oz. (3 specimens). Lunwa, mammae 6: 1 oz. (2 specimens). Dhrangadhra, weight $\frac{7}{8}$ oz.

Cranial characters.—Small, occipitonasal length about 24–27 mm. in length only. Rostrum moderately long; frontals considerably constricted behind the lachrymals, then rather sharply divergent and widened backwards, bearing strong ridges on their outer edges. Parietals rather wide and interparietal well developed. Bullae large and well inflated, usually over 20% of the occipitonasal length. Pterygoid fossae deep and wide, the mesopterygoid space distinctly narrowed at the back of the palate. Rather a prominent pair of second palatal foramina are usually present between the toothrows (as often in desert mice, *cf.* Gerbillinae).

Front palatal foramina very long, penetrating the toothrows; well over one-fifth of the occipitonasal length. Palate long, exceeding half the occipitonasal length. The zygomatic plate is moderately cut back above. Mandible with narrow rather reduced coronoid, and rather a deeply excised circular space joining the condylar with the angular process.

Dental characters.—Upper incisors narrow, yellow and plain. Molars rather heavily cuspidate; eight cusp spaces in M. 1 (lacking the posterointernal only); seven cusps in M. 2, but the anteroexternal one is extremely reduced; M. 3 of medium size, smaller than M. 2, with an anterointernal cusp and two laminae behind it (the foremost of these with three cusps). Lower molars as in the related species and without special peculiarity.

Cranial measurements.—

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
F.	11.3.13.10 Thar and Parkar, Sind	27.2	14.7	7.2	6.2 <i>circa</i>	5.5	4.1
M.	13.8.8.80 Dhrangadhra, Kathiawar	26.3	14.1	6.1	5.9	5.3	4.6
M.	13.8.8.81 Muli, Kathiawar	24.4	12.9	5.8	5.6	5.0	4.6
M.	13.8.8.82 Rajkot, Kathiawar	27.3	14.7	6.8	6.8	5.3	4.5
M.	13.8.8.83 Rajkot, Kathiawar	26.7	14.3	6.5	6.5	5.5	4.3
F.	13.8.8.85 Rajkot, Kathiawar	26.6	14.6	6.6	6.4	5.2	4.4
F.	13.8.8.86 Rajkot, Kathiawar	25.8	13.9	6.1	6.0	5.3	4.4
F.	13.9.18.86 Lunwa, Palanpur	25.5	13.8	6.1	6.0	5.5	4.4
F.	13.8.8.87 Rajkot, Kathiawar	26.3	14.4	6.4	6.4	5.5	4.3
F.	13.9.18.87 Lunwa, Palanpur. Old	27.1	15.0	7.0	6.6	5.8	4.6
F.	14.11.28.1 Sind	27.2	14.3	6.9	5.9	5.2	4.2
F.	14.11.28.2 Sind	26.5	13.9	6.5	6.3	5.6	4.3
M.	20.6.1.2 Kirgi, South Waziristan	24.2	12.4	5.5	5.6	4.8	4.2
F.	20.6.1.3 Kirgi Bridge, S. Waziristan	24.6	12.7	6.0	6.2	4.7	4.1
F.	20.6.1.4 Kirgi Bridge, S. Waziristan	24.3	12.8	5.9	5.7	4.9	4.3
F.	87.3.2.2 Kathiawar	26.6	14.4	6.6	6.4	—	—

Dimensions of Rattus gleadowi, in British Museum material.—The occipitonasal length varies between 24.2 and 27.3 mm. Toothrow 4.1–4.6 mm. The head and body length varies between 80 and 97 mm. The tail between 75 and 93 mm. Hindfoot 18–20 mm.

Species of *Rattus* not examined

Below are abridged versions taken from the original descriptions of many forms of *Rattus* which have been described, mainly by Miller, from Indian territory, which are unrepresented in the British Museum and unavailable to me:

(1) *Rattus? rattus robustulus* Blyth, 1859. *Mus robustulus* Blyth, *J. Asiat. Soc. Beng.*, 28, 294. See also Kloss, 1917, *Rec. Indian Mus.*, 13. From Schwegyin, North Tenasserim.

‘Stoutly built, tail not quite as long as head and body, the latter about 6 inches. Colour much as in *Mus decumanus* (= *Rattus norvegicus*) but feet whitish.’ From Kloss’s measurements, the greatest length of type skull was 45.8 mm., palate 21.8 mm., foramina 8.9 mm., diastema 12.5 mm., toothrow 7.3 mm., nasals 18 mm. This name antedates *R. r. tikos* (Tenasserim) and others of Hinton. The skull measurements indicate a larger animal than *tikos*.

(2) *Rattus rattus dentatus* Miller, 1913, Hastings Island, Mergui Archipelago, see above under *R. rattus*, was described as ‘like the form of *Rattus rattus* inhabiting Trang and South Tenasserim but cheek-teeth larger, equal to those of *R. r. viclana*, from Lankawi Island’ Head and body 180 mm., tail 190 mm., hindfoot 36 mm. Condylbasal 39 mm. Nasals 15.2 mm. Diastema 11.7 mm. Zygomatic breadth 19.8 mm. Alveoli, upper toothrow, 7 mm.

(3) *Rattus rattus insulanus* Miller, 1913, *Smiths. misc. Coll.*, 61, 21, 14, Helfer Island, Mergui Archipelago. ‘Like *R. r. dentatus*, but general outline of skull narrowed.’ Described as *Epimys rattus insulanus*. Head and body 185 mm., tail 185 mm., hindfoot 36½ mm. Condylbasal 40.6 mm., nasal 15.4 mm., diastema 11.3 mm., zygomatic breadth 18.6 mm., alveoli, upper toothrow, 7.6 mm.

(4) *Rattus rattus exsul* (*Epimys rattus exsul*) Miller, 1913, *Smiths. misc. Coll.*, 61, 21, 15, James Island, Mergui Archipelago.

'Like *R. r. dentatus*, but with auditory bullae appreciably reduced in size.' Head and body 175 mm., tail 183 mm., hindfoot 36½ mm. Condylbasal 37.4 mm. Nasals 14 mm., diastema 10.7 mm., zygomatic breadth 18.5 mm. Alveoli, upper toothrow, 6.9 mm.

(5) *Rattus rattus fortunatus* (*Epimys rattus fortunatus*) Miller, 1913, *Smiths. misc. Coll.*, 61, 21, 15, Chance Island, Mergui Archipelago.

'Somewhat larger and colour more yellowish (ground colour a clearer chamois and blackish hairs less abundant) than the other races inhabiting the Mergui Archipelago. Skull normal, with well-developed bullae.' Head and body 205 mm., tail 215 mm., hindfoot 38 mm. Condylbasal 41.5 mm. Nasals 17 mm. Diastema 12.9 mm. Zygomatic breadth 21.2 mm. Alveoli, upper toothrow, 7.2 mm.

(6) *Rattus sabanus stentor* (*Epimys stentor*) Miller, 1913, *Smiths. misc. Coll.*, 61, 19, James Island, Mergui Archipelago.

'A member of *vociferans* group with skull more robust and rostrum deeper in proportion to its length than in any of the previously known forms. Colour as *vociferans*.' Head and body 262 mm., tail 323 mm., hindfoot 46.3 mm. Condylbasal 53.6 mm. Zygomatic breadth 27.1 mm. Nasals 22.7 mm. Diastema 15.8 mm. Upper toothrow, alveoli, 9.7 mm.

(7) *Rattus sabanus insularum* (*Epimys vociferans insularum*) Miller, 1913, *Smiths. misc. Coll.*, 61, 19. Domel Island, Mergui Archipelago.

'Like *E. v. lancavensis* (= *R. sabanus lancavaneis*) of Lankawi Island but smaller, greatest length in fully adult individuals (of skull) rarely exceeding 54 mm.' Head and body 248 mm., tail 330 mm., hindfoot 45 mm., condylbasal 50.1 mm., zygomatic breadth 24.6 mm., nasals 20 mm., diastema 14.4 mm., alveoli, upper toothrow, 10 mm.

(8) *Rattus sabanus clarae* (*Epimys vociferans clarae*) Miller, 1913, *Smiths. misc. Coll.*, 61, 20, Clare Island, Mergui Archipelago.

'Size as in *E. v. lucas* (= *R. sabanus lucas*) of St. Luke, Hastings and Loughborough Islands. Colour duller and less yellowish than in the other Mergui Island races but not as darkened as in *R. s. matthaeus*.' Head

and body 235 mm., tail 316 mm., hindfoot 44 mm. Condylbasal 48.1 mm., zygomatic breadth 24.1 mm., nasal 20.1 mm., diastema 13.8 mm., upper toothrow, alveoli, 9.6 mm.

(9) *Rattus rattus shigarius* Miller, 1913, *Proc. biol. Soc. Wash.*, 26, 198. Shigar, Baltistan, Kashmir.

'Like the member of the *R. rattus* group common in Central Kashmir and currently regarded as identical with Hodgson's *Mus nitidus*' [sic! This is not known to occur in Kashmir]; 'but colour of upper parts paler and more greyish and dark dorsal area of tail conspicuously sprinkled with white hairs.' (Miller states that *nitidus* has a bicolor tail, which is incorrect, but that otherwise it is like *alexandrinus*. He is probably referring to *rattoides* or *turkestanicus*.) 'Underparts ivory yellow. Tail sparsely haired—all the hairs white except on dorsal surface where enough black hairs are intermingled to produce a rather noticeable dark area.' Head and body 198 mm., tail 211 mm., hindfoot 37 mm., condylbasal 42.6 mm., zygomatic breadth 22 mm., nasals 17.2 mm., diastema 12.2 mm., alveoli, upper toothrow, 7 mm. Described as *Epimys rattus shigarius*. I am not clear from descriptions as to whether this is really a form of *Rattus rattus* or whether it is a supposed form of *Rattus rattoides*, which is common in Kashmir.

(10) *Rattus blythi* Kloss, 1917, *Rec. Indian Mus.*, 13, 8, Schwegyin, Tenasserim. (*Mus cinnamomeus* Blyth, 1859, *J. Asiat. Soc. Beng.*, 28, 294, not of Pictet, 1844.)

Kloss thinks this is a member of the *cremoriventer* group. 'On the whole, spines of dorsal pelage much slenderer than *cremoriventer* but a few are present which approach them in breadth and stiffness.' The skull is said to resemble closely old examples of *cremoriventer* and to differ only in narrower and less spatulate nasals and broader anteorbital plates. The bullae are quite of the '*jerdoni*' type. The upper incisors are, however, much more curved backwards and both pairs are ivory white with no tinge of orange on the exposed portion, a character quite unknown in the other rats of this section.' Head and body 152 mm., tail 197 mm., hindfoot 32 mm. Undersurface and feet white. Greatest length of skull about 38 mm. Palatine length 15.4 mm. Palatal foramina 6.4 mm. Diastema 9.4 mm. Alveoli of upper toothrow 6 mm. Nasals 13.9 mm.

(11) *Rattus sabanus matthaeus* Miller, 1903, *Smiths. misc. Coll.*, 45, 29. (*Mus matthaeus*) from St. Matthew Island, Mergui Archipelago.

'A large member of the *sabanus-vociferans* group, differing from *vociferans* in duller, more rusty colour of back and sides, and strongly yellowish underparts. Blackish hairs of upper parts not as dark as in the mainland form.' Head and body 248 mm., tail 350 mm., hind-foot 50 mm. Greatest length of skull 56 mm., zygomatic breadth 25 mm.

(12) *Rattus sabanus stridulus* Miller, 1903, *Smiths. misc. Coll.*, 45, 29. (*Mus stridulus*) from Bentinck Island, Mergui Archipelago.

'A light-coloured member of the *sabanus-vociferans* group, with disproportionately small feet.' Head and body 222 mm., tail 292 mm., hindfoot 41 mm. (Hindfoot ranges between 39.6 and 42 mm., apparently.)

(13) *Rattus sabanus lucas* Miller, 1903, *Smiths. misc. Coll.*, 45, 30. St. Luke Island, Mergui Archipelago. (*Mus lucas*.)

'Like *Mus stridulus*, but feet of normal size.' Colour evidently lighter than in *matthaeus*. Head and body 215 mm., tail 309 mm., hindfoot 46 mm. Greatest length of skull *circa* 52 mm., zygomatic breadth 23 mm.

(14) *Rattus cremoriventer gilbiventer* Miller, 1903, *Smiths. misc. Coll.*, 45, 35. (*Mus gilbiventer*.) Sullivan Island, Mergui Archipelago.

'Like *M. cremoriventer* but with coarse spiny fur resembling in quality that of members of the *surifer* group.' (The tail is described as uniform brown throughout, as usual in *cremoriventer*.) 'Skull like that of *cremoriventer* but slightly larger, rostrum deeper, foramina longer, bullae less globular. Mandible more robust than in the related species. Teeth as in *cremoriventer* but slightly larger.' Head and body 125 mm., tail 185 mm., hindfoot 28.8 mm., skull greatest length 35 mm., zygomatic breadth 16 mm., nasals 13 mm., palatal foramina 6.4 mm. Note long tail.

(15) *Rattus rajah luteolus* Miller, 1903 (*Mus luteolus*), *Smiths. misc. Coll.*, 45, 36. St. Matthew Island, Mergui Archipelago.

'A small member of the *rajah-surifer* group resembling *Mus flavidulus* of Pulau Lankawi but with tawny element in colour distinctly less yellow.' Head and

body 190 mm., tail 170 mm., hindfoot 37 mm., greatest length of skull 45 mm., zygomatic breadth 19 mm.

(16) *Rattus rajah umbridorsum* Miller, 1903 (*Mus umbridorsum*), *Smiths. misc. Coll.*, 45, 37. Loughborough Island, Mergui Archipelago.

‘Like *Mus luteolus* but ground colour above slightly more yellow and black of back tending to concentrate into a noticeable dorsal streak.’ Head and body 180 mm., tail 170 mm., hindfoot 40 mm., greatest length skull 42 mm., zygomatic breadth 18 mm.

(17) *Rattus rajah bentincanus* Miller, 1903 (*Mus bentincanus*), *Smiths. misc. Coll.*, 45, 38. Bentinck Island, Mergui Archipelago.

‘Rather a large member of the *rajah-surifer* group, much resembling *Mus butangensis*, but colour of back less strongly suffused with yellow.’ Head and body 205 mm., tail 180 mm., hindfoot 42 mm., greatest length of skull 47 mm., zygomatic breadth 22 mm.

(18) *Rattus rajah casensis* Miller, 1903 (*Mus casensis*), *Smiths. misc. Coll.*, 45, 38. Chance Island, Mergui Archipelago.

‘Like *Mus butangensis*, but with well-developed throat band.’ Head and body 200 mm., tail imperfect, hindfoot 42 mm. Skull greatest length 47 mm., zygomatic breadth 21 mm.

(19) *Rattus rajah domelicus* Miller, 1903, *Smiths. misc. Coll.*, 45, 39. (*Mus domelicus*.) Domel Island, Mergui Archipelago.

‘Like *Mus casensis*, but ground colour above not as bright and throat band less distinct.’ Head and body 200 mm., tail 150 mm., hindfoot 40 mm., skull greatest length 49 mm.

In addition, there are about ten forms named, mostly by Miller, from the Andaman Islands and Nicobar Islands.

(20) *Rattus palmarum* Zelebor, 1869 (*Mus palmarum*), *Reise der Oesterr., Fregatte Novara, Zool. Th. I, Wirbelth., 1, Säugeh.*, 26, from the Nicobar Islands.

Miller gives the following measurements for this very early named form: head and body 275 mm., tail 215 mm., hindfoot 50 mm. Greatest length of skull 54 mm. Underparts ‘yellowish-white’ As figured in the original, tail wholly dark and belly rather dull. Molars *Rattus*-type (i.e. not a *Bandicota*).

This is a short-tailed rat which may ultimately prove to be one of the earliest names in the *mülleri* group (*Stenomys* as here understood).

(21) *Rattus stoicus* Miller (*Mus stoicus*), *Proc. U.S. nation. Mus.*, 1902, 24, 759. Henry Lawrence Island, Andaman Islands. Possibly represents *R. palmarum*; possibly a member of the *sabanus* group, or perhaps a representative of the *mülleri* group. Diastema evidently lengthened and tail shortened.

‘A large heavily built rat bearing a general likeness to *Mus validus* (= *R. mülleri validus*) and *Mus palmarum*. Tail unicolour, shorter than head and body. Underparts bluish grey. Mammae apparently 10. Skull as long as in *M. validus* but very slender.’ Miller compares the skull with *Rattus sabanus vociferans*. The bullae are said not to differ very materially from those of *vociferans* but somewhat more inflated anteriorly, apparently. Head and body 249 mm., tail 193 mm., hindfoot 47 mm. Greatest length of skull of largest specimen, 55.4 mm. Palatal 28 mm. Diastema 18 mm. Palatal foramina 10.6 mm. Nasals 22 mm. Zygomatic breadth 25 mm. Alveoli of upper toothrow 8.2 mm.

(22) *Rattus taciturnus* Miller, 1902, *Proc. U.S. nation. Mus.*, 24, 762. South Andaman Island.

Surely merely a subspecies of the last. Miller thinks this is the specimen Blanford thought was a variety of *R. bowersi* and which I have written up above as *Rattus mülleri* subsp.? ‘Slightly larger than *Mus stoicus* and colour both above and below more tinged with yellow.’ Head and body 266 mm., tail 228 mm., hindfoot 53 mm.

If this is the form I wrote up as ‘*R. mülleri* subsp.’, it should not be regarded as a form of *mülleri* on account of its short tail. The only skin I have seen is unmeasured.

(23) *Rattus? rattus flebilis* (*Mus flebilis*) Miller, 1902, *Proc. U.S. nation. Mus.*, 24, 762. Henry Lawrence Island, Andaman Islands.

‘A large member of the *R. rattus* group. Size about equal to *R. r. pannosus* of Butang Islands, but tail always considerably longer than head and body. Colour paler and more yellow than *pannosus* and resembling *Mus stoicus*. Skull like *pannosus* but with larger

bullae, more prominent supraorbital ridges and smaller teeth. Mammae 10.' Head and body 210 mm., tail 242 mm., hindfoot 41.4 mm. Greatest length of skull 45 mm., palatal length 21.4 mm., diastema 13 mm., foramina 8.8 mm., nasals 18 mm., zygomatic breadth 19.8 mm., alveoli, upper toothrow, 7.4 mm.

(24) *Rattus pulliventer* Miller (*Mus pulliventer*), 1902, *Proc. U.S. nation. Mus.*, **24**, 765. Great Nicobar Island.

'A rat of somewhat less bulk than *Mus flebilis* but smaller hindfoot and shorter tail. Length of the latter less than head and body. Fur densely spinous. Colour brown throughout, belly not distinctly paler than the sides. Mammae 8. The skull differs from that of other Andaman and Nicobar Island rats in its flat dorsal outline. Except for its flatness the skull closely resembles that of *R. rattus*', but with smaller bullae. Head and body 202 mm., tail 185 mm., hindfoot 35 mm. Greatest length of skull 44 mm., palatal length 22.6 mm., diastema 12.6 mm., foramina 7.8 mm., nasals 16 mm., zygomatic breadth 21.8 mm., alveoli, upper toothrow, 7.8 mm.

(25) *Rattus?* *rattus atridorsum* Miller, 1903, *Proc. biol. Soc. Wash.*, **16**, 50. (*Mus atridorsum*.) *Mus atratus* Miller, 1902, *Proc. U.S. nation. Mus.*, **24**, 767, not of Philippi. Barren Island, Andaman Islands.

'Size and proportions as in *Mus andamanensis* (= *Rattus rattus andamanensis*) but fur spineless. Colour of underparts yellowish brown; back strongly suffused with black, often entirely black. Skull shorter, broader, more robust than *andamanensis*, bullae smaller; teeth as in *andamanensis* and *rattus*, but much larger.' Head and body 160 mm., tail 182 mm., hindfoot 36 mm.

(26) *Rattus burrus* Miller, 1902, *Proc. U.S. nation. Mus.*, **24**, 768. Trinkut Island, Nicobar Islands.

'Like *Mus pulliventer* but tail shorter, back less distinctly grizzled and belly light buff. Fur spineless. Mammae 10. Skull much like that of *Mus norvegicus* (= *Rattus norvegicus*) but it is slightly smaller than in the house rat, the dorsal profile is less convex, the rostrum shorter and broader, interorbital region less constricted,

zygomatic arches less flaring, braincase broader and less elevated, interpterygoid space wider, and audital bullae slightly different in form and more resembling *Mus rattus*.' Described as *Mus burrus*. Head and body 215 mm., tail 215 mm., hindfoot 43 mm. Skull, greatest length 47.6 mm., palatal 23.4 mm., diastema 14 mm., palatal foramina 8.4 mm., nasals 17.4 mm., zygomatic breadth 22 mm. Upper tooththrow, alveoli, 7.6 mm.

(27) *Rattus burrus* (*Mus burrus*) Miller, 1902, *Proc. U.S. nation. Mus.*, **24**, 770. Car Nicobar Island.

'Like *Mus burrus* but much smaller, hindfoot 38 mm., greatest length of skull 41 mm.' Head and body 174 mm., tail 183 mm., nasals 15 mm., zygomatic breadth 19.8 mm., upper tooththrow, alveoli, 7 mm.

(28) *Rattus burrescens* (*Mus burrescens*) Miller, 1902, *Proc. U.S. nation. Mus.*, **24**, 771. Great Nicobar Island.

'Externally like *Mus burrus* but red of upper parts a little more intense. Skull distinguishable from the related species by the form of the nasal bones, which are strongly contracted a little in front of the middle.' Head and body 206 mm., tail 202 mm., hindfoot 40 mm. Greatest length of skull 44.6 mm., nasals 16 mm., zygomatic breadth 21.8 mm., alveoli, upper tooththrow, 7.4 mm.

Probably the last three are conspecific.

Genus 38. *Dacnomys* Thomas

1916. *Dacnomys* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 3, 404.

Type-species.—*Dacnomys millardi* Thomas.

Distribution.—SIKKIM, ASSAM, Laos in Indo-China.

Essentially like a large species of *Rattus*, but with an unusually long tooththrow, which approximates to or exceeds one-fifth of the occipitonasal length. Bullae small and reduced, about 9–11% of the occipitonasal length, which exceeds 52 mm. Palate more than half occipitonasal length. Palatal foramina relatively long.

This species was only comparatively recently discovered and consequently was not dealt with by Blanford.

102. *Dacnomys millardi* Thomas

Millard's Giant Rat

1916. *Dacnomys millardi* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 3, 405.

With the characters as indicated above under the genus, chief of which are the unusually large heavy teeth. The width of M. 1 appears to be about 3.3–3.8 mm.

External characters.—Large and heavily built rats, with rather harsh fur. Tail considerably longer than head and body, not well haired. Six plantar pads. Foot with five digits, all bearing claws; fifth toe shorter than the central three, hallux shorter than the fifth toe, but the outer digits are not much reduced. Hand with four functional fingers, all clawed. Mammæ 2–2 = 8, according to Thomas.

Colour.—Above dark brownish (*wroughtoni*, one skin) or dark greyish (*millardi*, two skins). Underparts silvery grey in *millardi*, dark brown in type skin of *wroughtoni*, greyish white in another specimen. Tail wholly dark throughout. Hands and feet rather paler in *wroughtoni* than in *millardi*.

External measurements.—

Head and body	Tail	Hind- foot	Ear

Dacnomys millardi millardi

F. Gopaldhare. Type	228	325	50	26

Another skin from Okotso in Naga Hills.

Dacnomys millardi wroughtoni

M. Dreyi. Type	290	335	56	27	Weight 1.25 lb.
M. Dreyi, Mishmi	290	330	55	25	

Cranial characters.—Skull large, the occipitonasal length in our material over 52 mm. and sometimes over 60 mm. Nasals rather long; frontals moderately constricted; in the adult or old specimens, the supraorbital ridges extremely thick; they are moderate in younger specimens. Suture of frontals and parietals broadly V-shaped. Parietals rather wide and interparietal prominent and large. Bullae small and flat, about one-tenth of the occipitonasal length or a little more or less. Pterygoid fossae rather shallow. Length of the palate more than half the occipitonasal length. Palatal foramina long and wider behind than in front apparently;

sometimes as much as 19% of the occipitonasal length. Zygomatic plate nearly straight anteriorly; jugal very short, zygoma powerful. The toothrow is in this genus unusually large and is about one-fifth of the occipitonasal length or more. M. 1 is more than 3 mm. in width. Mandible with a well-developed coronoid process and the angular portion well-ridged below.

Dental characters.—Upper incisors of medium width, yellow and more or less plain. Upper molars like those of a rather angularly-cuspidate *Rattus*. M. 1 with the usual eight cusps and three laminae (no posterointernal); M. 2 with a large anterointernal cusp (being all that remains of the front lamina), three well marked and angular cusps on the second lamina, and two on the back lamina; M. 3 but little reduced with an anterointernal cusp; the second lamina apparently originally with elements corresponding to three cusp spaces, but the outer one turned backwards, so that with wear it joins the hinder lamina. Lower molars as usual, biserially cuspidate and without peculiarity.

Cranial measurements.—

	Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Diastema
<i>Dacnomys millardi millardi</i>						
M. 22.12.6.1	52.7	27.7	9.1	5.9	11.5	13.5
Okotso, Naga Hills, Assam. 5 roots M. 1.						Rather young
16.3.25.98	54.1	27.7	10.3	5.6	11.1	14.2
Gopaldhara, Darjeeling. Type						
<i>Dacnomys millardi wroughtoni</i>						
M. 21.12.5.85	60.5	31.3	11.7	6.2	12.1	16.6
Dreyi, Mishmi. Old						
M. 21.12.5.84	60.9	32.4	11.7	5.8	12.4	16.8
Dreyi. Type						

Dimensions of Dacnomys millardi, in British Museum material.—The occipitonasal length varies between 52.7 and 60.9 mm. Toothrow 11.1–12.4 mm. Head and body length varies between 228 and 290 mm. Tail 325–335 mm. Hindfoot 50–56 mm.

The two named forms of *Dacnomys millardi* in India are retainable, on the material available, but it is not impossible that they will prove to be the same if a really representative collection ever comes to hand. *D. m. millardi* seems at the

moment based on rather young material and *wroughtoni* on very old material.

Provisional key to the Indian races of Dacnomys millardi

- 1 (2) The occipitonasal length 52–54 mm.
The palatal foramina length approximately 9–10.3 mm. Colour slightly darker *D. m. millardi*
- 2 (1) The occipitonasal length exceeds 60 mm. The palatal foramina length approximates to 11.7 mm. Colour slightly paler *D. m. wroughtoni*

The first based on two younger skulls, the second based on two old skulls.

(i) *Dacnomys millardi millardi* Thomas

1916. *Dacnomys millardi* Thomas, *J. Bombay nat. Hist. Soc.*, 24, 3, 405.

Type-locality.—Gopaldhara, near Darjeeling, 3,440 ft.

Range.—Specimens examined from the type-locality, and ASSAM: Okotso, Naga Hills.

Characters, so far as known, as in key above.

(ii) *Dacnomys millardi wroughtoni* Thomas

1922. *Dacnomys wroughtoni* Thomas, *J. Bombay nat. Hist. Soc.*, 28, 2, 430.

Type-locality.—Dreyi, Mishmi Hills, 6,000 ft.

Range.—Specimens seen from MISHMI: Dreyi.

Characters, so far as known, as in key above.

Genus 39. *Hadromys* Thomas

1911. *Hadromys* Thomas, *J. Bombay nat. Hist. Soc.*, 20, 4, 999.

Type-species.—*Mus humei* Thomas.

Distribution.—MANIPUR and KAMRUP.

This mouse represents another border-line genus which is just separable from *Rattus*. It was described in 1886 but until very recently was still imperfectly known*. When I published my last work on the genera of Living Rodents, 1940-41, the bullae were, for instance, still unknown. Now, however, Mr. W. J. C. Frost has brought home many specimens of this mouse, proving that it is common enough if

* Also see footnote on p. 714.—EDITOR.

someone is asked specially to collect it. The main character which distinguishes it from *Rattus* is that anteriorly the zygomatic plate is cut back above and then concave, a character not found elsewhere in *Rattus* or *Mus*-like genera in Asia, although present in an Australian genus (*Pseudomys*) and in African genera, not a good character, as it becomes inconstant in some forms. However, combined with the other characters of *Hadromys*, the thick and powerful incisors, the large M. 3 which is but little reduced and not much smaller often than M. 2, the shortened fifth finger and toe, etc., it seems reasonable to retain that name generically. I suspect it might be related to *Golunda*, although it is very much less extremely dentally than that.

103. *Hadromys humei* (Thomas)*

Hume's Rat

Text-fig. 45

1886. *Mus humei* Thomas, *Proc. zool. Soc. Lond.*, 63.

Type-locality.—Moirang, Manipur.

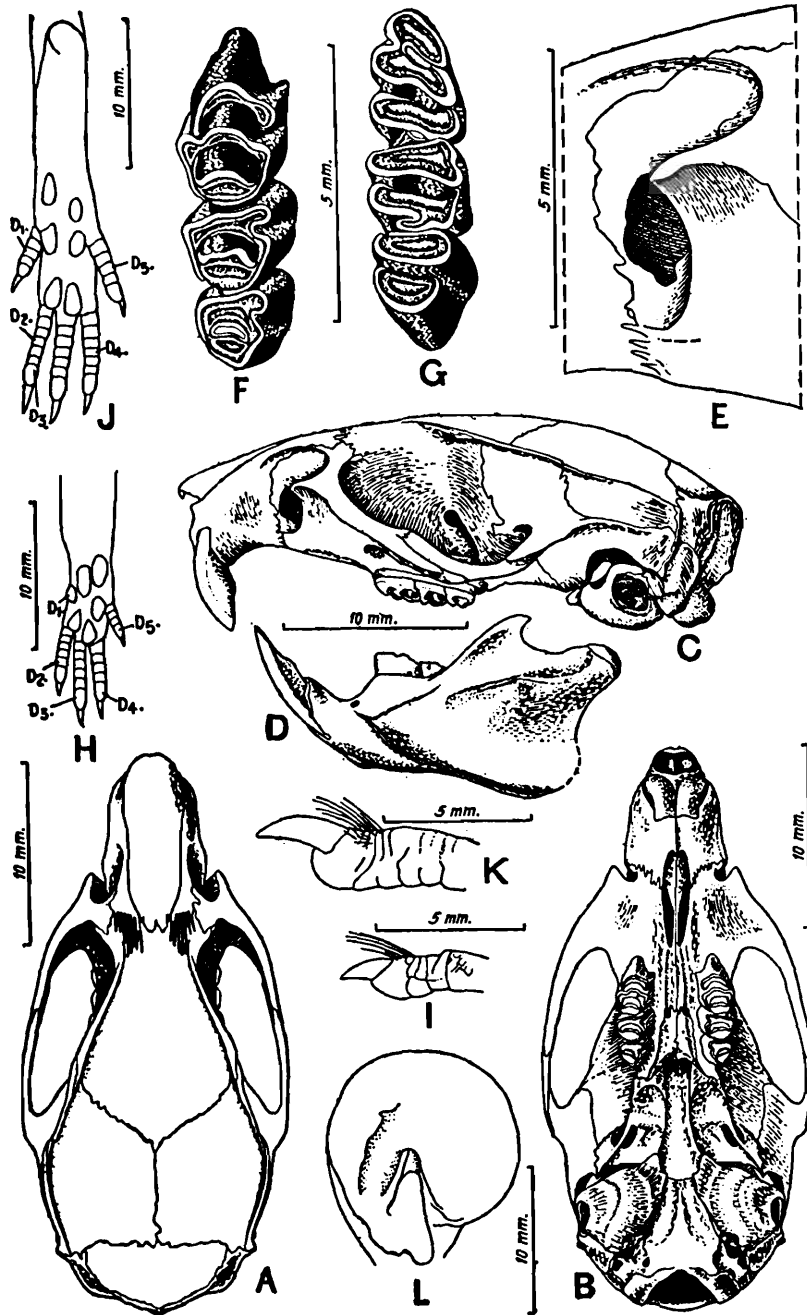
Range.—Specimens seen from MANIPUR: Moirang and Bishampur (3,000–4,000 ft.). KAMRUP: Angarakhata.

In addition to the generic characters of this mouse, Frost's collection enables me to state that the tail, which is bicolor, is on average longer than the head and body, the occipitonasal length is about 28.4–32.2 mm., the palate is more than half the occipitonasal in length, the palatal foramina are long, averaging 18% of the occipitonasal, the bullae are medium small (average 15% of the occipitonasal), the tooth-row is nearly as long as the foramina.

External characters.—Large mouse size, head and body 98–120 mm. Fur soft. Ear rather large. Tail longer than head and body.

It is rather well haired for a member of the present subfamily, but the scales are visible. Hand with four functional clawed fingers, the outer one strongly shortened, often scarcely reaching past base of the finger next to it. Foot with five toes; the fifth toe and the hallux, both clawed, are shortened, the fifth toe scarcely reaching past the base of the fourth toe. This character is useful in identifying the species.

* Also see Roonwal, M. L., 1949, *Trans. nation. Inst. Sci. India*, Calcutta, 3 (2), pp. 105–106, and Pl. VI, Fig. 5, for biology and ecology; and 1950, *Rec. Indian Mus.*, Delhi, 47 (1), pp. 36–39; 51–53; and Pl. VIII, for further taxonomic details.—EDITOR.



TEXT-FIG. 45. *Hadromys humei* (Thomas), ♀. A, B, C, dorsal, ventral and lateral view of skull. D, outer side-view of left mandible. E, a portion of the left side-view of skull (same as in C), further enlarged to show the concave anterior margin of the zygomatic arch. F, upper molar crowns of right side, in surface view. G, lower molar crowns of right side, in surface view; H, lower view of right hand. I, side-view of mid-finger (D_3) of right hand. J, lower view of right hindfoot. K, side-view of mid-toe (D_3) of right hindfoot. (After Roonwal, 1950, Pl. VIII.)

Apparently six plantar pads. Mammae 8 (Blanford). Colour above dark, speckled brown; the feet dark like the body.

Underparts pale fawn. Tail sharply bicolor, nearly black above, nearly white below in all specimens.

External measurements.—

	Head and body	Tail	Hind- foot	Ear
Frost collections—				
F. 357. Bishampur, Manipur	110	120	24	17
F. 420. Bishampur	110	125	25	18
F. 421. Bishampur	110	130	25	18
F. 422. Bishampur, 4,000 ft.	112	123	25	18
F. 423. Bishampur	100	123	23	17
M. 449. Bishampur	110	130	25	18
F. 450. Bishampur	98	120	25	16
F. 451. Bishampur	110	120	25	18
F. 452. Bishampur	118	130	25	17
M. 454. Bishampur	110	125	25	20
F. 455. Bishampur	98	124	25	17
F. 456. Bishampur	100	120	25	20
F. 459. Bishampur	105	130	25	18
F. 466. Bishampur	100	112	25	17
F. 467. Bishampur	105	117	26	17
F. 468. Bishampur	105	127	24	17
F. 469. Bishampur	110	120	25	17
M. 470. Bishampur	112	130	28	17
F. 471. Bishampur	105	130	26	17
F. 472. Bishampur	120	138	28	22
M. 474. Bishampur	112	128	25	16
F. Angarakhata, Kamrup	110	135	27	18
Frost Coll. 458, Bishampur	112	120	24	17

Also seen from Moirang, Manipur.

Cranial characters.—The main percentages and proportions as above. Nasals tending to be narrower behind than in front; frontals powerfully ridged and moderately constricted; the ridges extend well back over the parietals. Suture of frontals and parietals broadly V-shaped. Interparietal large and prominent. Occiput quite high and ridged centrally. Bullae rather small. Pterygoid fossae rather deep and hamulars joining the bullae. Palate long and palatal foramina narrow and long. Zygomatic plate constantly concave anteriorly, then sharply cut back above. Zygoma rather powerful, particularly anteriorly; jugal short. Mandible with lower border well ridged and the coronoid process well developed.

Dental characters.—Upper incisors very wide and powerful, reddish in colour and plain. Upper molars relatively wide

(width M. 1 approaches or equals 2 mm.). M. 3 large; narrower than M. 2 but scarcely shorter than that tooth. None of the series examined has the cusps clear but there seem spaces for eight cusps in M. 1; probably six in M. 2 (the anterointernal, three on the second and two on the third lamina) and M. 3 probably is similar in elements to M. 2. The centre lamina of M. 1 is very wide, wider than the front one, and the anteroexternal cusp in M. 1 is not large. Lower molars without extreme peculiarity; three laminae on M. 1, two on the other teeth, these bearing spaces for two cusps; terminal heel of M. 1 and M. 2 very reduced.

Cranial measurements.—

		Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Frontals width	Diastema
Frost collections—								
F.	357 Bishampur, Manipur	30.3	15.9	5.6	4.6	5.6	4.6	7.5
F.	420 Bishampur	31.7	?	6.1	4.8	5.7	4.8	?
F.	423 Bishampur	28.4	15.4	5.3	4.2	5.2	4.3	6.9
M.	449 Bishampur	32.2	16.8	6.0	4.7	5.6	4.8	7.8
F.	450 Bishampur.	29.4	15.5	5.6	4.5	5.6	4.3	6.8
F.	451 Bishampur	30.0	16.0	5.9	4.5	5.7	4.2	7.5
F.	452 Bishampur	29.3	15.3	5.6	4.5	5.4	4.2	6.7
M.	454 Bishampur	30.7	16.1	5.5	4.6	5.4	4.6	7.3
F.	455 Bishampur	29.7	15.4	5.6	4.8	5.7	4.9	6.8
M.	458 Bishampur	31.5	16.5	6.0	4.7	5.6	4.5	7.6
F.	459 Bishampur	31.1	16.4	6.2	4.6	5.6	4.9	7.4
F.	467 Bishampur	29.5	15.5	5.6	4.6	5.6	4.2	6.7
F.	468 Bishampur	29.3	15.6	5.7	4.4	5.4	4.6	7.1
F.	471 Bishampur	29.9	15.6	5.5	4.8	5.7	4.6	6.9
F.	472 Bishampur	31.2	16.2	6.0	4.6	5.6	4.7	7.1
M.	474 Bishampur	30.5	15.8	5.4	4.5	5.2	4.1	7.3
Number ?	(? 460)	29.7	15.4	5.5	4.7	5.6	4.6	7.2
M.	470 Bishampur.	30.3	16.0	7.2	5.7	4.5	5.7	?
The foramina measurement = the longer side								

Dimensions of Hadromys humei, in British Museum material.—The head and body length varies between 98 and 120 mm. Tail between 112 and 138 mm. Hindfoot 23–28 mm. The occipitonasal length varies between 28.4 and 32.2 mm. Toothrow 4.5–5.7 mm.

Genus 40. **Mus** Linnaeus

- 1758. *Mus* Linnaeus, *Syst. Nat.*, 10th ed., 1, 59.
- 1837. *Leggada* Gray, *Charlesworth's Mag. nat. Hist.*, 1, 586. (*Mus booduga* Gray.)
- 1911. *Pyromys* Thomas, *J. Bombay nat. Hist. Soc.*, 20, 996, in part; *Pyromys priestlyi* Thomas = skin of *Mus platythrix* mixed with skull of *Rattus gleadowi*.
- 1914. *Leggadilla* Thomas, *J. Bombay nat. Hist. Soc.*, 22, 4, 682. *Mus platythrix* Bennett.
- 1915. *Coelomys* Thomas, *J. Bombay nat. Hist. Soc.*, 23, 3, 414. *Coelomys mayori* Thomas. Valid as a subgenus.
- 1917. *Tautatus* Kloss, *J. nat. Hist. Soc. Siam*, 2, 279. *Tautatus thai* Kloss (a subspecies of *Mus cervicolor* Hodgson).
- 1918. *Mycteromys* Robinson and Kloss, *J. Fed. Malay States Mus.*, 8, 57. *Oromys crociduroides* Robinson and Kloss, from Sumatra. Valid as a subgenus.

Type-species.—*Mus musculus* Linnaeus.

Distribution.—As a commensal genus, it is distributed throughout the world. This applies to the type only. Wild species and races occur throughout the greater part of Europe, Asia and Africa. It becomes hard to say, at times, which forms of *M. musculus* are introduced and which are wild. Apart from this species, Java seems the easternmost limit in Asia. The genus is uncommon in the Malayan region and islands. The Asiatic range for species other than the type seems to be only the whole of INDIA, CEYLON and parts of BURMA: Yunnan; Liukiu Islands; Indo-China, Siam; Sumatra, Java. Many other species occur in Tropical Africa.

This is the first named genus in the subfamily. It was restricted by Miller to those small species like the type, which have the toothrow somewhat modified; the upper toothrow has M. 1 enlarged, usually clearly exceeding half the toothrow length, with its anterointernal cusp distorted inwards to a greater or lesser degree (this cusp most often in line with the second lamina); combined with strong to extreme reduction of M. 3. The anterior root of M. 1 is usually projected forward and often the roots of M. 1 are reduced. The occipitonasal length is rarely as much as 29 mm., though occasionally 30 mm. can be reached. The outer row of cusps in the upper molars is well marked. There are no extreme cranial or external specializations.

Some authors split this genus into several so-called genera, as '*Leggada*' and '*Leggadilla*', etc. The difference, specifically, between *Mus booduga*, type of '*Leggada*', and *M. musculus*, the type, is average, not absolute, and on those grounds it is hard to see how '*Leggada*' could be used as a genus. '*Leggadilla*', based on forms with supraorbital ridges, is quite impossible to distinguish from many specimens of so-called '*Leggada*' or *Mus*, which may have supraorbital ridges on the skull, individually, just as powerful as some specimens of '*Leggadilla*'. I think that *Coelomys* may be referred to this genus as a subgenus.

Usually, but not always, *Mus* species are smaller than *Rattus* and its immediate allies. But the largest *Mus* species, as *M. mayori* (occipitonasal length to 29 mm.) and *Mus platythrix* (occipitonasal once reaching 30 mm.), can be larger sometimes than *Rattus exulans* (occipitonasal lowest length 27.3 mm.) and *Rattus eha* (occipitonasal length lowest 28.3 mm.). Other small related species are *Rattus gleadowi* (24 mm. lowest), *Rattus meltada* (28 mm. lowest), *Hadromys* (28.4 mm. lowest), etc.

No general revision has been attempted of *Mus* in India since the extremely oversplit classifications of Thomas and Wroughton. It is not an easy genus to classify.

It seems to me that the two most distinct species in India are *Mus* (*Coelomys*) *mayori* and *Mus pahari*. Both of these have the palatal foramina shortened, normally less than 20% of the occipitonasal length. This is such a rare character, so far as I have seen, within the genus in Europe and Asia, that I propose to transfer *M. pahari* to *Coelomys*, in order to emphasize its distinctness (its other unusual characters are its short palate, less than half the occipitonasal length and its relatively wide frontals) and to retain *Coelomys* as a subgenus. The remainder of the species I consider represent typical subgenus *Mus*.

The character which appears to distinguish *Mus musculus* from the others is that its nose is shorter proportionately, i.e. the diastema is short, averaging less than one-quarter of the occipitonasal length. Most (but not all) specimens of the other species have the diastema approximating to or exceeding one-quarter of the occipitonasal length. (The very imperfectly known *M. fernandoni* is an exception.)

For the rest, it seems to me that there are three species or groups of species occurring together through a large part of India. One of these, the well known and long standing species, *M. booduga*, is excessively small (occipitonasal length most often under 20 mm.). The next group is medium in

size, with the occipitonasal length most often 20–22 mm., but under 23 mm. For this group, the first name seems to be *M. cervicolor*. (This would include a few forms, as *philipsi*, which have been regarded as '*Leggadilla*', i.e. with supraorbital ridges on the skull, which can, however, be well-developed individually in other subspecies of *cervicolor*.) The last group contains the large species, occipitonasal length generally exceeding 23 mm. *M. platythrix* is the first name and according to the classification here offered it includes the bulk of forms hitherto referred to '*Leggadilla*'. A distinct species occurs with it intermittently, which seems too large to be races of *M. cervicolor* (and in one place at least occurs with a race of *M. cervicolor*); the first name for this branch is *M. famulus* and its nearest allies which I propose to call races provisionally are *cooki* and perhaps *popaeus*. This last branch is a little difficult to define; but the Burmese *popaeus* is distinguishable by smaller size when compared with the Burmese race of *platythrix* (*shortridgei*), with which it occurs. Other geographical overlaps which seem to indicate that *M. famulus* and *M. cervicolor*, as here defined, are distinct species, are *M. f. famulus* in the Nilgiri region with *M. cervicolor palnica*, and *M. f. cooki* in Assam with *M. c. nagarum* (or in the same general neighbourhood). *Mus booduga* occurs with these forms in nearly all localities. It may be noted that *nitidulus* and *fulvidiventris* (the latter Ceylonese and hitherto referred to *booduga*), both long-standing names, seem in reality to represent *cervicolor*, and that *jacksoniae*, from Assam, is a subspecies of *pahari*.

Key to the Indian subgenera of Mus

1	(2) The palatal foramina shortened, normally less than one-fifth of the occipitonasal length	<i>Coelomys</i>
2	(1) The palatal foramina lengthened, normally clearly more than one- fifth of the occipitonasal length	<i>Mus</i>

Subgenus (a) **Mus** Linnaeus

This is comprised of species with long palatal foramina, as just indicated, and almost always with long palate, which is well over half the occipitonasal length in the majority of forms.

I am inclined to recognize half a dozen species in India, which may be keyed as follows:

Key to the Indian species of subgenus Mus

1	(4) The diastema short, normally less than one-quarter of the occipitonasal length.	2
2	(3) The occipitonasal approximates to 23 mm. or more. Toothrow 3.8-4.2 mm.	
	<i>Mus fernandoni</i>	
	The occipitonasal rarely reaches 23 mm.* Toothrow less than 3.8 mm. in skulls measured.	
	<i>Mus musculus</i>	
4	(1) In the majority of specimens, the diastema approximates to or exceeds one-quarter of the occipitonasal length	5
5	(6) Very small species; the occipitonasal length is usually less than 20 mm.	
	<i>Mus booduga</i>	
6	(5) Less small species; the occipitonasal length generally exceeds 20 mm.	7
7	(8) Medium sized species, the occipitonasal length usually not reaching 23 mm.	
	<i>Mus cervicolor</i>	
8	(7) Large species, the occipitonasal length most often exceeding 23 mm.	9
9	(10) The underparts yellowish or darkish grey, not white. In western subspecies, the tail length exceeds 90% of the head and body. In the Burmese subspecies (which occurs with a subspecies of the next) the occipitonasal length is less than 24 mm.	
	<i>Mus famulus</i>	
10	(9) The underparts vary but tend to be white, or light grey in the Burmese race. In all subspecies the tail averages less than 90% of the head and body. In the Burmese subspecies (occurring with a subspecies of the last) the occipitonasal length is more than 25 mm.	
	<i>Mus platythrix</i>	

The last four species occur together extensively. The Burmese short-tailed race of *famulus* makes that species rather hard to define. *M. fernandoni* is a very little known Ceylonese species and I hesitate to regard it as a form of *Mus musculus* to which it seems to make some approach in its reduced diastema.

* In specimens representing wild or semiwild forms of *Mus musculus* from Europe and Asia the occipitonasal length reaches 23 mm. only seven times in 142 skulls. In commensal specimens from India, this length is reached three times in 123 specimens.

104. **Mus musculus** Linnaeus

The House Mouse

1758. *Mus musculus* Linnaeus, *Syst. Nat.*, 10th ed., 1, 62.

Type-locality.—Uppsala, Sweden.

Vernacular names (ex Blanford).—*Musi*, *Chuhi*, *Mesuri*, H. *Chutu*, Kol. *Lengtia indur*, Beng. *Manei buduga*, Can. *Kusettamiyo*, Cing. *Shintad gandu*, Wadari (Ahmednagar).

Mus musculus, *Mus bactrianus*, and possibly *Mus sublimis* of Blanford's work on British Indian Mammals, 1891.

Distribution.—World-wide, owing to accidental human introduction to America, Australia, Tropical Africa, etc. Probably naturally distributed as a wild animal in the Palaearctic region.

It appears that, as in *Rattus rattus*, there are many subspecies of this species which are primarily house-dwelling or commensal and are characterized by their dull coloured underparts, and several wild subspecies which are characterized by their whitish or white underparts. White bellied or light-bellied forms live in many parts of Continental Europe and many parts of northern or Palaearctic Asia, including north-western India and the Himalayas. In Tropical Asia, most of the *M. musculus* forms seem to be indoor types.

As far as I understand this species, it is characterized by its long palatal foramina and by the fact that the muzzle is rather short, so that the diastema is most often under one-quarter of the occipitonasal length. Thomas (1919, 419) wished to restrict the genus to this species, on account of its shortened muzzle, and to revive Gray's name *Leggada* for the wild species from Africa and India with a longer muzzle. But the difference between the two is average and individual rather than absolute; it seems quite unnecessary and indeed impossible to follow Thomas's classification. Thomas stated, 'The essential characteristic of *Mus*, as compared with *Leggada*, is the shortening of the muzzle, a shortening which is emphasized by a somewhat more forward position of the anterior zygomatic root. Looking at the skull from below, the whole zygomatic plate is pushed forward, so that its anterior edge comes opposite a point in front of the middle of the palatal foramina while in *Leggada* it is at or even behind the 'middle. The length of the nasals in *Mus* is generally about equal to the distance from the external edge of one toothrow to the outer side of the zygoma of the opposite side, or (perhaps a better comparison) to the distance between the lips of the auditory

meatus of the two sides. In *Leggada* the nasal length generally decidedly surpasses these two distances. Not only is the muzzle of *Mus* shorter, but it is a little broader, so that the distance between the two anteorbital fossae goes less than three times in the nasal length, in *Leggada* more than three times. Every individual skull will not always answer to each of these tests, but on the whole there is rarely a case where one is doubtful as to which of the two groups a species should be placed in.' He states that the most doubtful are the races of *musculus* (*algirus* and *spicilegus*), of North Africa and Europe. I have measured all wild races of *Mus musculus* in the British Museum, and all of these average a shorter diastema than the '*Leggada*' species, but there are so many individual overlaps that there is no question, in my mind, of even subgeneric separation of the two groups. Almost *Mus booduga*, the type of '*Leggada*', might be regarded as a group of southern small races of *M. musculus*. The characters mentioned above by Thomas are not constant, as he himself points out. *M. musculus* does not even always average larger in size than the very small *M. booduga*, and several young skulls of species, such as *M. booduga*, *M. cervicolor* and even *M. platythrix*, may have a relatively short diastema and resemble average specimens of *M. musculus* in this character, while occasionally in *M. m. bactrianus*, the diastema may equal or exceed one-quarter of the occipitonasal length in old specimens. Moreover, South African forms currently referred to '*Leggada*' seem to have the short diastema of *Mus musculus*.

External characters.—Smallish mice with no special peculiarity; as a rule the tail exceeds head and body length in Indian subspecies; hallux clawed, as usual.

Colour.—The back varies from dark brown to rather lighter more sandy brown in *M. m. bactrianus*. The underparts are whitish to light grey in *bactrianus* and *homourus*, but dark brown or dull in the indoor types, such as *castaneus*. The tail is bicolor, dark above, white below in *bactrianus*, and usually so in *homourus*, poorly bicolor or more often wholly dark in the commensal types. Feet white or light in *bactrianus* and generally *homourus*, more often dark, with toes white only, in the commensal forms.

External measurements.—As in Table 89, below.

Cranial characters (based mainly on *M. m. bactrianus*).—The occipitonasal length appears to vary between about 18 and 23 mm. Supraorbital ridges often traceable, but not constantly present and usually not much marked. Nasals rather short (Thomas, 1919, stated that the nasals in

TABLE 89.—*External measurements of the Indian races of Mus musculus*

		Head and body	Tail	Hind- foot	Ear
<i>Mus musculus bactrianus</i>					
M.	Rohtas, Salt Range	78	89	17	13½
	Lehtrar, Murree	73	92	17	?
F.	Pangjur, Baluchistan	76	77	17	14
F.	Kallarkahar, Salt Range	73	80	16½	12
M.	Pangjur	72	76	18	15
F.	Jacobabad, Sind	83	88	17	20
F.	Jacobabad	72	83	16	20
F.	Kelat, Baluchistan	77	82	16	14
F.	Khojdar, Baluchis- tan	65	75	17	14
M.	Khojdar	70	83	18	13
F.	Panjur	75	?	18	15
F.	Lehtrar, Murree	78	95	17½	13
F.	Jhelum, Salt Range	74	87½	17	13
M.	Banni, Murree	81	96	18	15
F.	Pangjur	69	82	18	14
M.	Jhelum, Salt Range	67	74½	17	12½
F.	Jacobabad	67	79	16	14
M.	Jacobabad	63	72	16	13
F.	Kallarkahar, Salt Range	72	78	17	13
M.	Lehtrar, Murree	74	89	18	13
M.	Patriata, Murree	71	80	17	13
	Kallarkahar, Salt Range	78	86	16	14
F.	Sakesar, Salt Range	80	99	16	13
M.	Ara, Salt Range	70	70	16	14
F.	Kallarkahar	80	80	17	12
M.	Lehtrar, Murree	64	77	17	13½
M.	Pangjur	66	86	18	14
F.	Dail, Salt Range	63	71	15	12
M.	Pangjur	75	83	19	15
M.	Naundero, Sind	72	82	16	12
M.	Mastung, Baluchis- tan	85	89	18	15
M.	Mastung	64	78	18	14
M.	Lehtrar, Murree	67	79	16½	13
M.	Jhalar, Campbell- pore	68	80	18	13
M.	Pangjur	76	82	18	14
M.	Bhattu Hissar	52	56	15	12
M.	Jacobabad	71	64	16	16
M.	Mastung, Baluchis- tan	72	84	18	15
M.	Mastung	76	80	18	14
	Sourab, Baluchistan	75	89	18	15
F.	Kallarkahar, Salt Range	78	76	17	13

TABLE 89.—*External measurements of Mus musculus (contd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Mus musculus bactrianus</i> (concl'd.)				
M. Bhattu Hissar	63	77	17	12
F. Kallarkahar	82	80	17	14
M. Jacobabad	69	81	16	14
F. Kallarkahar	79	75	17	14
M. Sialkot, Punjab	83	95	17½	13
M. Turbat, Baluchistan	74	89	18	14
F. Pangjur	72	86	18	15
F. Jacobabad	72	80	17	14
M. Jacobabad	64	71	16	14
F. Pangjur, Baluchistan	76	83	18	15
Naundero, Sind	73	82	16	12
F. Mastung ..	73	87	18	14
M. Rawalpindi, Punjab	75	82	18	14
F. Pangjur	65	80	18	14
F. Mastung, Baluchis- tan	80	90	19	15
F. Pangjur	68	82	18	15
F. Sourab, Baluchistan	67	80	17	14
F. Mustang	75	85	18	15
M. Pangjur	82	72	18	14
M. Mustang	60	75	18	14
Chak, Sind	78	81	16	14
M. Locality ?	65	72	17	14
M. Naundero .	70	72	15	12
M. 12 miles west of Turbat .	72	80	17	14
M. 16 miles NE. of Mand	73	88	18	15
Gambat, Sind	67	76	11	16
M. Mastung	67	84	18	14
M. Pangjur ..	76	84	18	14
M. Chakdulla, Campbell- pore	52	70	17	13
M. Sourab	69	93	18	15
M. Chakdulla	68	73	17	13
F. Pangjur	79	86	18	15
Ara, Salt Range	74	83	17	14
M. Kashmor, Sind	62	70	16	14
M. Pangjur	62	64	16	14
F. Naundero	72	88	16	12
F. 12 miles W. of Turbat	63	80	17	14
M. Pangjur	58	73	18	14
M. Lehtrar, Murree	79	85½	17	13½
M. Kagan Valley, Hazara	83	75	17	12 Caught in ruin.
M. Kagan Valley	83	74	16	12 In ruin.
M. Dulai, Kashmir	72	74	16½	7 Under roots of tree.
M. Siwalik Hills, Punjab	75	61	17	14½ Edge of cultivation.
F. Rawalpindi	83	88	13	8 In house.

TABLE 89.—*External measurements of Mus musculus (contd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus musculus homourus</i>					
F. Sangser, Darjeeling	72	72	16	14	
M. Pashok	69	79	16	13	
F. Kalimpong	75	72	17	13	
M. Nimbong	72	73	17	14	
F. Gopaldhara	69	81	17	13	
M. Pashok	73	77	18	14	
M. Chuntang, Sikkim	78	84	18	13	$\frac{5}{8}$ oz.
M. Pedong, Darjeeling	70	75	17	14	
F. Pedong	69	70	17	14	
F. Chuntang	74	81	18	13	Mammae 10: $\frac{1}{2}$ oz.
M. Pedong	75	85	18	14	
M. Chuntang	79	82	18	13	$\frac{1}{2}$ oz.
M. Gopaldhara	65	75	17	13	
Gopaldhara	80	74	17	13	
F. Pedong	70	75	17	13	
F. Pedong	62	75	17	13	
M. Gopaldhara	67	84	18	14	
F. Pashok	70	71	16	13	
M. Gopaldhara	75	89	17	13	
F. Sukiapohkri	75	78	17	12	Mammae 10: $\frac{5}{8}$ oz.
M. Pedong	69	77	18	14	
M. Rongli	81	75	17	13	$\frac{5}{8}$ oz.
F. Batasia	75	73	17	12	Mammae 10: $\frac{5}{8}$ oz.
M. Gopaldhara	80	83	18	14	
F. Sukiapohkri	78	?	17	12 $\frac{1}{2}$	Mammae 10: $\frac{5}{8}$ oz.
M. Gopaldhara	64	75	16	13	
M. Tissa, Chamba	85	85	18	14	
M. Lohaghat, Almora, Kumaon	74	76	17	12	$\frac{5}{8}$ oz.
M. Khati, Kumaon	83	87	19	13	$\frac{3}{4}$ oz.
F. Punjab	74	72	14	13	In Pine woods.
M. Khati	80	87	18	12 $\frac{1}{2}$	$\frac{5}{8}$ oz.
M. Ratighat, Kumaon	70	80	17	12	$\frac{1}{2}$ oz.
F. Dagshai, Punjab	82	81	17	11	In hedge
M. Ratighat, Naini Tal	82	85	18	14	$\frac{3}{4}$ oz.
M. Tissa, Chamba	87	92	18	15	
M. Punjab	71	77	18	13	
M. Khati	88	82	18	13	$\frac{3}{4}$ oz.
F. Lohaghat, Kumaon	67	71	17	14	$\frac{5}{8}$ oz.
M. Khati	78	71	16	12	$\frac{5}{8}$ oz.
M. Khati	82	80	17	13	$\frac{5}{8}$ oz.
M. Lohaghat	68	70	17	12	$\frac{5}{8}$ oz.
F. Lwarkhet, Kumaon	83	81	17	13	Mammae 10: $\frac{7}{8}$ oz. Foetus 5.
M. Chamba	71	80	18	15	
F. Khati	81	85	17	13	$\frac{3}{4}$ oz.
M. Almora, Kumaon	69	79	17	13	$\frac{5}{8}$ oz.
M. Lwarkhet	82	80	16	12	$\frac{5}{8}$ oz.
F. Dhamtal, Kangra	67	62	15 $\frac{1}{2}$	15	
F. Gopalpur, Punjab	63	74	16	11	

TABLE 89.—*External measurements of Mus musculus (contd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus musculus homourus (contd.)</i>					
F. Dhamtal	68	72	15	14	
F. Dhamtal	81	97	17	16	
F. Guna, Central India	80	74	14	13	
M. Gopalpur, Kangra	69	77	15½	14	
M. Chamba State	62	74	17	12	
M. Dhamtal	75	84	17	15	
Dharmsala, Punjab	63	77	16	12	
F. Gopalpur, Kangra	62	73	15	13	
M. Dhamtal	79	90	19½	15	
F. Gopalpur	70	70	16	13½	
F. Gopalpur	87	88	17	14	
M. Chattri, Chamba	59	63	16	12	
F. Dhamtal	76	86	17	13	
Chamba, Chamba State	73	83	18	15	
M. Sangser, Darjeeling	75	70	17	14	
F. Chuntang, Sikkim	78	81	17	12	Mammæ 10: ½ oz.
M. Laprak, Gorkha, Nepal	67	75	19	14	
Satthar, Gorkha	70	?	17	14	
Apoon Sottidanda, Gorkha	67	75	18	13	
M. Chamba, Punjab	73	85	18	15	
M. Tissa, Chamba	74	83	18	15	
M. Tissa	82	85	18	15	
F. Tissa	78	70	17	14	
M. Siluni, Chamba	65	80	18	13	
F. Tissa	79	86	18	15	
M. Chakothi, Kashmir	71	64	16	12½	
Dachgam, Kashmir	85	68	18	11	
M. Prastan, Kashmir	82	63	13	9	
Kul, Kashmir	70	60	15	10	
F. Pandritton, Kash- mir	94	82	18	14	
F. Chichoti	84	78	21	16	
F. Sangi, Kashmir	71	68	17	13	
M. Pandritton	88	80	18	14	
F. Kirrim, Kashmir	82	73	17	14	
F. Kirrim	88	69	17	13	Amongst rocks and long grass.
F. Pandritton	67	61	17	13	
F. Mani, Vale of Kash- mir	83	60	18	14	
M. Chatta, Kashmir	72	74	18	14	On bank.
F. Dras, Ladak	96	81	18	15	In house.
M. Shar, Kashmir	74	78	18	15	Under hedge.
M. Shar, Kashmir	72	74	17	14	In hut.
M. Dangail, Kishtwar	72	76	20	15½	
F. Dachgam, Kashmir	77	65	17	13	
M. Dras, Ladak	99	74	18	15	

TABLE 89.—*External measurements of Mus musculus (contd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus musculus homourus (concl'd.)</i>					
M. Pandritton	78	74	18	14	In hut.
Jhelum River, Kashmir	78	62½	?	?	
M. Kul, Kashmir	73	60	16	11	
F. Kargil, Ladak	88	79	16½	13½	
M. Dachgam	73	69	16½	13	
F. Dras, Ladak	103	78	17	14½	Bungalow.
M. Shevaroy Hill, East- ern Ghats	60	66	15	11	
M. Shevaroy Hill	66	76	17	13	
M. Coonoor, Nilgiri Hills	75	83	20	15	
M. Shevaroy Hill	66	77	17	14	
<i>Mus musculus castaneus</i> and other house-dwelling dark-bellied forms					
F. Colombo, Ceylon	80	79	17	14	
M. Udugama, Ceylon	75½	86	16	14	Bungalow.
M. Cheddikulam, Ceylon	73	89	17	12½	
F. Kandy, Ceylon	94	91	15	14	
F. Cheddikulam	76	90	16½	13½	Native house.
M. Sagar, Mysore	80	85	16	12½	
F. Urugalla, Ceylon	83½	88	17	13	Native garden.
M. Ambawela, Ceylon	81	82	16½	12	
F. Kandy	82	83	16½	13	
F. Ambawela	76½	77	16½	12	
F. Cheddikulam	76	85	16½	13	Native hut.
F. Trinco, Ceylon	82	83	16	12½	
F. Udugama	82	?	15	12½	Jungle edge.
F. Urugalla, Ceylon	84	100	18½	13	Bazaar.
M. Trinco	69	81	16	12	
M. Urugalla	70	85	17	13½	Native house.
F. Gersoppa, Kanara	79	81	15	12	Weight ½ oz.
M. Sagar, Mysore	83	84	16	13½	
M. Gersoppa, Kanara	76	82	17	12	
F. West Haputale, Ceylon	83	83	14	12	Melanistic.
M. Surat district	69	83	16	11	
F. Delhi	80	89	19	12½	
M. Delhi	63	77	18	?	
F. Bhuj, Cutch	71	70	16	12½	House. Mammae 10.
F. Rajkot, Kathiawar	73	87	18	11	Mammae 10 : ½ oz.
F. Rajkot	77	82	16	12	Mammae 10 : ⅝ oz.
M. Sasan, Kathiawar	68	81	15½	9	½ oz.
M. Sasan	59	71	16	11	⅜ oz.
M. Rajkot	75	95	18	12	½ oz.
F. Sasan	80	91	17	12	Mammae 10 : ¾ oz.

TABLE 89.—*External measurements of Mus musculus (contd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus musculus castaneus</i> and other house-dwelling dark-bellied forms (<i>contd.</i>)					
M. Rajkot	78	87	15½	13	⅝ oz.
M. Sasan	73	80	17	11	⅝ oz. In hut.
Perhaps the next four represent <i>tyleri</i> of Schwarz and Schwarz.					
F. Deesa, Palanpur	76	95	17	12	Mammae 10 : ½ oz.
F. Deesa	72	81	15	12	Mammae 10 : ⅝ oz.
M. Deesa	77	85	16	11	⅝ oz.
M. Deesa	66	85	17	11	½ oz.
F. Rajapara, Kamrup	80	90	17	13	
F. Angarakhata, Kam- rup	80	93	17	13	
M. Angarakhata	68	87	17	13	
F. Angarakhata	86	88	17	12	
M. Angarakhata	67	84	17	13	
M. Angarakhata	72	79	16	14	
F. Angarakhata	73	82	17	12	
F. Angarakhata	78	90	18	13	
F. Angarakhata	85	94	18	14	Mammae 10 : 0.5 oz.
M. Angarakhata	78	91	18	14	
F. Rajapara	78	98	18	13	
M. Gadag, Mahratta	74	74	14	12	
F. Gadag	80	?	16	11	
F. Gadag	63	64	14	11	
Ootacamund	70	80	16	12	
F. Ootacamund	92	83	17	12	
M. Gadag	79	86	16	11	
M. Gadag	82	84	16	13	
M. Thana, 65 miles N. of Bombay	72	77	17	11	Cultivation.
M. Ootacamund	65	82	16	12	
F. Ootacamund	80	77	15	13	In garden.
M. Ootacamund	74	86	17	14	Garden.
M. Ootacamund	65	80	16	7	In house.
F. Kotagiri, Nilgiris	69	74	16	12	Mammae 10.
M. Kotagiri	68	77	16	11	
F. Kotagiri	78	81	16	14	Mammae 10.
M. Ootacamund	68	79	17	13	
M. Haleri Estate, Coorg	88	89	17	12½	
F. Kolar, Mysore	91	95½	17	12½	
M. Kolar	80	79	16½	12	
F. Kolar	93	95	17½	13	
M. Kolar	83	83	17	12	
M. Kolar	83	87	17½	12.75	
F. Kolar	84	90	17	13	
F. Bangalore, Mysore	83	89	16½	12	
M. Kolar	84	77	17	12	
F. Kolar	89	?	17	12½	
F. Bangalore	84	79	16½	12	

TABLE 89.—*External measurements of Mus musculus (contd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus musculus castaneus</i> and other house-dwelling dark-bellied forms (concl'd.)					
F. Virajpet, Coorg	92	84	17	13	
F. Helwak, Satara	71	74	13	13	
F. Dharwar ..	85	80	18	15	
M. Nimiaghat, Hazari- bagh	75	92	16	12	$\frac{1}{2}$ oz.
M. Nimiaghat	72	91	17	12	$\frac{1}{2}$ oz.
F. Gajhundi, Hazari- bagh	79	73	17	13	Mammae 10: $\frac{5}{8}$ oz.
F. Daltongunj, Bihar.	78	82	17	11	
M. Daltongunj	76	80	17	13	$\frac{3}{4}$ oz.
M. Luia, Chaibassa	72	83	16	11	$\frac{5}{8}$ oz.
F. Luia, Chaibassa	78	88	16	11	Mammae 10.
F. Salbani, Bengal	80	85	15	12	Mammae 10: $\frac{5}{8}$ oz.
F. Jalpaiguri, Bengal.	84	99	17	12	Mammae 10: $\frac{3}{4}$ oz.
F. Luia, Chaibassa	79	82	16	12	Mammae 10: $\frac{3}{4}$ oz.
M. Lanka, Cachar	73	84	18	12	
M. Lanka, Cachar	73	85	18	12	
F. Lanka, Cachar	73	84	18	12	
M. Margherita, Naga Hills	71	81	16	13	In hut.
M. Maymyo, Burma	86	95	18	13	
F. Monywa, Burma	91	97	18	13	
F. Gokteik, Burma	89	92	16 $\frac{1}{2}$	13	
M. Monywa	77	83	16 $\frac{1}{2}$	11 $\frac{1}{2}$	
F. Pagan, Burma	77	82 $\frac{1}{2}$	16	11.25	
<i>Mus musculus ?urbanus.</i> Northern dark-bellied specimens					
F. Gopaldhara, Darjee- ling	73	90	16	13	
M. Kalimpong	69	92	17	14	
F. Sedonchen, Sikkim	75	85	16	12	Mammae 10: $\frac{1}{2}$ oz.
F. Kalimpong	77	102	17	13	
F. Pedong, Darjeeling	75	97	18	14	
M. Pashok	70	94	16	14	
M. Kalimpong	68	90	17	13	
M. Kalimpong	73	92	17	13	
F. Kalimpong	79	93	17	13	
M. Tongsong, Darjee- ling	66	91	17	14	
F. Rongli	73	87	17	12	Mammae 10.
F. Kalimpong	85	?	18	14	
M. Kalimpong	80	?	17	14	
F. Ghoom	88	95	18	14	Mammae 10: 1 oz.
M. Pashok	68	93	16	13	
F. Pashok	76	90	15	13	
F. Rongli	78	90	16	12	Mammae 10: $\frac{3}{4}$ oz.
F. Pashok	73	91	16	14	
M. Pashok	69	88	15	13	

TABLE 89.—*External measurements of Mus musculus (contd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus musculus ?urbanus.</i> Northern dark-bellied specimens (concl'd.)					
F. Pashok	70	86	16	12	
F. Pashok	79	97	16	13	
F. Gopaldhara	71	80	15	13	
F. Rongli	80	96	17	13	Mammae 10 : $\frac{3}{4}$ oz.
F. Kalimpong	80	98	17	13	
M. Pashok	75	92	17	14	
M. Pedong, Darjeeling	72	90	17	13	
M. Kalimpong	72	97	17	13	
F. Pashok	71	81	16	12	
F. Patibaghan, Nepal	93	94	15	13	
M. Ramnagar, Kumaon	71	84	17	10	$\frac{5}{8}$ oz.
M. Pilibhit, Rohilkund	75	87	17 $\frac{1}{2}$	12	
M. Ramnagar	75	83	16	11	$\frac{5}{8}$ oz.
M. Ramnagar	72	81	18	11	$\frac{1}{2}$ oz.
F. Ramnagar	77	79	17	11	Mammae 10 : $\frac{5}{8}$ oz.
F. Ramnagar	80	90	16 $\frac{1}{2}$	12	Mammae 10 : $\frac{1}{2}$ oz.
F. Ramnagar	74	88	17	12	Mammae 10 : $\frac{1}{2}$ oz.
M. Pilibhit, Rohilkund	77	79	17	12	$\frac{5}{8}$ oz.
F. Pilibhit	77	78	17	11	Mammae 10 : $\frac{3}{4}$ oz.
F. Pilibhit	80	76	16	11 $\frac{1}{2}$	Mammae 10 : $\frac{7}{8}$ oz.
M. Pilibhit	78	83	17	12	
F. Jerna, Ramnagar	75	92	18	12	Mammae 10 : $\frac{5}{8}$ oz.
M. Hissar district, Punjab	77	78	17	12	
M. Hissar district	76	70	15	12	
M. Ambala, Punjab	79	82	16	11	Cactus hedge.
M. Ambala	69	80	13	10	
M. Ambala	68	65	15	11	
M. Ambala	80	82	16	11	
M. Ambala	72	73	15	11	
M. Ambala	60	70	15	10	
M. Ambala	79	76	16	10	
M. Ambala	74	76	16	12	
M. Poona	67	78	16	13	
M. Poona	67	78	16	13	
F. Dhamtal, Kangra, Punjab	80	98	18	13	
F. West of Tista River, Darjeeling	80	83	17	13	
F. Gopaldhara	84	95	18	13	
M. Gopaldhara	74	82	15	13	

Mus musculus ? subsp. With dark bell

Frost collections—

M. 536				
Calcutta	75	73	17	10
507				
Kalimpong, Sikkim	80	99	16	12

TABLE 89.—*External measurements of Mus musculus (concl'd.)*

		Head and body	Tail	Hind- foot	Ear
<i>Mus musculus</i> ? subsp. With dark belly (<i>concl'd.</i>)					
M. 508	Kalimpong	85	102	17	14
M. 520	Kalimpong	55	72	15	12
F. 519	Kalimpong	78	95	16	13
M. 334	Naga Hills	68	80	18	13

Mus musculus ? *bactrianus*. (White-bellied)

Frost collections—

M. 95	Umankot, Sind	67	75	17	12
M. 96	Umankot	70	80	16	12
M. 113	Umankot	60	70	15	10

Mus (= *musculus* group) are in length usually about equal to the distance from the external edge of one toothrow to the outer side of the zygoma of the opposite side, whereas in '*Leggada*' this measurement is surpassed by the nasal length; but I do not find this character constant in *Mus musculus*). Outer front margins of parietals noticeably pointed forward at their junction with the frontals. Interparietal large and extending across back of skull. Bullae of medium size. Pterygoid fossae quite deep and posterior nares usually not narrowed, though individually they can become so. Palate usually exceeds half the occipitonasal length (though not always so in this species). Palatal foramina elongated, extending between the toothrows and over one-fifth of the occipitonasal length normally. The diastema and muzzle is shortened in this species, and with about nine individual exceptions in Indian material measured it is less than one-quarter of the occipitonasal length. Zygomatic plate rather well cut back above. Coronoid process of mandible well developed.

Dental characters.—Upper incisors narrow, yellow and usually plain. Often, but not always, with a sub-apical notch 'formed on outer side of cutting edge of tooth immediately behind the margin of enamel' First upper molar usually larger than second and third together, the third very small.

Eight well marked cusps originally present in M. 1, the anterointernal one turned inwards until it is about in line with the middle and outer cusps of the second lamina. M. 2 consisting of an anterointernal cusp, three cusps on the second and two of the third lamina. M. 3 reduced and with elements indistinct. The outer row of cusps of the upper molars well developed and the front root of M. 1 extends noticeably in front of the front lamina of that tooth. M. 1 is said to be 3-rooted. M. 2 can have an anteroexternal cusp present. Lower molars with, as usual, three laminae (bi-serially cuspidate) on M. 1 and two on M. 2. M. 3 very small. Terminal heel clear in M. 1 and M. 2. M. 3 originally bilaminate.

Cranial measurements.—As in Table 90, below.

TABLE 90.—*Cranial measurements of the Indian races of Mus musculus*

	Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus musculus</i> ? subsp. (Dark-bellied)					
Frost collections—					
507	22·3	11·0	4·8	4·8	3·3
Kalimpong, Sikkim					
507	20·6	10·4	4·4	4·9	3·3
Kalimpong (no skin)					
M. 508	21·6	11·2	4·9	5·4	3·3
Kalimpong					
M. 520	21·8	11·1	4·9	4·9	3·2
Kalimpong				<i>circa</i>	
M. 334	21·5	10·5	5·0	4·8	3·8
Naga Hills, Assam					
<i>Mus musculus bactrianus</i>					
Frost collections—					
M. 95	21·1	10·2	4·5	4·5	3·2
Umarkot, Sind		<i>circa</i>			
96	19·8	10·4	4·9	4·8	3·2
Umarkot					
F. 6.12.3.9	22·1	11·6	5·2	5·5	3·4
Kerrim, Kashmir					
F. 6.12.3.11	23·3	12·0	6·1	5·5	3·2
Dras, Ladak					
M. 15.11.1.101	20·6	10·7	4·7	4·5	3·2
Jacobabad, Sind					
M. 15.11.1.102	20·2	10·2	4·6	4·8	3·1
Jacobabad					
M. 19.11.8.20	23·4	11·6	5·5	5·5	3·5
Mastung, Baluchistan					

TABLE 90.—*Cranial measurements of Mus musculus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus musculus bactrianus</i> (contd.)						
M.	19.11.8.21 Mastung, Baluchistan	21.4 <i>circa</i>	11.3	5.2	5.0	3.2
M.	19.8.11.28 Khojdar, Baluchistan	21.8	11.0	5.2	5.4	3.2
M.	19.11.7.48 Turbat, Kach	21.7	10.9	5.1	4.8	3.4
M.	19.11.7.51 Pangjur, Baluchistan	21.4	11.2	5.0	5.1	3.4
M.	19.11.7.52 Pangjur	21.7	10.0	5.0	5.0	3.4
F.	19.11.7.55 Pangjur	21.5 <i>circa</i>	11.2	5.2	5.5	3.3
F.	19.11.7.56 Pangjur	21.5	11.1	5.2	5.2	3.2
F.	19.11.7.54 Pangjur	22.0	11.7	5.5	5.4	3.2
M.	19.7.7.1905 Bambier, Baluchistan	21.9	10.7	5.0	4.5	3.2
F.	23.11.3.88 Kallarkahar, Salt Range, Punjab	21.6	11.1	5.4	5.1	3.3
F.	23.11.3.95 Jhelum, Salt Range	22.0	11.0	4.9	5.0	3.4
M.	74.11.1.21 Kalegar, Baluchistan	23.5 <i>circa</i>	12.3	5.5	?	3.5
	91.11.1.37 Kach, Baluchistan	23.2	12.4	5.7	5.3	3.5
M.	91.10.7.138 Jeypur, Sind	19.6	9.6	4.3	4.2	3.0 <i>circa</i>
F.	23.11.3.98 Dail, Salt Range	18.7	9.3	4.1	4.1	3.2
F.	15.11.1.105 Jacobabad	21.4	10.9	5.2	5.1	3.4
<i>Mus musculus</i> ? subsp.						
F.	20.11.1.52 Golaghat, Naga Hills, Assam	17.3	8.5	4.0	4.2	3.0
M.	21.7.8.79 Angarakhata, South Kamrup	17.3	8.7	4.0	3.8	2.9
M.	21.7.8.82 Angarakhata	17.8	8.7	4.2	3.8	2.9
<i>Mus musculus homourus</i>						
F.	15.9.1.212 Sukiapohkri, Darjeeling	21.7	10.5	5.1	5.0	3.2
F.	15.9.1.213 Sukiapohkri	21.4	10.6	5.0	5.0	3.2
F.	17.4.23.52 Kalimpong, Sikkim	22.8	11.4	5.4	5.1	3.4

TABLE 90.—*Cranial measurements of Mus musculus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus musculus homourus</i> (contd.)						
M.	15.9.1.208 Chuntang, Sikkim	21.9	10.7	4.9	5.1	3.4
F.	15.9.1.210 Chuntang	21.8	10.7	4.7	5.0	3.3
M.	15.9.1.207 Chuntang	22.5	10.4	5.0	5.1	3.2
F.	15.9.1.209 Chuntang	21.8	10.7	5.1	5.3	3.5
M.	17.4.23.43 Nimbong, Darjeeling. Old.	22.2	11.4	5.7	5.0	3.5
The foramina measurement = the longer side						
M.	17.4.23.44 Sangser, Darjeeling	23.4	12.0	6.1	5.1	3.4
F.	17.4.23.48 Sangser. Old	22.6	11.6	5.7	5.1	3.3
M.	17.4.23.46 Sangser. Old	22.8	11.4	5.8	5.1	3.5
M.	17.4.23.47 Sangser	22.5	11.5	5.6	4.8	3.4
F.	17.4.23.45 Sangser	21.7	11.0	5.3	4.8	3.5
F.	17.4.3.50 Sangser	21.7	11.4	5.7	4.9	3.2
In this series from Sangser, the diastema averages too long for the present species. Perhaps, therefore, these skulls have been wrongly identified and really represent <i>M. cervicolor</i> or an allied form.						
M.	16.3.15.84 Gopaldhara, Darjeeling	21.1	11.1	5.4	4.7	3.4
M.	16.3.25.85 Gopaldhara	22.3	11.6	5.5	5.4	3.6
F.	16.3.25.88 Gopaldhara	21.3	10.8	5.2	5.1	3.3
M.	16.3.25.83 Gopaldhara	21.8	10.5	4.7	5.0	3.1
F.	16.3.25.87 Pashok, Darjeeling	22.0	11.1	5.3	4.9	3.4
F.	15.9.1.211 Tonglu, Darjeeling	21.5	10.8	5.1	5.1	3.1
F.	14.7.10.177 Lohaghat, Kumaon	20.4	10.5	4.7	4.7	3.4
M.	14.7.10.186 Almora, Kumaon. Rather young	19.8	9.7	4.5	4.5	3.1
M.	14.7.10.185 Ratighat, Kumaon	21.8	11.4	5.1	5.3	3.5
F.	14.7.10.188 Lwarkhet, Kumaon	21.9	11.2	5.4	5.3	3.3
M.	20.6.7.52 Naga Hills, Assam	21.4	10.7	4.8	5.0	3.1

TABLE 90.—*Cranial measurements of Mus musculus (contd.)*

	Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus musculus urbanus</i> (' <i>dubius</i> ')					
M. 16.3.25.80 Tongsong, Darjeeling	20.8	10.2	4.4	4.7	3.0
M. 17.4.23.33 Kalimpong, Darjeeling. Old	22.0	11.0	4.7	5.1	3.3 <i>circa</i>
M. 17.4.23.24 Kalimpong	22.6	11.7	5.6	5.2	?
F. 17.4.23.42 Kalimpong	21.8	11.0	4.9	5.1	?
M. 17.4.23.37 Kalimpong	21.5	10.2	4.7	4.9	3.2
F. 17.4.23.39 Kalimpong	23.3	12.0	5.6	5.5	3.2 <i>circa</i>
F. 17.4.23.40 Kalimpong. M. 3/3 apparently absent, except on the left lower side a tiny third molar is present	21.9	11.0	5.2	5.0	?
F. 17.4.23.38 Kalimpong	21.9	10.9	5.0	5.0	3.3
M. 17.4.23.35 Kalimpong	21.1	10.5	4.9	4.9	3.2
M. 17.4.23.36 Kalimpong	21.7	10.9	4.9	4.8	3.2 <i>circa</i>
F. 17.4.23.41 Kalimpong	21.5	10.7	4.7	5.0	3.3
F. 15.9.1.202 Rongli, Sikkim	21.8	11.0	5.1	5.3	3.1
F. 15.9.1.201 Rongli	20.6	?	4.6	4.6	3.2 <i>circa</i>
F. 15.9.1.203 Rongli	20.9	10.4	4.7	4.9	?
F. 16.3.25.75 Pashok, Darjeeling	21.1	10.5	4.7	4.7	3.0
F. 16.3.25.74 Pashok	20.8	10.7	5.0	4.5	3.2 <i>circa</i>
F. 16.3.25.73 Pashok	20.9	11.0	4.5	4.8	3.2
M. 16.3.25.69 Pashok	21.0	10.5	4.6	4.6	3.2
M. 16.3.25.71 Pashok	21.8	10.8	4.8	5.2	3.1
F. 16.3.25.77 Pashok. M. 3/3 apparently absent	20.1	9.8	4.4	4.6	?
M. 16.3.25.72 Pashok	21.1	10.3	4.7	4.9	3.2 <i>circa</i>
F. 15.9.1.204 Ghoom, Darjeeling	23.2	12.1	5.7	5.7	3.3 <i>circa</i>
M. 16.3.25.78 Gopaldhara, Darjeeling	19.8	10.1	4.5	4.8	3.2

TABLE 90.—*Cranial measurements of Mus musculus (contd.)*

	Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus musculus urbanus</i> (' <i>dubius</i> ') (concl'd.)					
F. 16.3.25.79 Gopaldhara	20.8	10.5	4.6	5.1	3.4
F. 15.9.1.200 Sedonchen, Sikkim	20.5	10.3	4.6	4.7	3.2
F. 14.7.10.192 Pilibhit, Rohilkund, Kumaon	21.5	11.6	5.2	4.9	3.1
F. 14.7.10.193 Pilibhit, Rohilkund	20.8	10.5	4.8	4.8	3.0
M. 14.7.10.191 Pilibhit, Rohilkund	21.2	10.7	4.9	4.9	3.2
F. 14.7.10.198 Ramnagar, Kumaon	20.5	10.4	4.8	4.7	3.1
F. 15.9.1.205 Jalpaiguri, Bengal. Old	21.9	11.2	4.9 <i>circa</i>	5.1	?
<i>Mus musculus urbanus</i>					
M. 21.7.8.101 Angarakhata, North Kamrup	19.1	9.5	4.1	4.2	3.0
F. 21.7.8.107 Angarakhata	21.4	11.0	4.8	5.0	3.2
F. 21.7.8.106 Angarakhata	21.0	10.3	4.5	4.7	3.3
F. 21.7.8.105 Angarakhata	21.4	11.3	4.9	4.9	3.4
F. 21.7.8.104 Angarakhata	20.8	10.3	4.7	4.8	?
M. 21.7.8.100 Angarakhata	20.9	10.0	4.4	4.3	3.2
M. 21.7.8.97 Angarakhata	18.6	9.3	4.1	4.1	3.2
F. 21.7.8.96 Rajapara, South Kamrup	20.2	10.0	4.5	4.7	3.2
M. 21.7.8.91 Lanka, Cachar	19.6	9.7	4.4	4.4	3.2
F. 21.7.8.93 Lanka, Cachar	19.2	9.7	4.3	4.4	3.1
1770A Nepal	20.6	9.9	4.4	4.5 <i>circa</i>	3.2
F. 19.6.2.48 Nilgiri Hills	20.6	10.5	4.7	4.7	3.2
M. 19.6.3.59 Poona	20.5	10.3	4.5	4.7	3.4
85.8.1.314 Ajmere	20.3	9.8	4.6	4.5	3.1 <i>circa</i>
M. 98.9.2.3 Thana	20.0	9.6	4.2	4.4	3.1

TABLE 90.—*Cranial measurements of Mus musculus (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
The following are labelled ' <i>Mus musculus</i> '						
M.	8.10.3.8 Kagan Valley, NW. Frontier Province	21.0	10.9	5.0	5.0	?
F.	12.10.4.65 Bhuj, Cutch	20.2	9.9	4.4	4.7	3.2
F.	98.3.5.34 Ootacamund, South India	20.7	10.4	4.7	4.5	3.2
M.	98.3.5.31 Ootacamund	20.1	9.9	4.4	4.6	3.1
M.	18.7.1.15 Rangoon	19.0	9.4	4.1	4.4	3.0
F.	21.1.6.80 Shangpung, Jaintia Hills, Assam	20.6	10.5	4.6	4.7	3.1
F.	21.1.6.79 Shangpung. M. 3/3 apparently absent, except on the lower right jaw a small third molar present	19.8	9.7	4.5	4.5	?
	28.9.26.1 Andaman Islands. Rather young	19.7	9.1	4.3	4.2	3.2
<i>Mus musculus castaneus</i> (' <i>manei</i> ')						
M.	15.3.1.151 Udugama, Ceylon	21.4	10.5	4.9	4.8	3.2
F.	15.3.1.152 Udugama	21.4	10.5	4.6	4.8	3.0
F.	15.3.1.158 Ceylon	22.5	11.7	5.1	5.4	3.3
F.	15.3.4.115 Cheddikulam, Ceylon	21.5	10.9	4.7	4.8	?
M.	15.3.1.153 Cheddikulam	21.2	10.8	4.9	5.0	3.2
F.	15.3.1.150 Trinco, Ceylon	21.7	11.0	4.8	4.7	3.0
F.	15.3.1.155 Cheddikulam, Ceylon. M. 3/3 apparently absent	22.3	11.3	5.1	5.2	?
M.	13.8.22.77 Haleri, North Coorg	21.5	10.9	5.3	5.3	3.3
F.	15.7.3.40 Helwak, Satara district	19.8	10.0	4.5	4.6	3.1
F.	13.4.15.4 Delhi	21.0	11.0	5.0	4.9	3.2
M.	14.7.8.45 Maymyo, Burma	21.8	11.1	4.7	4.9	3.3
F.	14.7.19.195 Pagan, Burma	19.3	9.7	4.3	4.6	3.0
F.	15.4.3.115 Chaibassa, Orissa	21.4	10.9	4.7	5.2	3.2

TABLE 90.—*Cranial measurements of Mus musculus (contd.)*

	Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus musculus castaneus</i> (' <i>manei</i> ') (contd.)					
F. 15.4.3.43 Chaibassa	22.5	11.5	5.1	5.5	3.2
F. 15.4.3.112 Luia, Chaibassa	21.8	10.8	4.8	5.0	3.3
15.4.3.119 Salbani, Midnapur, Bengal	21.1	10.3	4.7	4.7	3.0
F. 15.4.3.118 Salbani	20.8	10.2	4.6	4.8	<i>circa</i> 3.1
M. 13.8.8.109 Rajkot, Kathiawar	21.5	11.0	5.1	5.1	3.2
M. 13.8.8.112 Sasan, Kathiawar	20.8	10.3	4.6	4.6	3.3
F. 13.8.8.111 Rajkot, Kathiawar	21.0	10.2	<i>circa</i> 5.1	4.7	3.0
F. 15.4.3.120 Hazaribagh	21.6	11.1	5.0	5.0	3.0
M. 15.4.3.116 Hazaribagh	21.1	10.5	4.7	4.9	3.2
M. 15.4.3.117 Hazaribagh	21.9	11.2	4.9	5.2	3.3
F. 13.9.18.85 Deesa, Palanpur	20.4	10.2	4.6	4.4	3.2
M. 13.9.18.99 Deesa, Palanpur	21.2	10.5	4.8	4.7	3.2
F. 13.9.18.100 Deesa. Old	21.1	10.7	5.2	4.9	3.2
M. 13.9.18.84 Deesa	20.2	10.3	4.4	4.5	3.1
M. 13.4.11.101 Kolar, Mysore	20.1	10.0	4.6	4.6	2.9
F. 13.4.11.105 Kolar, Mysore	20.5	10.1	4.7	4.7	3.3
M. 12.11.28.99 Sagar, Mysore	21.3	10.8	4.8	4.8	?
F. 13.4.11.104 Kolar, Mysore	21.4	11.0	4.7	5.0	3.5
F. 13.4.11.103 Kolar, Mysore	21.7	11.1	5.0	5.0	3.3
F. 13.4.11.108 Kolar	20.3	?	4.6	4.6	3.2
M. 13.4.11.100 Kolar	20.7	10.1	<i>circa</i> 4.8	4.6	3.2
M. 13.4.11.102 Kolar	20.7	10.5	4.7	5.0	3.4
F. 12.6.29.76 Dharwar district	21.1	10.5	4.6	4.8	3.0
M. 12.6.29.74 Dharwar district	20.1	10.0	4.2	4.6	3.1

TABLE 90.—*Cranial measurements of Mus musculus (concl'd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus musculus castaneus</i> (' <i>manei</i> ') (concl'd.)						
M.	12.6.29.73 Dharwar district	21.1	10.5	4.7	4.8	3.2
F.	12.6.29.78 Dharwar district	20.2	10.1	4.6	4.5	3.0
F.	12.11.28.98 Gersoppa, Kanara	19.8	9.9	4.2	4.7	3.1
M.	12.11.28.97 Gersoppa, Kanara	19.9	9.9	4.4	4.5	3.4
F.	15.5.5.210 Lower Chindwin, Burma	22.1	11.3	4.8	5.2	3.5
M.	15.5.5.209 Lower Chindwin	20.1	10.2	4.5	4.6	3.2
F.	14.7.8.46 Gokteik, Shan States, Burma	21.6	?	4.7	4.9	3.1
	15.4.3.114 Daltongunj, Bihar and Orissa	22.0	?	<i>circa</i> 5.2	5.3	3.2
				<i>circa</i>		

Some approximate dimensions of Mus musculus.—Occipito-nasal varies between about 17.3 and 23.5 mm., toothrow 2.8–3.6 mm. (or in specimen, perhaps misidentified, 3.8 mm.). Head and body approximately 52–116 mm., tail 32–102 mm., hindfoot 11–23 mm.

The most recent revision of *Mus musculus* is by Schwarz and Schwarz, 1943. These authors recognize fifteen forms of this species, four of which are considered wild, the others being considered as commensals of the various wild races. Of their races, five occur in India. The characters of three of these are clear to me, that is to say, there are three easily distinguished types of *M. musculus* in Indian territory, which may be keyed as follows:

1	(4) Underparts white, whitish or light grey.	2
2	(3) Dorsal coloration averages lighter (ochraceous grizzled with black, cf. Schwarz).	<i>Mus musculus bactrianus</i>
3	(2) Dorsal coloration averages darker (tawny or cinnamon, cf. Schwarz)	<i>Mus musculus homourus</i>
4	(1) Underparts dark, brown or dull.	<i>Mus musculus castaneus</i> and the other house- mice (indoor types)

Schwarz and Schwarz consider all these forms as commensal derivations of the Central Asian wild white-bellied and short-tailed *M. m. wagneri* Eversmann, 1848. They further divide the indoor commensal Indian mice as follows:

M. m. tytleri Blyth, 1859. 'Back tawny, evenly grizzled with black; belly ochraceous, with under-fur slaty. Line of demarcation indistinct. Tail fairly pale, particularly below, darker above, blackish towards tip, not distinctly bicolored. Feet as far as and including the metacarpals and metatarsals, ochraceous buff, toes white. Ears brown.'

Specimens quoted from Palanpur, Gwalior and Rohilkund. Type-locality, Dehra Dun.

M. m. urbanus Hodgson, 1845. 'Back tawny or cinnamon, suffused with black or with increased black superposed. Belly ochraceous, tawny or bluish grey, with dark wool, and with the individual hairs not or scarcely banded. Line of demarcation indistinct. Tail not distinctly bicolored but paler underneath near the root. Feet buffy or drab as far as and including the metacarpals and metatarsals. Toes white. Ears dark brown.' Distinguished from *tytleri* by its smaller size and quoted as occurring from the Eastern Himalayas and plains of northern India.

M. m. castaneus Waterhouse, 1843. 'Back cinnamon or tawny, overlaid or suffused with black, or with increased black superposed; belly ochraceous or tawny, the individual hairs distinctly banded with black, no line of demarcation. Tail not bicolored, in the dark phase almost black, in the cinnamon phase cinnamon above, slightly paler below, the tip all black. Feet sepia, drab or cinnamon, with only the end phalanges white. Ears brown or dark brown.' Compared with *urbanus*, this form is distinguished by the speckled belly, and by the feet having only the end phalanges instead of the whole of the toes white. There is also a slightly more dusky tinge on the back. India, Ceylon, Assam, Burma.

The difference between these three forms is not very clear to me in the large amount of Indian material examined, owing to the very great amount of apparent individual variability.

It appears that Indian *M. musculus* races have the tail usually longer than the head and body, thereby differing in general from the typical and other Palaearctic forms, nearly all of which have the tail short.

(i) **Mus musculus bactrianus** Blyth

1846. *Mus bactrianus* Blyth, *J. Asiat. Soc. Beng.*, **15**, 140.
 1853. *Mus gerbillinus* Blyth, *J. Asiat. Soc. Beng.*, **22**, 410.
 (Punjab.)
 1853. *Mus theobaldi* Blyth, *J. Asiat. Soc. Beng.*, **22**, 583.
 (Punjab.)

Type-locality.—Kandahar, Afghanistan.

Range.—Specimens examined from PUNJAB: (Salt Range); Rohtas, Kallarkahar, Jhelum, Sakesar, Ara; Rawalpindi; Lehtrar, Banni and Patriata, all near Murree; Sialkot; Jhalar and Chakdulla, Campbellpore; Bhattu Hissar; Siwalik Hills. KASHMIR: Dulai, Kerrim, Dras (Ladak), Kagan Valley, Hazara. BALUCHISTAN: Quetta, Bambier, Kach, Kalegar, Kelat, Khojdar, 16 miles north-east of Mand, Pangjur, Mustang, Sourab, Turbat and west of it. SIND: Jacobabad, Naundero, Chak, Gambat, Kashmor, Jeypur, Umankot. Persia: Chahabar, Seistan and south of Kerman. Afghanistan: Kandahar, Ghazni, Paghman, Shibar Pass.

Outdoor type. Underparts whitish or light grey. Dorsal coloration averaging lighter or paler than in *homourus*. Tail usually bicolor and feet usually white. Very similar to *M. m. praetextus* Brants, 1827, from Syria, merely averaging slightly smaller in head and body length.

(ii) **Mus musculus homourus** Hodgson

1845. *Mus homourus* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 268.
 1841. *Musculus nipalensis* Hodgson, *J. Asiat. Soc. Beng.*, **10**,
 915, *nom. nud.*
 1849. *Mus darjilingensis* Hodgson, *Ann. Mag. nat. Hist.*, **3**, 203.

Type-locality.—Nepal.

Range.—Specimens examined from SIKKIM, or DARJEELING DISTRICT: Sangser, Pashok, Kalimpong, Nimbong, Gopaldhara, Chuntang, Pedong, Sukiapohkri, Rongli, Batasia, Tonglu. PUNJAB: Tissa, Chamba; Dagshai, Dhamtal, Siluni, Chamba; Gopalpur; Dharmasala; Chattri (Chamba). KUMAON: Lohaghat (Almora), Khati, Ratighat (Naini Tal); Lwarkhet. CENTRAL INDIA: Guna. NEPAL: Laprak, Satthar and Apoon Sottidanda, all Gorkha. KASHMIR: Chakothi, Dachgam, Prastan, Kul, Pandritton, Chichoti, Sangi, Kirrim, Mani (Vale of Kashmir), Chatta, Dras (Ladak), Shar, Dangail (Kishtwar). Jhelum River. Kargail (Ladak). SOUTH INDIA: Coonoor,

Nilgiris. Shevaroy Hill, Eastern Ghats. (Naga Hills, Assam, one skull.)* Also from Yunnan, Siam, Tonkin and Annam.

Outdoor type. Underparts whitish or light grey. Dorsal coloration averaging darker than in *bactrianus*. Tail often bicolor.

(iii) *Mus musculus castaneus* Waterhouse

1843. *Mus castaneus* Waterhouse, *Ann. Mag. nat. Hist.*, **12**, 134.

1852. *Mus manei* Kelaart, *Faun. Zeyl.*, 64. Ceylon. (Gray, 1843, List Mamm. 111, *nom. nud.*)

Type-locality.—Philippine Islands.

For use of this name see Schwarz and Schwarz, *Journ. Mamm.*, **24**, 1943 (page 59 and onwards).

Dark-bellied and commensal indoor type of house-mouse. Tail usually dark. Schwarz and Schwarz also recognize as valid subspecies :—

(iv) *Mus musculus urbanus* Hodgson

1845. *Mus urbanus* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 269. (Katmandu, Nepal.)

1845. *Mus dubius* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 268. (Not of Fischer, 1829.)

(v) *Mus musculus tytleri* Blyth

1859. *Mus tytleri* Blyth, *J. Asiat. Soc. Beng.*, **28**, 296.

Type-locality.—Dehra Dun, U.P.

Range.—Dark-bellied house-mice have been examined from CEYLON: Colombo, Udugama, Cheddikulam, Kandy, Urugalla, Ambawela, Trinco, West Haputale. WESTERN INDIA: Sagar, Mysore; Gersoppa, Kanara; Surat district; Gadag, Mahratta; Ootacamund, Nilgiris; Thana, 65 miles north of Bombay; Kotagiri, Nilgiris; Haleri Estate, Coorg; Kolar, Mysore; Bangalore, Mysore; Virajpet, Coorg; Helwak, Satara; Dharwar; Nimiaghat, Hazaribagh; Gajhundi, Hazaribagh; Daltongunj, Bihar; Luia, Chaibassa; Poona. BENGAL: Jalpaiguri, Salbani (Midnapur). U.P. Delhi. CUTCH: Bhuj. KATHIAWAR, Rajkot, Sasan. PALANPUR, Deesa. Ajmere. KUMAON, Ramnagar; Pilibhit, Rohilkund. PUNJAB: Ambala. Hissar district; Dhamtal, Kangra. NEPAL: Patibaghan,

* Also recorded from central Manipur (Assam), see Roonwal, M. L., 1949, *Trans. nation. Inst. Sci. India*, Calcutta, **3** (2), p. 108; and, 1950, *Rec. Indian Mus.*, Delhi, **47** (1), p. 58.—EDITOR.

SIKKIM or DARJEELING district; Gopaldhara, Kalimpong, Sedonchen, Pedong, Pashok, Tongsong, Rongli, Ghoom, west of Tista River. ASSAM: Shangpung, Jaintia Hills, Margherita, Naga Hills, Lanka, Cachar; KAMRUP, Angarakhata and Rajapara. BURMA: Maymyo, Monywa, Gokteik, Pagan, Rangoon. ANDAMAN Islands (skull).

(vi) **Mus musculus pygmacus** Biswas and
Khajuria

See Appendix.

In Blanford's synonymy are also mentioned *Mus rama* Cantor, 1865, from Penang, a synonym of *castaneus* according to Schwarz and Schwarz, and *Mus kakhyensis* Anderson, 1878, from Ponsee, western Yunnan, which Schwarz and Schwarz make a synonym of *homourus*.

Incertae sedis

Mus sublimis Blanford (1879), Tankse, west of Pandong Lake, Ladak, I have not seen. Blanford thought it might be a variety of *M. musculus*. It is described as 'whitish below' and apparently it was supposed to have a larger hindfoot than Indian races of *musculus*, *bactrianus* included. Wroughton seems to treat this form as an *Apodemus* (1920, *J. Bombay nat. Hist. Soc.*, **26**, 966).

I do not know the status of *Mus hydrophilus* Hodgson (1845, *Ann. Mag. nat. Hist.*, **15**, 267), Nepal. It may be, of course, a *Rattus* or *Bandicota*.

105. Mus booduga (Gray)

The Common Indian Field-Mouse

1837. *Leggada booduga* Gray, *Charlesworth's Mag. nat. Hist.*, **1**, 586.

Vernacular names (Blanford).—Shimtad-phurka, Shimtad-bhurka—*Wadari*; Chilta yelka—*Tel. of Yamadis*.

Distribution.—Only known from India. It occurs, according to the classification here offered, commonly in the Peninsula northwards to Cutch and adjacent districts, and again in the Punjab; Kumaon; possibly the Bhutan Duars, and in the Mt. Poppa district of Burma.

This species is type of the supposed genus '*Leggada*' and the third named *Mus* species in Asia, being only antedated by *musculus* and *platythrix*. It is considerably smaller than

the last. From *musculus* it is only separable on average characters; the muzzle is normally, not always, less shortened and the diastema is on average (i.e. in the majority of specimens) more than one-quarter of the occipitonasal length. Out of 44 moderately or completely adult skulls, as many as 16 have the diastema below this percentage. I restrict *booduga* to the species in which the skull is at its smallest for Indian species; the occipitonasal length normally less than 20 mm. But again there are exceptions; 13 out of 44 reach 20 mm. in this length. A few skulls from the Bhutan Duars approximate to this length but I suspect they might well in reality represent *M. cervicolor nagarum*.

Two skulls, 12.11.28.103 (Mysore) and 13.8.22.76 (Coorg), with occipitonasal lengths respectively of 22.1 mm. and 21.6 mm. may in reality represent *M. cervicolor palnica* which occurs at both these localities.

The species seem to occur in the same general neighbourhood as or actually with forms which I refer to *M. cervicolor*, but that species can only be defined on average characters when compared with *booduga*, just as *booduga* can only be defined on average characters when compared with *Mus musculus*.

External characters.—Small mice, head and body length apparently 80 mm. at highest. Tail usually shorter than head and body length. The fur usually without spines. Hand with four fingers, all bearing claws, and foot with five toes, all bearing claws, as usual. Mammae usually 10.

Colour.—Above brown, lighter or darker, sometimes sandy. Feet usually whitish or pale. The tail is nearly constantly bicolor (dark above, pale below) in a large series. Underparts white, whitish or grey, sometimes quite dull grey, but apparently both types occur together in many localities, and on the material examined it does not seem possible to divide this species into races based on colour of underparts, as will be noted below.

External measurements.—As in Table 91, below.

Notes from skins.—Lohaghat, Kumaon: weight $\frac{1}{4}$ oz. Ramnagar: $\frac{1}{4}$ oz. Chandgarh, Nimar: trapped in hedge, mammae 8, weight $\frac{3}{8}$ oz., foetus 6, and $\frac{1}{4}$ oz. Asirgarh, Nimar: trapped in hedge near cultivation, $\frac{1}{2}$ oz. Nimiaghat: $\frac{1}{4}$ oz. and $\frac{3}{16}$ oz. Dhain: trapped in long grass, $\frac{3}{8}$ oz. Luia, Chaibassa: $\frac{1}{8}$ oz. and $\frac{1}{4}$ oz. Pachmiri: trapped on bank of stream, $\frac{3}{8}$ oz. Ghodesgaon, Khandesh: trapped near river. Rajkot: $\frac{1}{4}$ oz. and $\frac{1}{2}$ oz., and mammae 10, and $\frac{3}{8}$ oz. Chanda: in hedge, $\frac{1}{2}$ oz. Nokania, Cutch: trapped under old wall near water. Motimajiti: $\frac{3}{8}$ oz. Poona: common, caught in

TABLE 91.—*External measurements of the Indian races of Mus booduga*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus booduga booduga</i> ('dunni')					
M. Danta, Gujerat	68	67	14	11	
M. Deesa, Palanpur	78	83	15	?	
M. Danta	66	69	14	11	
M. Lunwa, Palanpur	60	65	14	?	
M. Lunwa	59	62	15	11	
F. Danta	61	61	14	11	Mammae 10
M. Palanpur	61	60	14	11	
F. Rajkot, Kathiawar	70	58	14	11	Mammae 10
Rajkot, Kathiawar	71	77	16	12	
F. Rajkot	60	55	13	10	Mammae 10
M. Motimajiti, Kathiawar	68	70	15½	11	
M. Rajkot, Kathiawar	63	61	13½	11	
F. Vankaneer, Kathiawar	69	60	13	10	Mammae 10
M. Muli, Kathiawar	55	58	13	10	
M. Motimajiti, Kathiawar	63	64	15	11	
M. Nokania, Cutch	58	54	14	9	
M. Bageswar, Kumaon	71	64	14	11	
M. Lohaghat, Kumaon	56	55	14	10	
F. Lohaghat	47	53	13	11	
M. Dela, Ramnagar	60	60	15	11	
F. Bageswar, Kumaon	71	60	13	11	Mammae 10
F. Ramnagar, Kumaon	54	54	14	11	
M. Lohaghat, Kumaon	58	60	15	11	
F. Sitabani, Kumaon	53	49	14	10½	
F. Pilibhit, Rohilkund	60	56	13	10½	Mammae 10
F. Ramnagar, Kumaon	55	60	14	11	
M. Ramnagar	60	64	14	11	
F. Almora, Kumaon	70	66	14½	11	Mammae 10
M. Almora, Kumaon	64	64	14	12	
M. Pilibhit, Rohilkund	55	56	14	11	
M. Ambala, Punjab	50	50	12	10	
Ambala, Punjab	70	64	15	14	
M. Ambala	50	50	18	11	
M. Ambala	58	43	12	10	
F. Rawalpindi, Punjab	61	75	16	12	
M. Near Ambala	54	48	12	?6	
M. Ambala	55	56	11	10	
M. Handisera, Punjab	60	50	13	10	
Type of 'dunni'. Ambala	58	60	12	11	

The following were identified as '*lepida*':

M. Vijayanagar, Bellary	76	60	14½	12
M. Vijayanagar	62	59	14	10½
F. Vijayanagar	66	64	14	11
Vijayanagar	73	49	13½	11
Tirthemalai, Salem district	73	55	16	14
Chettiri Range, E. Ghats	52	57	15	12
Chettiri Range	59	?	15	11

TABLE 91.—*External measurements of Mus booduga (contd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Mus booduga booduga</i> (' <i>dunni</i> ') (contd.)				
Chettiri Range	56	54	14	12
Ballapalli Range, Cudda- pah	64	64	15	12
Balapalli Range	58	57	14	11
F. Balapalli Range	54	52	14	11
M. Balapalli Range	52	49	13	11
Chettiri Range	50	?	14	11
F. Chettiri Range	57	55	14	11

The following were identified as '*terricolor*' :

	Oudh, Balaghat, C.P.	73	74	15	12	
	Chanda	70	69	15	?	
	Chandgarh, Nimar	63	55	13	10½	
F.	Chandgarh, Nimar	63	57	13½	10	Mammae 8
M.	Asirgarh, Nimar	61	63	14	10	
	Asirgarh, Nimar	66	62	14	11	
	Chanda	68	65	14	11	
F.	Bori, Hoshangabad	74	64	14	12	Mammae 10
	Dhain, Hoshangabad	68	63	14	12	
F.	Rorighat, Hoshangabad.	68	77	16½	12	
	Luia, Chaibassa	65	62	13	10	
F.	Daltongunj, Bihar	61	55	13	10	
	Luia, Chaibassa	63	57	13	10	
	Koira, Chaibassa	64	58	13	10	
	Nimiaghat, Hazaribagh	60	60	13	11	
	Barkagaon, Hazaribagh.	55	55	13	10	
F.	Pili, Sipna, Berar	61	67	15	13	
	Luia, Chiabassa	80	66	15	13	
	Nimiaghat, Hazaribagh	61	65	13	10	
F.	Mundra, Sangor	55	55	14	11	
	Sonawahnee, Balaghat	72	61	15	13	
	Bharnabhari, Bhutan					
	Duars	63	55	14	11	
	Hasimara, Bhutan Duars	70	63	14	11	
F.	Hasimara	62	60	14	11	
	Bharnabhari	67	65	14	12	
	Hasimara	65	64	14	11	
	Hasimara	69	?	13	11	
F.	Hasimara	60	64	14	11	
M.	Bharnabhari	62	59	14	11	
F.	Hasimara	57	56	14	11	
	Bharnabhari	54	53	14	11	
F.	Hasimara	65	63	14	11	
F.	Pachmiri, Hoshangabad.	62	58	15	12	
F.	Bori, Hoshangabad	59	65	15	14	
M.	Mundra, Sangor	58	62	14	11	
M.	Pili, Sipna, Berar	62	?	15	12	

Bhutan Duars specimens may represent *Mus cervicolor nagarum*.

TABLE 91.—*External measurements of Mus booduga (concl'd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Mus booduga booduga</i> ('dunni') (concl'd.)				
The following were identified as <i>booduga</i> :				
F. Gadag, South Mahratta	68	62	14	12
F. Gadag	70	58	15	12½
M. Gadag	67	61	14	11½
F. Gadag	62	58	14	12
M. Near Poona	67	72	15	11
M. Poona	56	63	15	11
M. Poona	61	61	15	12
M. East Khandesh	73	65	14	11
M. Helwak, Satara district	76	66	15	12
M. Kardibetta Forest, Mysore	75	66	16	13
M. Dharwar	65	53	14	11
M. Dharwar	73	62	17	12
M. Bangalore, Mysore	74	57	14	11
F. Khandalla, Bombay	63	68	15	11
Khandalla	52	66	17	13
F. Khed, Ratnagiri	62	68	14	12
F. Khed, Ratnagiri	68	80	14	12
F. Shirgaon, Ratnagiri	74	66	15	13

Mus booduga lepidoides

F. Mount Poppa, Burma	77	49	13½	12
Mt. Poppa	75	58	14	12
Mt. Poppa	71½	48	14	11.25
M. Mt. Poppa	69	53	14	12.25
F. Mt. Poppa	75	53	14	12
F. Mt. Poppa	75	55½	14	12.25
F. Mt. Poppa	74	52	14	11
Mt. Poppa	70	51	14	11.25
M. Mt. Poppa	66	51	14.75	11.75

bank with cheese. Danta, Gujerat: $\frac{3}{8}$ oz. and $\frac{1}{4}$ oz., mammae 10. Oudh, Balaghat: $\frac{1}{2}$ oz., trapped on bank near river. Mundra, Sangor: in hedge, $\frac{1}{4}$ oz. and $\frac{3}{16}$ oz. Near Ambala, Punjab: sandy soil, and trapped in cactus hedge, nocturnal. Almora, Kumaon: mammae 10: $\frac{1}{2}$ oz., $\frac{3}{8}$ oz., caught in house. Sonawahnee, Balaghat: caught in camp, foetus 4, $\frac{1}{2}$ oz. Vankaneer: mammae 10: $\frac{1}{4}$ oz. Bageswar, Kumaon: mammae 10: $\frac{1}{2}$ oz. Muli: $\frac{1}{4}$ oz. Daltongunj: $\frac{1}{4}$ oz. Palanpur: $\frac{1}{4}$ oz. Dela, Ramnagar: $\frac{1}{2}$ oz. Rorighat, Hoshangabad: trapped on bank, weight $\frac{3}{8}$ oz. Bori: $\frac{1}{4}$ oz., and mammae 10. Lunwa: $\frac{1}{4}$ oz. Deesa: weight $\frac{1}{2}$ oz.

Cranial characters.—Very small mice. The occipitonasal length is on average below 20 mm., although in extreme old

age this length may even reach 21 mm., but the majority of the specimens appear to be under 20 mm. in length and may be as low as 16 mm. Supraorbital ridges usually absent but sometimes traceable. The nasals are possibly a little longer proportionately than in *Mus musculus*. Suture of frontals and parietals much as described above for *M. musculus*. Interparietal well developed. Bullae of medium size. The palate usually exceeds half the occipitonasal length and the palatal foramina are long, extending between the toothrows and normally over one-fifth of the occipitonasal length. Pterygoid fossae of moderate depth. The muzzle is on the whole less shortened than in *M. musculus* and the diastema averages more than one-quarter of the occipitonasal length, but the difference is average rather than absolute, as all rather young skulls of those species previously referred to '*Leggada*' have the diastema short, as in *musculus*; in the present species, out of about 44 skulls measured, there are 16 individuals which are indistinguishable from *musculus* in the diastema character, which is a high percentage. Zygomatic plate moderately or well cut back above. Coronoid process of mandible moderately developed.

Dental characters.—Upper incisors narrow, yellow, usually plain and often with subapical notch as in *M. musculus*. M. 1 usually larger than M. 2 plus M. 3, its anterior root slanting forward and its anterointernal cusp distorted inward about into line with the cusps of the second lamina. Apparently this tooth has eight cusps as usual. M. 3 is very small and reduced. M. 2 apparently has six main cusps. Outer row of cusps of upper molars originally strong. Very many of the specimens seen have the pattern worn out. Rarely an extra cusp in front of the front lamina of M. 1 (in front of the centre front cusp and on the anterior extension of the front root) may be present, but it is uncommon in the material examined. Lower molars like those of *M. musculus*, M. 3 often, but not always, tending to be a little more reduced.

Cranial measurements.—As in Table 92, below.

Dimensions of Mus booduga, in British Museum material.—The head and body length varies between 47 and 80 mm. The tail between 43 and 83 mm. Hindfoot 11–18 mm. Toothrow 2.8–3.6 mm. If No. 12.11.26.108 represents *M. cervicolor palnica*, then the largest occipitonasal length for this species is 21.2 mm., but most of the skulls are below 20 mm. The smallest skull apart from young specimens is 17.4 mm.

It seems fairly clear that the form described from Mount Poppa under the name *lepidoides* is a race of *Mus booduga*

TABLE 92.—*Cranial measurements of the Indian races of Mus booduga*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus booduga booduga</i>						
M.	11.12.21.24 Hyderabad, Khandesh	19.2 <i>circa</i>	10.2	5.0	4.5	3.2
M.	12.6.28.26 Asirgarh, Nimar	19.9	10.3	5.2	5.0	3.2
M.	12.6.28.28 Asirgarh, Nimar. Skull ridged	19.7	10.2	4.9	4.5	3.2
	12.6.28.29 Asirgarh, Nimar. Skull ridged	18.4	9.7	4.5	4.0	3.3
M.	12.10.4.64 Nokania, Cutch ('dunni')	17.7	8.8	4.4	3.9	2.9
M.	12.6.29.88 Dharwar district. Old	19.9	10.6 <i>circa</i>	5.2	4.9	3.3
F.	12.6.29.89 Dharwar	19.3 <i>circa</i>	9.8	4.9	4.6	3.2
M.	12.11.28.101 Kardibetta Forest, Mysore	19.7	10.1	5.1	4.2	3.3
M.	12.11.28.103 Kardibetta Forest. Probably represents <i>Mus cervicolor palnica</i> Old	22.1	11.4	5.8	5.0	3.5
F.	12.11.29.147 Hoshangabad	19.3	10.4	5.0	4.8	3.3
F.	12.11.29.150 Hoshangabad	20.2	10.7	5.2	4.8	3.4
M.	12.11.29.156 Balaghat, C.P. Young	16.7	8.4	4.0	3.6	3.1
F.	12.11.29.151 Mundra, Sangor	18.4	9.4	4.4	4.5	3.0
F.	12.11.29.191 Rorighat, Hoshangabad	21.2	11.0	5.2	4.7	3.7
M.	13.8.22.76 Kutta, Coorg. Possibly represents <i>Mus cervicolor palnica</i>	21.6	11.1	5.5	4.9	3.5
M.	13.9.18.77 Lunwa, Palanpur	19.4	10.0	4.8	4.7	3.2
M.	13.9.18.78 Palanpur ('dunni')	19.0	9.8	4.5	4.5	3.3
M.	13.9.18.79 Lunwa, Palanpur	19.3	10.4	4.8	4.3	3.1
M.	13.9.18.80 Deesa, Palanpur. Very old	21.2	11.2	5.3	4.8	3.2
M.	13.9.18.81 Danta, Gujerat	19.9	10.3	4.6	4.6	<i>circa</i> 3.1
M.	13.9.18.82 Danta	20.0	10.1	5.0	4.8	3.1
F.	13.9.18.83 Danta. Skull ridged	19.8	10.1	4.8	4.5	?
M.	13.8.8.101 Rajkot, Kathiawar	19.1	9.7	4.5	4.4	3.1

TABLE 92.—Cranial measurements of *Mus booduga* (contd.)

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus booduga booduga</i> (contd.)						
F.	13.8.8.102 Rajkot	19.6	10.2	4.8	4.6	3.3
M.	13.8.8.104 Motimajiti, Kathiawar	19.2	10.3	5.0	4.5	3.2
M.	13.4.11.109 Bangalore, Mysore	19.0	9.7	4.8	4.3	3.1
F.	14.7.10.163 Ramnagar, Kumaon	19.0	9.9	4.7	4.2	3.3
M.	14.7.10.170 Bageswar, Kumaon	19.9	10.2	5.2	4.7	2.9
F.	15.4.3.125 Daltongunj, Chaibassa, Orissa	18.0	9.3	4.6	3.7	2.8
M.	15.4.3.128 Nimiaghat, Hazaribagh	18.5	c. 9.9	4.6	4.0	3.1
M.	19.6.3.62 Poona	18.0	9.1	4.4	4.0	3.0
F.	19.6.3.63 Poona	20.5	10.6	5.2	4.5	3.4
M.	19.6.3.64 Khandalla	20.5	10.7	5.0	4.7	3.6
F.	19.6.3.65 Khandalla	20.0	10.6	5.0	4.5	3.4
M.	26.9.2.25 Hasimara, Bhutan Duars.	.. c. 19.9	9.9	5.2	4.6	3.2
	Probably represents <i>Mus cervicolor nagarum</i>					
M.	13.4.10.43 Vijayanagar, Bellary.	.. 20.3	10.6	5.8	4.8	3.0
	Old (' <i>lepida</i> ')					
M.	13.4.10.44 Vijayanagar (' <i>lepida</i> ')	17.4	9.0	4.3	4.0	3.0
F.	3.4.10.46 Vijayanagar (' <i>lepida</i> ')	18.4	9.4	4.6	4.3	3.2
M.	13.8.8.105 Motimajiti, Kathiawar	20.5	11.2	5.5	4.8	3.2
M.	19.6.3.61 Poona	20.5	10.8	5.2	4.7	3.6
F.	26.9.2.28 Bhutan Duars.	20.4	10.4	5.4	4.3	3.0
	Probably represents <i>Mus cervicolor nagarum</i>					
F.	19.6.2.16 Ootacamund, Nilgiris	19.6	9.8	4.4	4.5	3.2

The following are either young or perhaps represent *M. musculus*:

F.	15.4.3.127 Hazaribagh	16.5	8.3	3.8	3.7	3.2
M.	9.4.6.39 Punjab	17.2	8.9	4.1	4.0	3.2
M.	9.4.3.7 Punjab	17.2	8.7	3.7	3.8	3.0

TABLE 92.—*Cranial measurements of Mus booduga (concl'd.)*

	Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus booduga booduga</i> (concl'd.)					
M. 15.4.3.126 Barkagaon, Hazaribagh	17.4	8.7	4.1	4.0	3.0

The type of *M. b. 'dunni'* has the occipitonasal about 17.8 mm.

<i>Mus booduga lepidoides</i>					
M. 14.7.19.203 Mount Poppa, Burma	19.2	10.7	4.9	4.5	3.2
F. 14.7.19.209 Mount Poppa	19.5	10.5	4.9	5.0	3.2

characterized by its very short tail. All other specimens were referred to by Wroughton as *booduga* (and he included *cervicolor* in it as well). The latter can be distinguished by its larger skull, but I think Wroughton was correct in regarding the other names as synonyms of *booduga* (the Ceylonese *fulvidiventris*, which I very provisionally treat as a race of *cervicolor*, excepted). There are two types of colour of underparts in *Mus booduga*, the one pure white, the other grey white or in some specimens quite dull grey. But both these types appear to occur side by side in the same localities, and intermediates occur, and I cannot see where to draw a line between the two types. Cf. the following notes I made when looking at the skins:

M. b. lepidoides: Mt. Poppa, belly whitish.

M. b. 'dunni': Belly mainly grey; Kumaon, and one specimen from Ambala, Punjab. Belly mainly white; Cutch, Gujerat, Kathiawar, Ambala and Kumaon.

M. b. 'lepada': Belly mainly white; Salem district, Ballapalli, Bellary. Belly mainly grey; Bellary.

M. b. 'terricolor': Belly mainly white; Hoshangabad, Balaghat, Chanda. Belly mainly grey; Chaibassa, Bhutan Duars, Hazaribagh, Nimar, Berar, Hoshangabad, Daltongunj, Sangor.

M. b. booduga: Belly mainly grey; Poona, Ghodesgaon, Ratnagiri, Mysore, Dharwar, Satara, Khandalla, Gadag. Belly mainly white; Poona, Dharwar, Ghodesgaon and Gadag.

Thus both types seem to occur, together, at Kumaon, Ambala, Bellary, Hoshangabad, Poona, Ghodesgaon, Dharwar

and Gadag, and the biggest clash seems nearest the type-locality. Intermediate specimens, of course, exist between the two types, and I would doubt whether any racial significance exists between the two types, great as are the distinctions between the extremes.

Provisional key to the races of Mus booduga

- 1 (2) Length of the tail normally under 80% of the head and body. *M. b. lepidoides*
- 2 (1) Length of the tail most often exceeds 90% of the head and body *M. b. booduga* (with 'lepidoda', 'terricolor', 'dunni')

(i) Mus booduga booduga (Gray)

1837. *Leggada booduga* Gray, *Charlesworth's Mag. nat. Hist.*, 1, 586.
1839. *Mus lepidus* Elliot, *Madras J. Litt. Sci.*, 10, 216. (Southern Mahratta Country.)
1851. *Mus terricolor* Blyth, *J. Asiat. Soc. Beng.*, 20, 172. (Southern India.)
1852. *Mus albidiventris* Blyth, *J. Asiat. Soc. Beng.*, 21, 351. (Near Calcutta.)
1866. *Mus beavani* Peters, *Proc. zool. Soc.*, 559. Manbhoum, India.
1912. *Leggada dunni* Wroughton, *J. Bombay nat. Hist. Soc.*, 21, 339. (Ambala, 900 ft., Punjab.)

Type-locality.—South Mahratta, India.

Range.—Specimens seen from MYSORE, Bangalore, Kardibetta Forest. NILGIRI HILLS, Ootacamund. COORG: Kutta. DHARWAR district; Dharwar, Gadag. BOMBAY STATE: Helwak, Satara; Khed and Shirgaon, Ratnagiri; Poona, Khandalla, East Khandesh. BIHAR AND ORISSA: Barkagaon, Daltongunj, Nimiaghat, Hazaribagh, Koira and Luia, Chai-bassa. CENTRAL PROVINCES: Asirgarh and Chandgarh, Nimar, Mundra, Sangor, Dhain, Bori, Pachmiri, Rorighat, all Hoshangabad; Sonawahnee, Balaghat; Oudh, Chanda; Pili, Berar. CUTCH, Nokania. GUJERAT: Deesa, Danta, Lunwa. KATHIAWAR: Muli, Motimajiti, Rajkot, Vankaneer. PUNJAB: Ambala, Handisera, Rawalpindi (skin). KUMAON: Bageswar, Almora, Lohaghat, Dela, Sitabani, Pilibhit (Rohilkund). BHUTAN DUARS, Hasimara, Bharnabhari (the last could refer to *M. c. nagarum*). BELLARY, Vijayanagar. E. GHATS, Chettiri Range; Tirthemalai, Salem. CUDDAPAH, Balapalli Range.

(ii) **Mus booduga lepidoides** (Fry)

1931. *Leggada lepidoides* Fry, *J. Bombay nat. Hist. Soc.*, **34**, 921.

Type-locality.—Mount Poppa, Burma.

Range.—Specimens seen from BURMA: Mount Poppa.

Tail much shorter proportionately than in the western race, which it otherwise resembles.

Fry, 1931, revised all those mice which Wroughton and Thomas referred to *Leggada booduga*, and recognized nine distinct species (!). Some of these are forms of *Mus cervicolor*. I am convinced that the four forms of *booduga* he retained, as listed above, i.e. *terricolor*, *lepida*, *booduga* and *dunni*, cannot be distinguished from each other by colour.

106. **Mus cervicolor** Hodgson

The Fawn-coloured Mouse

1845. *Mus cervicolor* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 268.

Distribution, as here understood.—CEYLON, PENINSULAR INDIA in part, north about to SOUTH RAJPUTANA, NEPAL, ASSAM, BURMA, Liukiu Islands (*M. c. caroli* Bonhote), Indo-China (*M. c. annamensis* Robinson and Kloss) and Siam (*M. c. thai* Kloss).

Essentially like *Mus booduga*, but occurring with it in various places and always averaging larger. The occipito-nasal length of the skull normally exceeds 20 mm. (Six exceptions in about 51 skulls; all but one of these occur in the form *M. c. nagarum*). Diastema normally longer than in *M. musculus* (about 13 individuals out of about 51 skulls are exceptions).

So far as I can see, the first name for this group of races is *Mus cervicolor* Hodgson, which has formerly been referred to *booduga* by some authors, Wroughton included, although Blanford kept it apart. But certainly our Nepalese skulls are all over 20 mm. in occipitonasal length, therefore larger than is normal for *booduga*, and *cervicolor* was named from Nepal. The second name here included in this species is *fulvidiventris* from Ceylon, which has hitherto been regarded as a synonym of *booduga* (Blanford, Wroughton), or a race of it, by Phillips. Its position is very provisional, as of only three skulls available, two exceed 20 mm. in occipitonasal length but one does not. But even if it is a form of *booduga*, it is distinguishable at least on average from that, by the

fact that the head and body length mostly exceeds 70 mm. in the series examined, whereas more specimens than otherwise are below this length in western longer-tailed *booduga* forms, and *fulvidiventris* seems as dark as any series of *booduga* or darker than usual in colour. *M. c. nitidulus*, kept apart by Blanford and Wroughton, seems to me to be a race of this species. It is a little difficult to reconcile Blanford's statement, however, that *nitidulus* has the tail 'not shorter than head and body' when the whole series I have seen has the tail about as shortened as any on average in our material, whereas *cervicolor* was supposed to have the tail shorter than head and body, whereas in specimens I have seen it is usually longer than this measurement. To this species I also provisionally refer the smaller '*Leggadilla*' forms *phillipsi* and *surkha*. These, it is true, have the skull ridged as in *M. platythrix* and other larger forms previously referred to '*Leggadilla*', but so does *nitidulus* sometimes and other individuals of almost any of the other subspecies. The external characters of *phillipsi* and *surkha* are not so remarkable that it is necessary to give them specific rank, in my opinion. Two other names, *palnica* and *nagarum*, in general so like *nitidulus* and *cervicolor* that all four might really be one widely ranging race, come into this species in size. The occipitonasal length in this species does not reach 23 mm., with two exceptions in about 51 skulls.

Forms of this species, as here understood, occur with *M. booduga* at Gujerat, the Central Provinces, Vijayanagar, Coorg, Mysore, the Nilgiris, etc., and with *M. famulus*, as here understood, in the Nilgiri Hills, and the Naga Hills, Assam.

External characters.—In this species, in some races the tail normally exceeds head and body length (*cervicolor*, *palnica*), but it is generally shorter than this measurement in the others. The fur is spiny in *phillipsi* and *surkha*, usually not so in the other races. Hand with four clawed fingers and foot with five clawed toes, as usual. Mammae, where known apparently, usually 10 (11 in one specimen of *nitidulus*).

Colour.—Back, as a rule, rather dark brown. The typical race sometimes tends to be paler brown and *surkha* sometimes, not always, tends to be greyer. Feet usually whitish or pale, but in some specimens of *nagarum* and *nitidulus* they are darker. Underparts white in *phillipsi* and *surkha*, greyish-whitish (only white in one specimen) in *fulvidiventris*, rather light grey in other races. Tail bicolor, dark above, pale below.

External measurements.—As in Table 93, below.

TABLE 93.—*External measurements of the Indian races of Mus cervicolor*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus cervicolor cervicolor</i>					
Bouzini, Nepal	75	76	18	14	
Hazaria, Pathegatta, Nepal	60	?	17	14	
Hazaria	64	76	18	15	
Tribeni, Nepal	70	61	15	13	
Sipuri, Nepal	65	69	17	13	
M. Kindat, Chindwin	68	61	16	13	
<i>Mus cervicolor nagarum</i>					
F. South Kamrup	72	63	14	12	Mammae 10
M. Angarakhata, South Kam- rup	78	74	17	14	
M. Angarakhata	68	74	16	12	
F. Rajapara, South Kamrup	73	?	14	12	
M. Angarakhata	78	69	16	13	
F. Angarakhata	78	64	15	12	Mammae 10
M. Angarakhata	64	64	15	12	
M. Dening, Mishmi	83	76	17	15	
M. Dening	68	61	17	13	
F. Dening	81	79	17	14½	
F. Dening	80	75	18	16	
M. Dening	69	72	16	14	
M. Dening	80	79	19	15	
Gologhat, Assam	73	68	15	13	
M. Gologhat	73	63	13	10	
F. Gologhat	70	61	16	13	
F. Gologhat	74	60	15	14	
M. Gologhat	75	63	13	10	
F. Gologhat	76	55	13	10	
F. Khonshnong, Jaintia Hills	75	65	14	12	
M. Khonshnong	78	56	18	15	
F. Khonshnong	73	78	17	14	
F. Khonshnong	69	74	16	14	
M. Khonshnong	78	71	18	15	
F. Khonshnong	80	73	14	15	
M. Khonshnong	60	61	14	12	
M. Shangpung, Jaintias	86	71	15	14	
F. Shangpung	75	70	15	12	
Shangpung	66	65	15	13	
F. Laitkynsao, Khasi Hills.	75	81	18	14	
M. Gologhat, Type	76	77	17½	14	
F. Angarakhata	78	60	15	12	Weight 0.3 oz.
<i>Mus cervicolor nitidulus</i>					
F. 40 miles SE. of Pegu, Burma	85	65	15½	13	Mammae 10
F. 16 miles SE. of Pegu	76	64	16	13	
F. 16 miles SE. of Pegu	73	68	16	13	

TABLE 93.—*External measurements of Mus cervicolor (contd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus cervicolor nitidulus (concl'd.)</i>					
M. 16 miles SE. of Pegu	83	73	16	13	
F. 40 miles SE. of Pegu	91	69	15	13	Mammae 10
M. 40 miles SE. of Pegu	64	60	15½	12	
F. 30 miles SE. of Pegu	86	69	16	13	Mammae 10
F. 12 miles SE. of Pegu	84	64	15	12	Mammae 11
F. 16 miles SE. of Pegu	79	59	19½	12	
F. 16 miles SE. of Pegu	65½	61	16	12½	
M. Kin, Lower Chindwin	67	66	17½	12	
M. Mandalay Hill	80	?	16	12	
M. Pegu	80	67	16	13	
<i>Mus cervicolor palnica</i>					
Perumal	76	80	17	13	
M. Perumal	73	77	17	13	
M. Haleri Estate, Coorg	85	82	17½	13½	
M. Kutta, South Coorg	80	86	17½	13	
F. Shambalgamur	72	73	17	13	
Kotagiri, Nilgiris	57	60	16	12	
M. Coonoor, Nilgiris	65	75	18	14	
M. Kardibetta Forest, Mysore	95	?	17	?	
M. Kardibetta Forest	80	74	16½	c. 14	
M. Kotagiri, Nilgiris	66	76	18	14	
F. Kodaikanal	70	71	17	14	
Shambalgamur. Type	78	90	17	13	
<i>Mus cervicolor fulvidiventrís</i>					
Cheddikulam, N. Ceylon	75	66	15½	12	
Kottawa, S. Ceylon	73	81½	16	11	
M. Mankeni, E. Ceylon	65	69	14½	12	
F. Mankeni	57	64	15	11	
Mankeni	71	67	15½	11½	
M. Mankeni	72	64	14½	11½	
Ambawela, Uva, Ceylon	75	69	15½	12	
Mahaoya, E. Ceylon	72	61	15½	11	
Mahaoya	74	60	15	12	
Kottawa, S. Ceylon	75	62	15	11½	
F. Urugalla, Ceylon	70½	65	14½	11	
Urugalla	73	58	15	13	
Urugalla	70½	62	16	12	
<i>Mus cervicolor phillipsi</i>					
M. Danta, Gujerat	70	60	13½	11	
F. Danta	74	61	14	?	
F. Chikalda, Berar	70	59	14	?	
F. Mount Abu, Rajputana	70	60	15	11	Mammae 10
M. Asirgarh, Nimar. Type	79	60	14	?	

TABLE 93.—*External measurements of Mus cervicolor (concl'd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus cervicolor phillipsi</i> ('surkha')					
M. Kurumbapatti, Salem district, Eastern Ghats	69	61	15	?	
M. Kurumbapatti	74	67	17	12	
M. Kurumbapatti	75	67	17	12	
F. Kurumbapatti	66	54	14	?	
M. Kurumbapatti	71	54	15	13	
M. Balapalli, S. Cuddapah	75	65	16	14	
F. Balapalli	72	59	16	14	
F. Balapalli	74	65	16	14	
F. Vijayanagar, Bellary	83	58½	14	12	Mammae 10
M. Vijayanagar. Type	89	64	15	12	

Notes from skins.—*nagarum*: Laitkynsao; weight 0.5 oz. Rajapara, Kamrup; contained 7 young, mammae 2–3 = 10. Angarakhata, weight 0.25 oz.; mammae 10.

palnica: Kardibetta Forest, Mysore; bamboo jungle, ⅝ oz. Cotengady Estate: common, occurs in houses. Coonoor; clearing in evergreen jungle.

fulvidiventris: Urugalla; trapped alive in chena field. Mankeni; trapped alive in native hut. Urugalla; in banana garden. Cheddikulam; trapped in bungalow. Mayaoya; in sayo plantation. Ambawela; trapped in native compound.

cervicolor: Kindat; 'caught in my house'

nitidulus: SE. of Pegu; caught in house and caught in hole in field. Vitkangale; mammae 5½ pairs (5 and 6), dug up in paddy field. 40 miles SE. of Pegu: mammae 10, 6 young in a nest.

surkha: Vijayanagar; 10 mammae.

phillipsi: Danta; mammae 10; ⅝ oz. and ½ oz. Mt. Abu; ½ oz. Chikalda; trapped under stone wall.

Cranial characters.—This is nearly always a larger species than *Mus booduga* with which it occurs. The occipitonasal length normally exceeds 20 mm. (Six individual exceptions in 49 skulls measured, five of them belonging to the race *M. c. nagarum*, which nearly approaches *booduga*; one in *fulvidiventris*, Ceylon, which has heretofore been regarded as a race of *booduga*, and may be so; it is poorly represented in our collection, but as two out of three skulls are over 20 mm. in occipitonasal length, I very provisionally regard it as a form of *cervicolor*.) The occipitonasal length does not normally reach 23 mm. Supraorbital ridges quite clear in the forms *phillipsi* and *surkha*, absent in many specimens,

easily traceable in some specimens of the typical race, *nitidulus*, and more rarely *nagarum*. On these grounds, I think it is not necessary to regard *phillipsi* (with *surkha*) as anything but a well-marked race of *Mus cervicolor*, though it was originally named as '*Leggadilla*' (= species with supra-orbital ridges). The rostrum is not shortened in this species; at least as a general rule, although 13 specimens out of about 49 measured have the diastema under one-quarter of the occipitonasal length as in *musculus* (about one for each race except the typical, and the remainder in *M. c. nagarum*). The suture of the frontals and parietals appears to resemble that of *M. musculus* and *M. booduga*. Interparietal well developed. Bullae rather small or of medium size. Pterygoid fossae shallow or moderate. The palate usually exceeds half the occipitonasal length and the palatal foramina are usually more than one-fifth of the occipitonasal length. The zygomatic plate is cut back above. Mandible with the coronoid process low or moderate.

Dental characters.—Upper incisors narrow, yellow and plain, often with subapical notch as in the species above. Molars with originally eight main cusps in M. 1, six in M. 2; M. 3 very small. M. 1 usually larger than M. 2 plus M. 3, and with the customary inward distortion of the antero-internal cusp; usually the front root of M. 1 extends forward as in the related species and the outer row of cusps is strong. Lower molars about as in the related species; M. 3 very small, but bilaminate originally in at least some of the races.

Cranial measurements.—As in Table 94, below.

TABLE 94.—*Cranial measurements of the Indian races of Mus cervicolor*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus cervicolor phillipsi</i>						
F.	12.10.16.2 Nimar, C.P.	22.2	11.7	5.5	5.3	3.7
M.	13.9.18.74 Danta, Gujerat	21.7	11.0	5.4	5.0	3.6
M.	13.9.18.75 Mt. Abu, Rajputana	21.2	10.8	5.3	4.7	3.6
F.	13.9.18.76 Mt. Abu	23.2	11.9	6.0	5.3	3.4

The type has the occipitonasal about 22.4 mm.

TABLE 94.—*Cranial measurements of Mus cervicolor (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus cervicolor phillipsi</i> ('surkha')						
F.	13.4.10.42 Vijayanagar, Bellary	22.0	11.2	5.7	4.9	3.6
M.	12.10.16.1 Bellary. Type	21.9	11.0	5.5	4.7	3.6
<i>Mus cervicolor fulvidiventrīs</i>						
M.	15.3.1.159 Urugalla, Ceylon. Skull ridged	21.1	10.7	5.2	4.6	3.2
M.	15.3.1.170 Mankeni, Ceylon	20.4	10.1	5.2	4.4	3.2
F.	15.3.1.171 Mankeni	19.7	?	c. 5.0	4.3	3.1
<i>Mus cervicolor nagarum</i>						
M.	20.6.7.48 Golohat, Naga Hills, Assam	20.5	10.4	5.0	4.4	3.7
F.	20.6.7.49 Golohat	18.2	9.0	4.3	4.1	2.9
F.	20.6.7.51 Golohat	21.4	10.9	5.4	4.8	3.5
M.	21.1.6.64 Khonshnong, Jaintia Hills	19.5	9.7	4.7	4.5	2.9
F.	21.1.6.67 Khonshnong	20.0	10.0	5.0	4.5	3.1
F.	21.1.6.70 Shangpung, Jaintia Hills. Old	19.2	9.7	4.9	4.2	2.9
F.	21.1.6.71 Shangpung. (Identification not certain)	18.4	9.0	4.6	4.3	3.0
M.	21.7.8.74 Angarakhata, North Kamrup. (Identification not certain)	19.7	9.9	4.8	4.6	3.5
M.	21.7.8.76 Angarakhata. (Identification not certain)	20.1	10.2	5.0	4.5	3.2
M.	21.7.8.77 Angarakhata	21.1	10.9	5.4	4.9	3.5
M.	21.7.8.78 North Kamrup. (Identification not certain)	20.2	10.6	5.3	4.5	3.4
M.	21.7.8.81 Angarakhata. (Identification not certain)	20.5	10.4	5.0	4.5	3.5
F.	21.7.8.87 Angarakhata. (Identification not certain)	20.0	10.1	4.9	4.3	3.4
F.	21.7.8.89 Angarakhata. (Identification not certain)	20.6	10.5	c. 4.8	4.8	3.3
	20.11.1.50 Laitkynsao, Khasi Hills, Assam	21.9	11.1	5.5	4.6	3.9
M.	21.12.5.61 Dening, Mishmi	22.3	11.3	5.4	4.9	3.7
F.	21.12.5.64 Dening	20.1	10.2	5.1	4.5	3.5

TABLE 94.—*Cranial measurements of Mus cervicolor (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus cervicolor nagarum</i> (concl'd.)						
M.	21.12.5.67 Dening	20.7	10.6	5.2	4.5	c. 3.5
M.	21.12.5.68 Dening	20.3	10.4	5.1	4.5	3.7
F.	21.12.5.68 Dening	21.5	11.1	5.4	4.8	3.7
F.	21.12.5.71 Dening	22.1	11.6	5.8	4.9	3.5
M.	20.11.6.72 Khonshnong, Jaintia Hills, Assam. Old	22.4	11.8	6.1	5.4	c. 3.6
F.	21.1.6.73 Khonshnong	21.9	11.1	5.9	5.0	3.4
F.	21.1.6.74 Khonshnong. Old	23.1	?	6.0	5.1	3.7
F.	21.1.6.76 Shangpung, Jaintia Hills	21.6	11.1	5.7	4.9	3.7
M.	21.12.5.62 Dening, Mishmi	22.0	?	c. 5.5	4.9	3.7

The type has the occipitonasal length about 21.1 mm. Those forms above marked 'identification not certain' are labelled '*Leggada booduga*' and their skins are not traced. Several of these above have the skulls labelled '*booduga*' but the skins are *nagarum*.

Mus cervicolor palnica

M.	23.1.8.6 Kodaikanal, Madura. The foramina measurement = the longer side	21.2	10.5	5.4	4.6	3.5
M.	19.6.2.40 Nilgiri Hills	21.0	10.9	5.4	4.5	3.5
M.	19.6.2.43 Nilgiri Hills	22.4	11.5	5.9	4.7	3.5
M.	23.1.8.5 Shambalgamur, Madura. Type	22.9	11.3	5.5	5.3	3.6

Mus cervicolor cervicolor

M.	22.5.16.35 Hazaria, Nepal Terai	21.0	11.1	5.4	5.0	3.3
F.	22.5.16.36 Hazaria	21.7	11.1	5.5	5.0	3.4
	45.1.8.391 Nepal. (Nasals not entirely complete)	c. 20.6	10.8	5.3	5.2	3.5
	45.1.8.392 Nepal. Topotype. Skull ridged	22.5	11.7	5.9	5.4	3.7

TABLE 94.—*Cranial measurements of Mus cervicolor (concl'd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus cervicolor nitidulus</i>						
M.	17.4.14.22 Pegu, Burma	22.0	11.4	5.7	4.8	3.5
F.	17.4.24.25 16 miles south of Pegu. Old	22.9	12.1	c. 6.3	5.3	3.5
F.	17.4.24.26 Pegu	21.5	11.4	5.3	4.9	3.7
M.	18.7.1.10 South-east of Pegu	22.5	c. 12.1	6.1	5.1	3.7
	18.7.1.11 16 miles south of Pegu	20.4	10.2	5.2	4.6	3.4
F.	18.7.1.14 South-east of Pegu	21.9	11.7	6.0	4.8	3.7

Dimensions of Mus cervicolor, including all races in British Museum material.—Head and body length varies between 57 and 95 mm. Tail varying between 54 and 90 mm. Hind-foot 13–19 mm. Occipitonasal length 18.2–23.2 mm. (mostly over 20 mm.). Toothrow 2.9–3.9 mm.

Key to the subspecies of Mus cervicolor

1	(2) Underparts white. Fur spiny.....	<i>M. c. phillipsi</i>	
2	(1) Underparts grey, or greyish white. Fur mostly soft.		2
3	(6) The tail most often exceeds head and body length in specimens available.		4
4	(5) The palatal foramina exceed 23% of the occipitonasal length. Palate proportionately longer.	<i>M. c. cervicolor</i>	
5	(4) The palatal foramina are usually less than 22% of the occipitonasal length. Palate proportionately shorter.. ..	<i>M. c. palnica</i>	
6	(3) The tail in most specimens is less than the head and body length..		7
7	(8) The tail is most often less than 90% of the head and body length...	<i>M. c. nitidulus</i>	
8	(7) The tail is most often more than 90% of the head and body length		9
9	(10) The underparts average lighter, whitish grey. . . .	<i>M. c. fulvidiventris</i>	
10	(9) The underparts average darker, duller grey.	<i>M. c. nagarum</i>	

The last five forms closely resemble each other. The Ceylon race may stand, but the other four might almost be

considered as the same animal. *M. c. nitidulus* can be distinguished from *fulvidiventris* on the colour of the underparts; in this character, *nitidulus* agrees with *nagarum*.

M. c. phillipsi and *surkha* stand somewhat apart from the other races and have been regarded as species of '*Leggadilla*' (i.e. mice with supraorbital ridges). Though these ridges are present in these forms, they may appear individually, and often do, in the other races. *M. c. phillipsi* is supposed to be darker than *surkha* in colour, but on material available I cannot satisfactorily draw a line between them, and I think that for the present *surkha* will have to be regarded as a synonym.

(i) *Mus cervicolor phillipsi* Wroughton

1912. *Mus phillipsi* Wroughton, *J. Bombay nat. Hist. Soc.*, **21**, 772.

1913. *Leggadda* (sic) *surkha* Wroughton and Ryley, *J. Bombay nat. Hist. Soc.*, **22**, 17. (Vijayanagar, Bellary.)

Type-locality.—Asirgarh, Nimar, Central Provinces, 1,500 ft.

Range.—Specimens examined from NIMAR, Asirgarh; CENTRAL PROVINCES, Chikalda, Berar; RAJPUTANA, Mount Abu; GUJERAT, Danta. BELLARY, Vijayanagar; CUDDAPAH, Balapalli Range. EASTERN GHATS: Kurumbapatti, Salem district.

A distinct race with well-ridged skull and with the underparts white. Fur spiny. Definitely smaller than *Mus platythrix* adult skulls, to which this form shows some resemblance. I cannot find characters to distinguish '*surkha*' from *phillipsi*. Tail short, usually under 90% of head and body.

(ii) *Mus cervicolor fulvidiventris* Blyth

1852. *Mus fulvidiventris* Blyth, *J. Asiat. Soc. Beng.*, **21**, 351.

Type-locality.—Trincomali, Ceylon.

Range.—Specimens examined from CEYLON: Ambawela, Kottawa, Mankeni, Mahaoya, Urugalla, Cheddikulam.

This is *Mus booduga* in part of Blanford and Wroughton; *M. booduga fulvidiventris* of Phillips.

So far as I can tell at present, this seems to represent *M. cervicolor* rather than *M. booduga*, as two out of three skulls available exceed 20 mm. in occipitonasal length (one goes up to 21 mm.) but one-third is 19.7 mm. in this length and more material is required before this form can be placed with certainty. It seems, however, a valid race, even if it was transferred to *M. booduga*. The underparts are whitish

grey, less white than *phillipsi*, most often lighter than those below. The tail is usually over 90% of head and body, but does not exceed the head and body as a rule. The fur is not spiny, at least as compared with *phillipsi*.

(iii) **Mus cervicolor palnica** (Thomas)

1923. *Leggada palnica* Thomas, *J. Bombay nat. Hist. Soc.*, **29**, 1, 87.

Type-locality.—Shambagama, 6,000 ft., Palni Hills.

Range.—Specimens examined from COORG, Halery Estate, Kutta. MYSORE, Kardibetta Forest. SOUTH INDIA: Coonoor, Kotagiri, Kodaikanal, Perumal (Nilgiris), and the type-locality in Palni Hills (Madura).

This race has usually grey underparts and is distinguished from the other races, the typical perhaps excepted, by the fact that very generally the tail exceeds the head and body length. The palatal foramina average proportionately shorter than in the typical race.

(iv) **Mus cervicolor cervicolor** Hodgson

1845. *Mus cervicolor* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 268.
 1845. *Mus strophiatatus* Hodgson, *Ann. Mag. nat. Hist.*, **15**, 268.
 (Nepal.)
 1855. *Mus cunicularis* Blyth, *J. Asiat. Soc. Beng.*, **24**, 721,
 (Cherrapunji, Khasi Hills, Assam.)

Type-locality.—Nepal.

Range.—Specimens examined from Nepal: Bouzini, Hazaria, Patheghatta, Sipuri, Tribeni. A skin from Kindat, Chindwin, WEST BURMA, also bears this name, but as its tail is shorter than the head and body its identification is doubtful. I have not seen its skull. Probably it is *nitidulus*.

This race is not very well represented in our collection; it is usually duller-bellied than *fulvidiventris*, and three out of four authentic Nepalese skins have the tail exceeding the head and body length. The palatal foramina are proportionately longer than the last.

(v) **Mus cervicolor nitidulus** Blyth

1859. *Mus nitidulus* Blyth, *J. Asiat. Soc. Beng.*, **28**, 294.

Type-locality.—Schwegyin, Burma.

This is *Mus nitidulus* of Blanford, 1891, and *Leggada nitidula nitidula* of Wroughton. Specimens seen from BURMA: Kin. Mandalay; 12–40 miles SE. of Pegu.

This form seems very close to *cervicolor* but the tail is short

in specimens available to me, always below the head and body length, usually under 90% of this length.

(vi) **Mus cervicolor nagarum** (Thomas)

1921. *Leggada nagarum* Thomas, *J. Bombay nat. Hist. Soc.*, 27, 3, 597.

Type-locality.—Gologhat, Naga Hills, Assam, 300 ft.

Range.—Specimens examined from ASSAM: Laitkynsao, Khasi Hills; Shangpung and Khonshnong, Jaintia Hills; Gologhat, Naga Hills; NORTH KAMRUP: Angarakhata and Rajapara. MISHMI, Dening.

This race is very near the last, but has the tail most often over 90% of the head and body, although rarely (7 skins in 30) as long as head and body. It borders in a way on *Mus booduga* in that certain skulls (5 in about 27) have the occipitonasal length less than 20 mm. Its tail length is only on average rather than absolutely different from *nitidulus*, and perhaps it will have to be united with that form. Perhaps also the Bhutan Duars skins of *Mus booduga* really belong with this form.

This species nearly becomes indistinguishable from *Mus booduga* in the last-named race and comes extremely near the next, *Mus famulus*, by near intergradation of characters of *M. f. popaeus* with *nitidulus*. It becomes hard to draw a line between the three, and allocation of races to the various species becomes something of a matter of convenience.

From the literature *M. nitidulus* seems more like a house-mouse or member of *M. musculus* group. The two nominal synonyms of *cervicolor*, *strophiatulus* Hodgson and *cunicularius* Blyth, the latter from Cherrapunji, in Assam, seem to have been described as white-bellied forms, which does not suggest *M. c. cervicolor*.

(vii) **Mus cervicolor imphalensis** (Roonwal)*

1948. *Leggada nagarum imphalensis* Roonwal, *Proc. nation. Inst. Sci. India*, 14, 386.

Roonwal (1948) named a form *Leggada nagarum imphalensis* from 16 miles north of Imphal on Dimapur Road, Manipur.

* For a fuller description of *M. c. imphalensis* see Roonwal, M. L., 1950, *Rec. Indian Mus.*, Delhi, 47 (1), pp. 53–57, Pl. I, Fig. 2, and Pl. IX. For some ecological notes, see Roonwal, 1949, *Trans. nation. Inst. Sci. India*, Calcutta, 3 (2), p. 107 and Pl. VI, Fig. 6.

Also see Appendix,

Its status is not very clear from the description. Assuming it is a race of *Mus cervicolor*, it must come very near *nitidulus*. It differs from *nagarum* in having larger head and body (85–91 mm., mean 87·8), shorter tail (56–64, mean 60), and is said to have the dorsum colder and darker, the nasals longer, the upper incisors slightly proodont instead of orthodont, the zygomatic plate straight instead of convex. This form is not available to me for examination.

107. *Mus famulus* Bonhote

1898. *Mus famulus* Bonhote, *J. Bombay nat. Hist. Soc.*, 12, 99.

Distribution, as here understood.—The Nilgiri Hills in PENINSULAR INDIA, Naga Hills in ASSAM, BURMA and in all probability Yunnan and Siam.

Essentially like *Mus cervicolor*, which antedates it, but occurring with *cervicolor* in the Nilgiri Hills and the Naga Hills, and differing in average larger size. Thus the occipito-nasal length is most often more than 23 mm. in length; two exceptions in 17 skulls available. Colour of the typical race rather distinct from other *Mus* species examined; but the eastern races are much like large *cervicolor* races in appearance. Diastema normally exceeds one-quarter of the occipito-nasal length (two exceptions only apparently and their identification is provisional).

With *famulus* I unite *cooki* which is a race with a large skull occurring in the same general neighbourhood as *M. c. nagarum*; and *popaeus*, which on skull average just falls into this species, although it is obviously very close to *M. c. nitidulus*, so that the lines drawn between the two species here are somewhat a matter of convenience.

As compared with *Mus platythrix*, which antedates *famulus* and with which it occurs, the underparts are almost always duller in the present species, although the Burmese race of *platythrix* is perhaps not distinguishable on this character. The tail of *famulus* and *cooki* averages over 90% of the head and body, therefore definitely longer than *platythrix* races. This is not the case in *M. f. popaeus*, which occurs in Mount Poppa district with *M. platythrix shortridgei*. These two forms are, however, easily distinguished on size alone; the largest skull of *popaeus* has the occipitonasal length 23·8 mm. and its hindfoot does not exceed 17 mm. The smallest skull of *M. platythrix shortridgei* has the occipitonasal length 27·8 mm. and its hindfoot is 20 mm. at lowest. Only about seven examples of *Mus platythrix* as a whole, except obviously

young specimens, are as small as the largest skull of *M. f. popaeus*, and the toothrow seem normally to be 4 mm. at least in length in *platythrix*, whereas in *popaeus* it rarely reaches this length.

This species occurs with *M. cervicolor* as noted above, with *M. booduga* in the Nilgiri Hills and Mount Poppa and with *M. platythrix* in Mount Poppa.

External characters.—The head and body does not normally reach 100 mm. in length. The tail averages shorter than head and body; below 90% in *popaeus* but above 90% in the other two forms here referred to this species. Fur evidently soft in the typical race, slightly bristly in *cooki* and harsh in *popaeus*. Hand with four clawed fingers and foot with five clawed toes. Apparently there are six plantar pads in the typical race.

Colour.—The typical race, for which I have only one skin, is deep rich almost dark chocolaty brown in colour, and with a curiously coloured belly which might be described as reddish-yellowish. Feet rather dark and tail wholly dark (very dark above, slightly fainter below). The other two races are nondescript lighter brownish above; *popaeus* tends to have the feet white, but they seem darker in *cooki*. Underparts grey, tending to be a little lighter in *popaeus*; tail clearly bicolor (dark above, pale below) in both.

External measurements.—As in Table 95, below.

TABLE 95.—*External measurements of the Indian races of Mus famulus*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus famulus famulus</i>					
F. Coonoor, Nilgiris	81	79	20	14	Mammae 3 pairs
<i>Mus famulus cooki</i>					
F. Kabaw Valley, 20 miles west of Kindat, Burma	96	86	18	16½	Mammae 10
M. 40 miles west of Kindat	89	90	18½	16	
F. 50 miles west of Kindat	95	89	19	16	
F. 50 miles west of Kindat	99	96	21	15	
M. 50 miles west of Kindat	82	80	19	15	
F. 50 miles west of Kindat	81	79	18½	14	
F. 50 miles west of Kindat	90	92	19½	17	
F. 50 miles west of Kindat	88	85	18	15	
F. Gokteik, Burma	76	68	18	15½	
M. Gokteik. Type	88	91	19	17	

TABLE 95.—*External measurements of Mus famulus (concl'd.)*

	Head and body	Tail	Hind- foot	
<i>Mus famulus cooki</i> (concl'd.)				
Frost collections—				
M. Naga Hills, Assam	80	81	20	15
M. Naga Hills	95	88	20	15
M. Naga Hills	85	78	17	15
F. Naga Hills	70	75	18	15
M. Naga Hills	95	80	18	15
F. Naga Hills	70	73	18	15
F. Naga Hills	85	80	18	15
M. Naga Hills	75	60	15	12
F. Naga Hills	70	83	19	15
F. Naga Hills	70	75	17	15
F. Naga Hills	82	65	14	13
M. Naga Hills	80	88	18	15
<i>Mus famulus popaeus</i>				
F. Mount Poppa, Burma.	85	72½	17	13 Mammae 10
F. Mount Poppa	92	75	16½	12.25 Mammae 10
M. Mount Poppa	100	75½	17	13
M. Mount Poppa	94	79	17	13
M. Mount Poppa	99	75	16½	13.25
M. Mount Poppa	92	80	17	13
M. Mount Poppa. Type	99	78½	17	13

Notes from skins.—Mt. Poppa (*popaeus*), containing 8 young; mammae 3-2 = 10; *famulus*: caught in evergreen jungle in glen; mammae 3 pairs; *cooki*: Kabaw Valley; mammae 2-3 = 10. Dug up in a paddy field.

Cranial and dental characters.—The three races which I refer to this species are essentially like *Mus cervicolor* races, but always averaging larger; the occipitonasal length is most often over 23 mm. (always so in our material for *famulus* and *cooki*, but not reaching this length in two individuals of *popaeus*). Supraorbital ridges traceable, but weak, except in *popaeus* where individually they can become prominent. The diastema normally exceeds one-quarter of the occipitonasal length, but there are two individual exceptions in 17 skulls. To *cooki* I refer a series of rather large skulls collected by Mr. Frost in the Naga Hills, Assam.

Cranial measurements.—As in Table 96, below.

Dimensions of Mus famulus, in British Museum material.—The head and body length varies between 76 and 100 mm. Tail between 68 and 96 mm. Hindfoot 16-21 mm. Occipitonasal length varies between 21.9 and 25.8 mm. Toothrow 3.5-4.2 mm.

TABLE 96.—*Cranial measurements of the Indian races of Mus famulus*

	Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus famulus famulus</i>					
F. 19.6.3.38 Nilgiri Hills	23.9	12.2	6.4	5.0	3.7
97.11.12.1 Coonoor, Nilgiris. Type	c. 23.5	12.0	6.0	5.1	3.7
<i>Mus famulus cooki</i>					
M. 15.5.5.213 Madaw, Manipur	23.4	12.1	c. 6.2	5.4	4.0
M. 16.3.26.48 Chin Hills, Burma	24.2	12.3	6.3	5.2	3.7
F. 16.3.26.49 Chin Hills. Old	25.8	13.4	c. 7.4	6.0	4.0
A juvenile skull from Gokteik, Burma, was also examined.					
Frost collections—					
M. 279 Naga Hills, Assam	24.3	12.2	6.1	5.1	4.1
M. 286 Naga Hills	c. 24.9	12.6	6.5	5.4	3.9
M. 311 Naga Hills	24.7	12.4	6.2	5.1	3.9
M. 341 Naga Hills	24.6	12.4	6.4	5.4	3.9
F. 342 Naga Hills. (Identification provisional)	23.0	11.2	5.7	4.8	3.9
F. 356 Naga Hills	23.4	12.2	5.6	4.8	4.2
M. 359 Naga Hills	23.5	12.0	6.1	5.0	3.8
<i>Mus famulus popaeus</i>					
M. 14.7.1.196 Mt. Poppa, Burma	22.2	11.8	6.0	5.2	3.5
M. 14.7.19.199 Mt. Poppa. Skull well ridged	23.7	12.7	6.2	5.3	?
F. 18.7.1.6 Mt. Poppa. Rather young	21.9	11.6	5.7	5.2	3.5
F. 88.12.1.50 Bhamo, Burma. (Nasals incomplete)	23.0	12.5	6.5	5.2	3.9
M. 14.7.19.200 Mt. Poppa. Type. Skull well ridged	23.8	12.9	6.5	5.4	?

Key to the subspecies of Mus famulus

1	(2) Colour dark deep brown, the underparts little lighter and washed with ochraceous. Tail apparently nearly wholly dark...	<i>M. f. famulus</i>	
2	(1) Colour lighter brown, the underparts lighter, greyish in colour. Tail clearly bicolor...		3
3	(4) Tail averaging more than 90% of head and body length. Belly a little darker.	<i>M. f. cooki</i>	
4	(3) Tail averaging less than 90% of head and body length. Belly a little lighter.	<i>M. f. popaeus</i>	

(i) *Mus famulus famulus* Bonhote

1898. *Mus famulus* Bonhote, *J. Bombay nat. Hist. Soc.*, **12**, 99.

Type-locality.—Coonoor, Nilgiri Hills, South India, 5,000 ft.

Range.—Specimens seen from NILGIRIS, Coonoor.

Differing rather markedly in colour, as indicated above, from the other races.

(ii) *Mus famulus cooki* Ryley

1914. *Mus cookii* Ryley, *J. Bombay nat. Hist. Soc.*, **22**, 664.

Type-locality.—Gokteik, Shan States, Burma, 2,133 ft.

Range.—Specimens examined from BURMA: (West Burma): Kabaw Valley, 20 miles west of Kindat, 40–50 miles west of Kindat. (East Burma): Gokteik, Shan States. MANIPUR, Madaw. ASSAM: Naga Hills.

Coloration different from the typical. Tail proportionately longer than in the next. Larger in skull length than *M. cervicolor nagarum*, in the same general neighbourhood of which it occurs.

(iii) *Mus famulus popaeus* (Thomas)

1919. *Leggada nitidula popaea* Thomas, *J. Bombay nat. Hist. Soc.*, **26**, 2, 420.

Type-locality.—Mount Poppa, Burma.

Range.—Specimens seen from BURMA: Mount Poppa and Bhamo.

Much like the last, but shorter tailed. Considerably smaller than *M. platythrix shortridgei*, with which it occurs.

(Occipitonasal length not reaching 24 mm. in this race.) This form comes near *M. cervicolor nitidulus*, of which it was named as a race, but it seems to average larger in skull size.

108. *Mus platythrix* Bennett

The Brown Spiny Mouse

1832. *Mus platythrix* Bennett, *Proc. zool. Soc. Lond.*, 121.

Leggadilla platythrix of Thomas and Wroughton.

Vernacular names (Blanford).—Legyáde, Legadgandu or Rále-lagangandu, Wadári; Gijeli-gandu, *Tel. of Yanadis*; Kal ilei, *Can.*

Distribution.—PENINSULAR INDIA: TRAVANCORE to SIND, KATHIAWAR, CUTCH, KUMAON, PUNJAB, MT. POPPA DISTRICT OF BURMA.

The second named species of *Mus* in Asia, this is a distinct large species, with the skull usually well ridged; occipitonasal length normally exceeding 23 mm., and as much as 30 mm. in one specimen. Diastema normally more than one-quarter of the occipitonasal length (about 12 exceptions, including some young skulls, in roughly 60 skulls). The underparts are usually white (light grey in the Burmese race). The tail is short, averaging below 90% of the head and body in all races. In the Burmese race, the occipitonasal length exceeds 27 mm. (compare *M. famulus popaeus*, with which it occurs). The fur usually tends to be spiny. In this species I include all forms referred to '*Leggadilla*', which was based on those forms with supraorbital ridges, except *phillipsi* and '*surkha*', and *fernandoni* from Ceylon.

Most distinct is the Burmese race, *shortridgei*, which might be regarded as a distinct species. The palatal foramina are usually extremely lengthened, except in a race from Coorg and district for which the prior name seems to be *bahadur*.

External characters.—Medium-sized or large mice. The head and body length exceeds 100 mm. in large specimens of all races, except *ramnadensis*, and in some forms, as *shortridgei*, may exceed 120 mm. Tail short in all races averaging below 90% of the head and body. The fur is crisp and usually tends to be spiny. Hand with four clawed fingers. Foot with five clawed toes; as usual, the hallux shorter than D. 5, which is shorter than the central three. At least in the typical race, six plantar pads can sometimes be traced in dried skins. Mammae 10 or 12, or in two specimens 13.

Colour.—The typical race is dorsally rather dark brown, but varying and sometimes paler brown; the fur apparently greyer basally, browner terminally; feet usually whitish; underparts normally white, with a clear line of demarcation along the sides; tail bicolor, dark above and white below. *M. p. sadhu* seems similar, but many of the specimens tend to be grey (drab grey) dorsally. *M. p. ramnadensis* (of which 'siva' is surely a synonym) is more rufescent brown dorsally than *sadhu*, the difference between the two being quite well marked. *M. p. shortridgei* differs from the other races in the colour of the underparts, which are not white but are more whitish or light grey; the back is drab grey. *M. p. 'grahami'* is near *platythrix*, but rather dark brown above; the tail seems only obscurely bicolor and the underparts are white. *M. p. gurkha* averages a little paler than the last. Other names to be considered are 'cinderella', *bahadur* and 'hannyngtoni'. The last named, from Coorg, was based on an extremely old specimen and was said to differ from 'grahami' in its larger hindfoot. It is more likely, in my opinion, to be a name based merely on very old specimens of 'grahami'. From material I have seen, I am convinced that 'cinderella', said to occur with *sadhu* and to differ in smaller size, is a name merely based on immature specimens of *sadhu*. There is little in the original description if anything to distinguish *bahadur* from the typical race. Certainly the character of '10 mammae' as against '12 mammae' is individual in this group so far as one is able to judge, as often in other species, but on the other hand the palatal foramina of the type of *bahadur* seem rather short, as in 'grahami'. Its measurements were given as 85 mm., head and body; tail 65–70, incomplete; hindfoot $17\frac{1}{2}$ mm.; ear 13 mm. The name antedates 'grahami' and I propose to make the latter a synonym of it.

External measurements.—As in Table 97, below.

Notes from skins.—*M. p. platythrix*: Rorighat, Hoshangabad; trapped in hedge near cultivation; $\frac{1}{2}$ oz. Khandalla; pregnant, six small embryos. Asirgarh, Nimar; mammae 10; trapped in hedge. Chikalda, Berar; mammae 4–2 = 12, fetus 2; 1 oz. Hawbshavi; 1 oz. Konkan; lives in trees, especially toddy palms. Pili, Sipna; $\frac{1}{2}$ oz. Matheran; trapped among the stones in the dry bed of a stream in one of the valleys. Damthal, Kangra; mammae 2–3 = 10.

M. p. gurkha: Paresnath; $\frac{7}{8}$ oz. Bageswar; mammae 10; weight $1\frac{3}{8}$ oz. Paresnath; mammae 10; 1 oz. Singar, Bihar; $1\frac{1}{8}$ oz.

M. p. shortridgei: Mingun; weight $1\frac{1}{2}$ oz. Mt. Poppa; $1\frac{7}{8}$ oz.

TABLE 97.—*External measurements of the Indian races of Mus platythrix*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus platythrix bahadur</i> ('grahami')					
F. Wotekolli, Coorg	106	?	18	15	
F. Wotekolli	89	70	19	?	
M. Wotekolli	115	84	18	15½	
F. Wotekolli	118	77	18	14½	
F. Wotekolli	78	66	18	15	
F. Wotekolli. Type	109	72	18½	15	Mammae 10
Makut, Coorg. Type of 'hannynghoni'	120	88	22½	17½	Mammae 10
M. Makut ('hannynghoni')	108	?	23	16½	
<i>Mus platythrix gorkha</i>					
M. Hazaribagh	86	72	17	16	
F. Hazaribagh	89	74	16	15	Mammae 10
F. Bageswar, Kumaon	106	80	18	15½	Mammae 10
F. Paresnath	91	68	16½	16	Mammae 10
F. Singar, Gaya, Bihar	110	?	18	?	
M. Jerna, Ramnagar, Kumaon. Type	82	73	18	14½	
<i>Mus platythrix platythrix</i>					
F. Dharwar	110	81	21	16	
Hawbshavi, Dharwar	104	77	18	14	
M. Hawbshavi	111	73	19	16	
F. Dharwar	105	77	20	16	
M. Dharwar	89	67	17	15	
F. Asirgarh, Nimar	108	71	18	15	Mammae 10
F. Matheran	85	69	17	15	
M. Shirgaon, Ratnagiri	84	77	18	15	
F. Shirgaon, Ratnagiri	100	86	20	15	
F. Shirgaon, Ratnagiri	97	62	19	16	
F. Shirgaon, Ratnagiri	106	79	17	16	
M. Ghatmatha, Satara	99	90	19	14	
F. Konkan	95	77	18	15	
M. Poona	88	72	18	?	
Sivasamudram, S. Mysore	102	60	17	14	
F. Khandalla, Bombay	76	70	19	15	
F. Chikalda, Berar	91	63	18	14	Mammae 12
Damthal, Kangra, Punjab	84	?	18	16	
F. Damthal, Kangra	90	84	18	17	Mammae 10
M. Damthal, Kangra	87	77	18	14½	
M. Damthal, Kangra	102	?	18	16	
F. Damthal, Kangra	90	68	18	15	
M. Damthal, Kangra	80	73	18	16	
M. Damthal, Kangra	82	76	18	16	
M. Damthal, Kangra	89	77	18	15½	
F. Damthal, Kangra	103	84	18	16	
M. Damthal, Kangra	88	75	18	16	

TABLE 97.—*External measurements of Mus platythrix (contd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus platythrix ramnadensis</i>					
F. Ramnad, Madura, Madras	81	57	17	14	Mammae 10
<i>Mus platythrix ramnadensis</i> ('siva')					
M. Balapalli Range, Cud- dapa	89	72	18	16	
M. Balapalli Range	80	72	18	16	
M. Kodura, Balapalli Range	76	66	17	15	
Balapalli Range	87	68	19	16	
F. Palkonda, Balapalli Range	87	70	18	16	
M. Balapalli Range	84	74	19	16	
F. Balapalli Range	83	63	17	16	
F. Balapalli Range	86	59	17	16	
F. Kodura, Balapalli Range	75	65	18	16	
F. Cumbum, Madura	71	67	17	13	
M. Cumbum, Madura	72	64	16	13	
Cumbum, Madura	90	75	16	13	
F. Chettiri Range, Salem, Eastern Ghats	68	49	16	14	
M. Chettiri Range	73	55	16	14	
F. Tirthemalai, Salem district	93	71	19	17	
F. Sivasamudram. Type	81	56	16	14	
<i>Mus platythrix sadhu</i>					
F. Bhuj, Cutch. Mammae 5 pairs. Type 'cinderella'	85	?	16	13	Trapped in house
M. Dhrangadhra, Kathiawar	69	65	17	12	
F. Kudia, Kathiawar	92	74	17	13	
F. Kudia, Kathiawar	73	72	18	13	Mammae 13
F. Satapur, Kathiawar	89	73	18	15	Mammae 12
F. Kudia, Kathiawar	89	71	17	13	Mammae 13
M. Satapur, Kathiawar	70	67	17	13	
F. Vankaneer, Kathiawar	75	66	17	13	Mammae 12
F. Muli, Kathiawar	72	59	16	13	
M. Satapur, Kathiawar	80	67	17	12	
F. Charwa, Cutch	81	71	16	?	
M. Padampur, Cutch	88	74	17	?	
F. Charwa, Cutch	104	70	16	15	
M. Dhonsa, Cutch	98	78	17	14	
F. Bhuj, Cutch	77	65	16	13	
M. Mt. Abu, Rajputana	94	74	17	11	
M. Mt. Abu	86	68	16	14	
Mt. Abu	89	74	17	14	
F. Mt. Abu	92	72	17	14½	Mammae 12
M. Lahore district, Punjab	90	68	18	10	
M. Virawah, Sind. Type	79	57	17	12½	
F. Virawah. Type of 'Pyro- mys priestlyi'	98½	73½	16	?	

TABLE 97.—*External measurements of Mus platythrix (concl'd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus platythrix shortridgei</i>					
F. Mt. Poppa, Burma	117	92	21	18½	
M. Mt. Poppa	125	99	21.25	17	
M. Mt. Poppa	117	97	20½	17½	
F. Mt. Poppa	99	97	20.25	17½	
M. Mt. Poppa	123	93	21	19	
F. Mt. Poppa	114	93	20½	18	
F. Mt. Poppa	110	85	20	17.75	
M. Mingun, near Sagaing, Burma	113	84	20½	17½	
M. Mingun	122	81	20	18	
M. Pagan, Burma	100	88	21	?	
M. Pagan	108	95	21	15.25	
M. Mt. Poppa. Type	122	101	21½	17.75	Weight 2 oz.

M. p. ramnadensis: Ramnad; mammae 3-2=10.

M. p. sadhu: Bhuj; trapped in house; mammae 12; ¾ oz. Satapur; ⅝ oz. and 1 oz.; mammae 12; ⅜ oz. Vankaneer; mammae 12; ⅝ oz. Muli, Kathiawar; ½ oz. Charwa; trapped in a bank near water; ¾ oz. and 1 oz. Kudia, Junagadh; mammae 13; 1½ oz.; rocks, mammae 13; roots of tree; 1½ oz. Mt. Abu; foetus 6, mammae 12; 1½ oz., 1 oz. and ⅞ oz. Dhonsa; trapped among rocks; 1 oz. Lahore district; Punjab; in fields. Kudia; ¾ oz. Padampur; ¾ oz.; hill amongst rocks.

Cranial characters.—Rather large mice, the occipitonasal length in adult exceeding 23 mm., and in one extremely old specimen reaching 30 mm. Nasals rather narrow and pointed. Frontals width tending to be narrower on average than is usual in other Indian species, but this seems not to be a constant character. Supraorbital ridges present, though sometimes weak in some specimens. Suture of frontals and parietals in general resembling *M. musculus*, *M. booduga* and allied species. Interparietal well developed. Bullae of medium size. Pterygoid fossae tend to be rather deep and the posterior nares can sometimes be narrow. Palate length normally exceeds half the occipitonasal length. Palatal foramina long to very long, more than one-fifth of the occipitonasal length, typically penetrating well between the tooth-rows, but somewhat shorter in *bahadur* and *gurkha* than in the others. Muzzle not shortened; diastema, normally more than a quarter of the occipitonasal length, but about a dozen individual exceptions (including youngish specimens) in about

57 measured skulls. Zygomatic plate usually well cut back above. Mandible with quite strong coronoid process.

Dental characters.—Upper incisors narrow, yellow and plain, often with the subapical notch present. M. 1 usually larger than M. 2 plus M. 3, its anterior root projecting forwards as usual. This tooth has eight main cusp spaces, and often an extra cusp present in front of the front lamina of M. 1 (on the top of the front root). M. 2 has six main cusps as usual. M. 3 is very small. The anterointernal cusp of M. 1 is strongly distorted inwards, as a rule. The outer row of cusps of the upper molars are well developed. M. 2 may sometimes have a small anteroexternal cusp. The extra front cusp in front of M. 1 seems mostly absent in *bahadur* and *shortridgei*. Lower molars as usual; M. 1 with three, M. 2 and M. 3 with two, laminae. M. 3 much smaller than M. 2.

Cranial measurements.—As in Table 98, below.

TABLE 98.—*Cranial measurements of the Indian races of Mus platythrix*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus platythrix platythrix</i>						
	7.11.22.24	24.9	13.6	6.2	5.8	4.3
	Konkan, Bombay					
	7.7.7.4431	25.2	13.9	6.5	6.1	4.5
	Ahmednaggar					
F.	12.3.8.16	25.0	13.5	6.2	5.9	4.3
	Chikalda, Berar					
F.	12.6.28.25	27.1	14.6	7.3	6.7	4.5
	Asirgarh, Nimar. Old					
M.	12.8.29.79	25.3	13.2	6.3	6.3	4.5
	Dharwar district					
M.	12.6.29.80	26.3	14.4	6.7	6.7	4.6
	Dharwar district					
F.	12.6.29.82	27.1	15.0	7.3	7.0	4.6
	Dharwar					
F.	12.6.29.84	25.9	13.6	6.8	6.2	4.6
	Dharwar district					
F.	15.7.3.47	27.0	14.7	7.0	7.0	4.9
	Shirgaon, Ratnagiri					
F.	15.7.3.48	26.9	15.0	7.4	7.1	4.7
	Shirgaon, Ratnagiri					
M.	15.3.7.49	28.7	15.5	7.4	7.0	4.6
	Ghatmatha, Satara. Old					
F.	19.6.3.67	23.9	12.4	5.7	5.7	4.3
	Khandala, Bombay. Rather young					
F.	19.6.3.68	23.5	12.5	5.5	5.7	4.2
	Khandala					

TABLE 98.—*Cranial measurements of Mus platythrix (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus platythrix platythrix</i> (concl'd.)						
M.	23.9.1.83 Damthal, Kangra, Punjab	26.0	14.2	6.9	6.7	4.0
F.	23.9.1.90 Damthal, Kangra	25.0	13.1	6.7	6.2	4.0
F.	23.9.1.91 Damthal, Kangra	25.6	c. 13.8	7.2	6.3	c. 4.0
	46.11.22.252 Madras	25.0	c. 13.8	6.4	6.4	4.3
	46.11.22.253 Madras	26.1	13.5	6.3	6.2	4.8
	80.11.11.47 South India	27.3	13.8	6.8	6.5	4.6
	80.11.11.45 South India	25.0	13.4	6.3	6.2	4.8
M.	91.11.11.54 Travancore	25.9	13.4	6.7	6.0	4.2
	91.11.1.57 Ahmednagar	25.4	13.4	6.5	6.5	4.3

A type has the occipitonasal about 26.5 mm.

Mus platythrix ramnadensis

	5.11.26.9 Ramnad, South Madras	24.3	13.2	6.3	6.2	4.2
M.	20.4.22.5 Cumbum, Madura. ('siva')	23.1	12.0	6.0	5.9	3.9
F.	20.4.22.7 Cumbum, Madura. ('siva')	24.5	13.4	6.8	6.2	4.3
F.	20.4.22.8 Cumbum, Madura. ('siva')	23.4	12.5	6.1	5.8	4.4

The type of 'siva' has the occipitonasal about 23.8 mm.

Mus platythrix sadhu

M.	12.9.17.5 Lahore, Punjab	23.0	c. 12.3	5.8	5.7	4.0
F.	12.10.4.59 Charwar, Cutch	23.8	12.9	5.8	6.0	4.1
M.	12.10.4.60 Dhonsa, Cutch. Old	26.0	14.4	6.9	6.0	4.1
M.	12.10.4.61 Padampur, Cutch	24.0	13.0	6.0	6.0	4.2
	12.10.4.63 Bhuj, Cutch. ('cinderella'. Young)	22.6	11.6	5.4	5.6	4.0
M.	13.9.18.70 Mt. Abu, Rajputana	25.0	c. 13.7	6.4	6.4	4.3

TABLE 98.—*Cranial measurements of Mus platythrix (contd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus platythrix sadhu</i> (concl'd.)						
M.	13.9.18.71	24.6	13.4	6.4	6.6	4.3
	Mt. Abu					
M.	13.9.18.72	24.7	13.1	6.4	6.2	4.0
	Mt. Abu					
F.	13.9.18.73	24.3	13.2	6.4	6.1	4.2
	Mt. Abu					
M.	13.8.8.91	23.5	12.6	5.7	5.6	4.3
	Satapur, Kathiawar					
	13.8.8.92	22.0	11.8	5.3	5.2	4.3
	Dhrangadhra, Kathiawar. Young					
F.	13.8.8.94	25.1	13.7	6.5	6.4	4.2
	Satapur, Kathiawar					
M.	13.8.8.95	23.4	12.0	5.7	5.8	4.1
	Kudia, Kathiawar					
F.	13.8.8.96	25.0	13.6	6.4	6.4	4.6
	Kudia, Kathiawar					
F.	13.8.8.97	25.1	13.7	6.5	6.2	4.2
	Kudia, Kathiawar					
F.	13.8.8.98	22.3	12.0	5.4	5.3	4.2
	Muli, Kathiawar. Young					
F.	13.8.8.99	23.0	12.2	5.6	5.7	4.1
	Vankaneer, Kathiawar					

The type of 'cinderella' has the occipitonasal length about 23.2 mm.

Mus platythrix shortridgei

	14.7.19.185	27.8	14.3	7.7	6.5	?
	Mount Poppa, Burma					
F.	14.7.19.187	c. 27.8	14.5	7.6	6.7	4.5
	Mt. Poppa					
F.	14.7.19.190	28.2	14.6	8.0	6.6	4.2
	Mt. Poppa. Foramina measurement = longer side					
M.	14.8.19.191	28.2	14.4	7.9	6.4	4.4
	Mingun, Burma					
M.	14.7.19.193	28.2	14.7	7.5	6.4	4.5
	Pagan, Burma. Foramina measurement = longer side					

The type has the occipitonasal length about 29.6 mm.

Mus platythrix bahadur ('grahami')

M.	13.8.22.79	27.1	14.0	7.4	5.7	4.2
	Wotekolli, Coorg. Old					
F.	13.8.22.80	26.7	13.9	7.2	5.7	4.1
	Wotekolli					

TABLE 98.—*Cranial measurements of Mus platythrix (concl'd.)*

		Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus platythrix bahadur</i> (' <i>grahami</i> ') (concl'd.)						
F.	13.8.22.82 Wotekolli. Young	c. 24.5	12.5	6.0	5.2	4.2
F.	13.8.22.83 Wotekolli. Old	26.9	13.8	7.4	5.7	4.0
F.	13.6.21.2 Makut, Coorg. Very old.	30.1	15.8	8.6	6.5	4.6
F.	12.10.16.3 Karwar, Kanara. Old.	28.1	14.4	7.5	6.2	4.4
		Type of ' <i>hannynghoni</i> '				
		Type of ' <i>bahadur</i> '				
<i>Mus platythrix gorkha</i>						
F.	15.4.3.132 Hazaribagh, Bihar	25.1	12.7	6.3	5.2	4.1
	15.4.3.134 Singar, Gaya, Bihar. Old	26.6	14.4	7.5	5.9	4.1
M.	14.2.1.1 Jerna, Ramnagar, Kumaon.	24.5	12.8	6.1	5.5	4.3
		Type				

Dimensions of Mus platythrix, in British Museum material.—The occipitonasal length varies between 22 mm. (a young specimen) and 30.1 mm. Toothrow 3.8–4.9 mm. Head and body length varying between 68 and 125 mm. Tail between 49 and 101 mm. Hindfoot 16–23 mm.

Key to the subspecies of Mus platythrix

1	(4) The palatal foramina approximate to 22% of the occipitonasal length at highest, but are usually less.		2
2	(3) Back averages slightly darker.	<i>M. p. bahadur</i>	
3	(2) Back averages slightly paler.	<i>M. p. gorkha</i>	
4	(1) The palatal foramina exceed 23% of the occipitonasal length.		5
5	(6) Underparts light grey. Hindfoot 20 mm. at least. Head and body length normally exceeds 100 mm.	<i>M. p. shortridgei</i>	
6	(5) Underparts usually white. Hindfoot usually less than 20 mm. (about 3 exceptions in about 65 skins of remaining races). Head and body most often less than 100 mm.		7

7	(8)	Length of the occipitonasal is most often more than 25 mm.	<i>M. p. platythrinx</i>	
8	(7)	Length of the occipitonasal rarely reaches 25 mm. (about 5 exceptions in 23 skulls)		9
9	(10)	Back usually grey in colour.	<i>M. p. sadhu</i>	
10	(9)	Back usually brown, often pinkish brown in colour .	<i>M. p. ramnadensis</i>	

(i) *Mus platythrinx platythrinx* Bennett

1832. *Mus platythrinx* Bennett, *Proc. zool. Soc. Lond.*, 121.
 1839. *Mus saxicola* Elliot, *Madras J. Litt. Sci.*, 10, 215. (Madras.)
 1854. *Mus spinulosus* Blyth, *J. Asiat. Soc. Beng.*, 23, 734. (Punjab.)

Type-locality.—Deccan, Peninsular India.

Range.—Specimens examined from TRAVANCORE, NILGIRIS, Ootacamund, MADRAS; MYSORE, Sivasamudram; DHARWAR district, Dharwar and Hawbshavi. BOMBAY STATE: Ahmednagar; Ghatmatha, Satara district; Khandalla; Khed and Shirgaon, Ratnagiri; Konkan; Matheran; Poona. CENTRAL PROVINCES: Asirgarh, Nimar; Chikalda, Berar; Rorighat, Hoshangabad. PUNJAB: Damthal, Kangra.

Large race, occipitonasal length usually exceeds 25 mm. (about 3 exceptions in 23 skulls measured). Hindfoot most often not as high as 20 mm. Belly usually white. Palatal foramina very long. Usually with an extra cusp in front of the front lamina of M. 1.

(ii) *Mus platythrinx sadhu* (Wroughton)

1911. *Leggada platythrinx sadhu* Wroughton, *J. Bombay nat. Hist. Soc.*, 20, 4, 1001.
 1912. *Leggada cinderella* Wroughton, *J. Bombay nat. Hist. Soc.*, 21, 770.

Type-locality.—Virawah, Sind, and of 'cinderella', Bhuj, Cutch. The latter name based apparently on immature examples. '*Pyromys priestlyi*' Thomas (1911, *J. Bombay nat. Hist. Soc.*, 20, 4, 996), Virawah, Sind, is based apparently on a skin of this race mixed with a skull of *Rattus leadowi*.

Range.—Specimens examined from KATHIAWAR: Dhrangadhra, Kudia, Muli, Satapur, Vankaneer. CUTCH: Bhuj, Charwar. Dhonsa, Padampur. RAJPUTANA, Mount Abu. PUNJAB, Lahore district. SIND, Virawah.

Very like *M. p. platythrinx*, but smaller, occipitonasal length most often not reaching 25 mm. (about 5 exceptions in 18 skulls).

(iii) *Mus platythrix ramnadensis* Bentham

1908. *Mus (Leggada) ramnadensis* Bentham, *Rec. Indian Mus.*, **2**, 385.

1913. *Leggada siva* Wroughton and Ryley, *J. Bombay nat. Hist. Soc.*, **22**, 242. (Sivasamudram, southern Mysore, 2,500 ft.)

Type-locality.—Ramnad, Madura, Madras.

Range.—Specimens examined from MADRAS: Ramnad, Madura, and Sivasamudram, also Cumbum, Madura. EASTERN GHATS: Salem, Chettiri Range, and CUDDAPAH, Bala-palli Range. (Kodura and Palkonda). Tirthemalai, Salem. It is like *M. p. sadhu*, but is browner in colour, dorsally.

(iv) *Mus platythrix bahadur*

(Wroughton and Ryley)

1913. *Leggada bahadur* Wroughton and Ryley, *J. Bombay nat. Hist. Soc.*, **22**, 18.

1913. *Leggada grahami* Ryley, *J. Bombay nat. Hist. Soc.*, **22**, 434.

1913. *Leggada hannyingtoni* Ryley, *J. Bombay nat. Hist. Soc.*, **22**, 435.

Type-locality.—Of *bahadur*, Karwar, Kanara district; of *grahami*, Wotekolli, southern Coorg, 2,000 ft.; of *hannyingtoni*, Makut, 250 ft., southern Coorg.

Large race, the occipitonasal length most often exceeds 25 mm. Hindfoot most often not as high as 20 mm., but exceeding it in two (old ?) specimens referred to '*hannyingtoni*', which I believe to be based on old specimens of this race. Belly usually white. Palatal foramina distinctly shortened when compared with other subspecies, the next excepted. Usually without extra front cusp in front of foremost lamina of M. 1. Back tending to be rather dark.

(v) *Mus platythrix gurkha* (Thomas)

1914. *Leggadilla gurkha* Thomas, *J. Bombay nat. Hist. Soc.*, **23**, 2, 200.

Type-locality.—Jerna, Ramnagar, Kumaon, 1,500 ft.

Range.—Specimens examined from KUMAON: Bageswar and the type-locality. BIHAR: Singar (Gaya), and Paresnath. Hazaribagh.

Essentially like the last race, but averaging a little paler dorsally.

(vi) **Mus platythrix shortridgei** (Thomas)

1914. *Leggadilla shortridgei* Thomas, *J. Bombay nat. Hist. Soc.*, 23, 1, 30.

Type-locality.—Mount Poppa, Burma.

Range.—Specimens examined from BURMA: Mount Poppa; Mingun, near Sagaing. Pagan.

This very distinct race, which might be regarded as a valid species, differs from the others in the colour of its underparts, which are grey, not white; its unusually large size, hindfoot 20 mm. and more; head and body 99–125 mm., but over 100 mm. in all but one specimen. The palatal foramina are very long, as in the typical race. There is usually no extra front cusp in front of the front lamina of M. 1. Occipitonasal length exceeds $27\frac{1}{2}$ mm., usually exceeds 28 mm. in skulls available.

109. **Mus fernandoni** (Phillips)

1932. *Leggadilla fernandoni* Phillips, *Spolia Zeylan.*, 16, 325.

Type-locality.—Kumbalgamuwa, Central Province, 3,000 ft., Ceylon.

Range.—Specimens seen from CEYLON: Kumbalgamuwa.

This species is much like *M. platythrix*, but rather surprisingly, both skulls available to me have the diastema shorter than a quarter of the occipitonasal length, as *Mus musculus*. Until more specimens come to hand, I have no alternative but to give it specific rank. The toothrow, 3.8–4.2 mm., is longer than in *Mus musculus* skulls I have measured. The supraorbital ridges are quite strong on the skull. Occipitonasal length about 23–25 mm. Tail less than 90% of the head and body length. Fur spiny.

Palatal foramina a little shorter than is usual in *platythrix*.

External characters.—The very few specimens available indicate that it is a medium-sized Mouse, with spiny or bristly fur, a short tail, and hands and feet of the usual proportions, including a clawed hallux as normal. The duplicate skin is noted as being trapped in the jungle.

Colour.—Above brown, with the feet whitish. Underparts apparently white. Tail bicolor.

External measurements.—

	Head and body	Tail	Hind- foot	Ear
M. Kumbalgamuwa, Ceylon	94	70	18	15
M. Kumbalgamuwa. Type	98	82	17	?

Cranial characters.—Skull and dentition much like that of *Mus platythrix*; occipitonasal length about 23–25 mm. Supra-orbital ridges well developed. But the diastema in both skulls seen is rather short, less than a quarter of the occipitonasal length, as in *Mus musculus*. Molars well cuspidate, but M. 1 with the extra front cusp scarcely apparent.

Cranial measurements.—

	Occipito-nasal	Palate	Diastema	Palatal foramina	Toothrow
M. 31.9.6.3 Kumbalgamuwa, Ceylon	25.3	12.3	6.1	5.2	4.2
M. 31.9.6.2 Ceylon. Type	c. 22.9	11.5	c. 5.5	?	3.8

Dimensions of Mus fernandoni, in British Museum material.—Head and body length 94–98 mm. Tail 70–82 mm. Hindfoot 17–18 mm. Occipitonasal length 22.9–25.3 mm. Toothrow 3.8–4.2 mm.

Subgenus (b) *Coelomys* Thomas

1915. *Coelomys* Thomas, *J. Bombay nat. Hist. Soc.*, 23, 3, 414.

Distribution.—As here understood: CEYLON; SIKKIM, ASSAM, BURMA, Indo-China, Siam; Java.

I use this name for two aberrant species, which agree in having the palatal foramina shortened, less than one-fifth of the occipitonasal length, normally. *M. mayori*, the type, is a rather large species which, as it seems it will not stand as a genus on dental characters when compared with both *Rattus* and *Mus* (being somewhat intermediate between them), it seems wisest to regard as a subgenus of *Mus*. To this subgenus I refer the very distinct species *M. pahari*, which is characterized by its short palatal foramina, short palate (normally less than half the occipitonasal length), and proportionately wider frontals than is usual in other species of *Mus* in Asia. (*M. mayori* also sometimes has the palate a little less than half the occipitonasal length.)

Key to the species of subgenus Coelomys

- 1 (2) Occipitonasal length usually exceeds 27 mm. Length of the toothrow exceeds 4 mm. Hindfoot 23 mm. and more. Diastema usually exceeds 7 mm. *Mus mayori*

- 2 (1) Occipitonasal length usually less than 26 mm. Length of the toothrow less than 4 mm. Hind-foot usually below 23 mm. Diastema less than 7 mm. . . . *Mus pahari*

110. *Mus pahari* Thomas

The Sikkim Mouse

1916. *Mus pahari* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 3, 415.

Distribution.—SIKKIM, ASSAM, NORTH BURMA, Siam, Indo-China, Java. ('*Mycteromys crociduroides vulcani*' seems to me to be a Javanese representative of this species, rather than of true Sumatran *Mus crociduroides*).

This species is remarkable among Asiatic *Mus* (*mayori* excepted), in having the palatal foramina short, less than 20% normally of the occipitonasal length. The skull lacks ridges as a rule, and is 26 mm. at highest, usually less, in occipitonasal length. The palate is shorter than is usual in Asiatic *Mus*, being mostly less than half the occipitonasal length. The toothrow length is less than 4 mm. in Indian specimens, and the hindfoot usually is less than 23 mm. These characters of toothrow and hindfoot length will distinguish it from *M. mayori* of Ceylon, which it most resembles. The tail in Indian races usually exceeds head and body length.

Occipitonasal length usually exceeding 23 mm. The diastema usually shorter than a quarter of the occipitonasal, as in *M. musculus*.

External characters.—Smallish mice, the head and body length not generally reaching 100 mm. In the Indian races, the tail most often is longer than the head and body. The fur tends to be bristly or somewhat spiny, particularly in the typical race. Hand with four clawed fingers. Hindfoot with five clawed toes; the fifth toe shorter than the central three, but longer than the hallux; apparently six plantar pads.

Colour.—Dorsally greyish brown or dark brown. The feet usually light. Underparts light grey. Tail usually dark above, pale below, but in the typical race some specimens have it wholly dark.

External measurements.—As in Table 99, below.

Notes from skins.—*M. p. jacksoniae*: Dreyi; weight 0.60 oz. Khonshnong; weight 0.70 oz. Tura; weight 0.75 oz. and 1 oz. Dening; weight 0.60 oz. Nam Tisang, Upper Irrawaddy;

TABLE 99.—*External measurements of the Indian races of Mus pahari*

	Head and body	Tail	Hind- foot	Ear	
<i>Mus pahari pahari</i>					
M. Pashok, Sikkim	91	88	19	15	
M. Pashok	90	92	19	16	
M. Pashok	90	92	20	15	
F. Pashok	85	100	20	15	
F. Pashok	83	95	19	16	
F. Pashok	90	91	20	17	
M. Pashok	75	93	21	15	
M. Pashok	94	89	20	17	
F. Pashok	87	95	20	16	
F. Pashok	87	85	18	15	
F. Chuntang, Sikkim	87	87	19½	14	Mammae 10
M. Lohit Valley, Sadiya	92	?	19	15	
M. Golaghat, Assam	96	70	17	14	
F. Nam Tamai, North Burma	90	100	20	16	
M. Batasia. Type	94	91	20	15	Weight 8 oz.
<i>Mus pahari jacksoniae</i>					
F. Dening, Mishmi	92	90	20	16	
M. Dening	86	91	23	16	
M. Dening	92	98	20	17	
F. Dening	97	97	20	17½	
M. Dening	82	86	19	14	
M. Dening	89	96	20	16	
F. Dening	82	92	20	16	
F. Dening	83	90	20	16	
M. Dening	92	92	20	18½	
Dreyi, Mishmi	83	107	22	16	
M. Dreyi	93	83	20	17	
F. Tura, Garo Hills	95	95	18	15	
M. Tura	83	89	19	15	
F. Khonshnong, Jaintia Hills	93	92	18	16	
F. Nam Tisang, Upper Irra- waddy	90	95	20	16	
F. Dreyi, Mishmi	88	94	20	15	
M. Type. Laitkynsao, Assam	90	83	19	15½	Weight 75 oz.

trapped in bed of torrent. *M. p. pahari*: Nam Tamai Valley; trapped in jungle. Chuntang; mammae 10; weight 7½ oz.

Cranial characters.—Moderately large mice, the occipito-nasal length varying between 23 and 26 mm. Generally the diastema is short, as in *Mus musculus*; in only three specimens I have measured from India is it as high as a quarter of the occipitonasal length. Rostrum rather short. Supraorbital ridges normally absent. Suture of frontals and

parietals about as in other species of *Mus*. Interparietal large. Bullae of medium size. Pterygoid fossae tend to be rather shallow, and posterior nares rather wide. Palate short, less than half the length of the occipitonasal, which is unusual in Indian *Mus*. Palatal foramina short, for this genus; often barely reaching the toothrows, and normally less than one-fifth of the occipitonasal length. (Half a dozen individual exceptions in about 29 skulls). Zygomatic plate usually but little cut back above. Mandible with quite strong coronoid process.

Dental characters.—Upper incisors narrow yellow, plain, and often with the subapical notch present. Molars tending to be rather generalized in type for the present genus; M. 1 with eight cusp spaces; moderate inward distortion of the anterointernal cusp; M. 3 small; M. 2 apparently with six cusp spaces. The front root of M. 1 is moderately thrown forwards. Outer row of cusps of upper molars originally well developed. M. 1 often seems about equal to M. 2 plus M. 3, but the latter tooth seems constantly strongly reduced. Lower molars biserially cuspidate as usual; three laminae on M. 1, two on the other teeth. M. 3 is very strongly reduced, but bilaminate originally.

Cranial measurements.—As in Table 100, below.

TABLE 100.—*Cranial measurements of the Indian races of Mus pahari*

	Occipito-nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus pahari pahari</i>					
15.9.1.198	24.3	11.5	5.7	5.0	3.7
Chuntang, Sikkim.	Foramina measurement=longer side				
M. 16.3.25.113	25.8	12.3	6.3	5.0	3.5
Darjeeling					
M. 16.3.25.66	25.9	12.3	6.4	5.0	?
Pashok, Sikkim					
M. 16.3.25.66	25.4	12.0	6.1	4.7	c. 3.5
Pashok					
F. 16.3.25.67	25.1	12.1	6.2	5.3	?
Pashok					
F. 16.3.25.68	25.3	12.1	6.4	5.0	?
Pashok					
M. 16.3.25.112	25.2	11.9	6.2	4.9	c. 3.6
Darjeeling					
F. 16.3.25.115	25.7	12.3	6.3	4.8	3.6
Darjeeling					
F. 16.3.25.116	25.8	12.5	6.3	5.3	3.7
Darjeeling					

TABLE 100.—*Cranial measurements of Mus pahari (concl'd.)*

	Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus pahari pahari</i> (concl'd.)					
M. 20.6.7.44 Lohit Valley, Sadiya	24.2	11.4	6.0	4.8	?
F. 2.11.1.64 Nam Tamai, Upper Burma. Old	26.1	12.6	6.9	c. 5.0	3.8
M. 80.11.11.82 Darjeeling	23.4	11.2	5.3	4.3	3.5
M. 16.3.25.14 Darjeeling	24.8	11.7	6.0	4.6	3.6

The type has the occipitonasal about 25.1 mm.

Mus pahari jacksoniae

M. 20.11.1.46 Tura, Garo Hills, Assam	23.3	11.1	5.5	4.5	3.5
M. 21.12.5.72 Dening, Mishmi	24.4	11.7	5.7	4.8	3.7
M. 21.12.5.73 Dening	23.6	11.2	5.2	4.7	3.8
M. 21.12.5.74 Dening	24.2	11.6	5.7	4.9	3.7
M. 21.12.5.75 Dening	23.9	11.6	5.7	4.4	3.5
F. 21.1.6.77 Khonshnong, Jaintia Hills, Assam	24.9	12.7	6.6	5.2	3.9
F. 21.12.5.77 Dening, Mishmi	23.6	11.1	5.4	4.4	3.5
F. 21.12.5.78 Dening	23.8	11.5	c. 5.7	4.4	3.5
F. 21.12.5.79 Dening	23.8	11.5	5.6	4.6	3.5
F. 21.12.5.82 Dreyi, Mishmi	24.9	12.0	6.2	5.1	3.5
F. 21.12.5.83 Dreyi	24.5	12.0	5.9	4.8	3.8
M. 21.12.5.81 Dreyi	23.7	11.7	c. 5.7	4.7	3.7
M. 21.12.5.76 Dening, Mishmi	25.0	12.0	5.8	5.0	3.7
M. 21.7.6.18 Mokokchung, Naga Hills, Assam	24.5	11.7	5.5	4.9	3.7

The type has the occipitonasal about 24.3 mm.

Dimensions of Mus pahari, all races included, in British Museum material.—The head and body length varies between 75 and 105 mm. Tail between 70 and 107 mm. Hindfoot

17–23 mm. The occipitonasal varies between 23·3 and 26·1 mm. Toothrow 3·5–3·9 mm.

Key to the Indian subspecies of Mus pahari

- 1 (2) In the majority of specimens, the occipitonasal length of the skull exceeds 25 mm. (4 exceptions in 14 skulls). *M. p. pahari*
- 2 (1) The occipitonasal length does not reach 25 mm. (1 exception in 15 skulls). *M. p. jacksoniae*

I cannot see that these two forms differ very markedly from each other in colour, but there is a distinct size difference in average length of skulls, as just indicated.

(i) **Mus pahari pahari** Thomas

1916. *Mus pahari* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 3, 415.

Type-locality.—Batasia, Sikkim, 6,000 ft.

Range.—Specimens examined from SIKKIM: Batasia, Chungtang. Darjeeling: Pashok. ASSAM: Lohit Valley, Sadiya. Golohat in Naga Hills. UPPER BURMA: Nam Tamai.

(ii) **Mus pahari jacksoniae** (Thomas)

1921. *Leggada jacksoniae* Thomas, *J. Bombay nat. Hist. Soc.*, **27**, 3, 596.

Type-locality.—Laitkynsao, Khasi Hills, Assam.

Range.—Specimens examined from ASSAM: Khonshnong in Jaintia Hills, Mokokchung in Naga Hills, Laitkynsao in Khasi Hills, Tura in Garo Hills; Dening and Dreyi, Mishmi. NORTH BURMA: Nam Tisang (Upper Irrawaddy).

On average smaller in skull size than the last.

The allied race *M. pahari gairdneri* Kloss, from Siam and Indo-China named in 1920, antedates *jacksoniae*. But it seems, judging by our material, to differ from both of the above Indian races by its shorter tail.

111. Mus mayori (Thomas)

Mayor's Mouse

1915. *Coelomys mayori* Thomas, *J. Bombay nat. Hist. Soc.*, **23**, 3, 416.

Distribution.—Ceylon.

This mouse, which has a rather generalized first upper molar for the present genus, agrees with *M. pahari* in its

shortish palatal foramina, which are less than one-fifth, normally, of the occipitonasal length. The size is large, occipitonasal length usually exceeding 27 mm., though not apparently reaching 30 mm. The toothrow length exceeds 4 mm., and the hindfoot is 23 mm. and more. The diastema is over a quarter of the occipitonasal length. Tail apparently most often exceeding head and body length.

External characters.—Largish dark mice, head and body exceeding 100 mm. in large specimens, with thick fur, slightly inclined to be bristly in the typical race, and definitely so in *pococki*. Tail often a little longer than head and body, sometimes a little shorter. Hand with four functional fingers, all clawed. Foot with five toes, all bearing claws, fifth toe longer than hallux, but shorter than central three toes. Apparently six plantar pads.

Colour.—Dorsally dark brown throughout. Underparts typically but little lighter; occasionally mixed with dirty whitish; or in *pococki*, pure white. Feet usually dark, with white toes. Tail usually dark above, pale below. Dorsally, *pococki* tends to have the head and shoulders rather lighter brown than in the typical race, as far as the scanty material shows.

External measurements.—As in Table 101, below.

TABLE 101.—*External measurements of the Indian races of Mus mayori*

	Head and body	Tail	Hind- foot	Ear
<i>Mus mayori mayori</i>				
F. Pattipola, Ceylon	90	99	24	18
F. Pattipola	90	99	25	16½
F. Pattipola	89½	85	23	17½
F. Pattipola	94	103	25	17½
M. Pattipola	105	99	23	16
F. Pattipola	89	100	25	16½
F. West Haputale, Ohiya	93	94	23	16
F. West Haputale	100	90	23	18
M. West Haputale	110	100	23	19
West Haputale. Type	98	102	26	17
<i>Mus mayori pococki</i> ('bicolor')				
Type. Kottawa, Ceylon	104	82	25	17½ Tail imperfect
F. Mousekande, Gammaduwa, Ceylon	90	93	25	17

Notes from skins.—*M. m. mayori*: Pattipola, trapped in jungle, wet and misty, and 'near summit level' *M. m. pococki*: Trapped in the jungle at Mousekande, Gammaduwa.

Cranial characters.—Largish mice, occipitonasal length usually about 27–29 mm. Nasals rather narrow, and rostrum rather pointed. Supraorbital ridges very weak. Suture of parietals and frontals about as in the other members of the genus. Interparietal apparently well developed. Bullae rather small. Pterygoid fossae very shallow. Palate often slightly less than half the occipitonasal length. Muzzle not shortened, the diastema exceeds a quarter of the occipitonasal length. Palatal foramina rather short for this genus, barely reaching the toothrows in some specimens, and less than one-fifth of the occipitonasal length normally. Zygomatic plate moderately well cut back above. Lower jaw with quite well developed coronoid process.

Dental characters.—Upper incisors narrow, opisthodont, yellow and plain. M. 1 larger as a rule than M. 2 plus M. 3, but with the anterointernal cusp not specially distorted inwards. M. 1 with eight cusps, M. 2 with six. M. 3 vestigial. Outer row of cusps of upper molars well developed. Front root of M. 1 not very much thrown forwards. This tooth seems to have three main (or possibly four) roots in a specimen examined. In a way this species is dentally intermediate between *Rattus* and *Mus*, but on account of its very small M. 3 and enlarged M. 1 it seems most reasonable to refer it to *Mus*. Lower molars without extreme peculiarity; M. 3 strongly reduced, but originally bilaminate.

Cranial measurements.—As in Table 102, below.

TABLE 102.—*Cranial measurements of the Indian races of Mus mayori*

	Occipito- nasal	Palate	Diastema	Palatal foramina	Toothrow
<i>Mus mayori mayori</i>					
M. 15.3.1.239 Pattipola, Ceylon	28.5	14.1	7.6	5.5	4.2
F. 15.3.1.240 Pattipola	27.8	13.5	7.0	5.2	4.1
F. 15.3.1.244 Pattipola	c. 25.3	13.3	6.8	5.3	4.1
M. 14.12.1.7 Pattipola. Type. Old	29.4	?	c. 7.8	5.7	4.2
<i>Mus mayori pococki</i> ('bicolor')					
F. 23.12.15.153 Mousekande, Ceylon	28.9	14.6	7.6	5.5	4.4
F. 35.10.6.11 Mouskande	29.5	14.4	7.5	5.7	4.6

Dimensions of Mus mayori, in British Museum material.—The head and body length varies between 89 and 110 mm. The tail between 82 and 103 mm. Hindfoot 23–25 mm. The occipitonasal varies between about 25·3 and 29·5 mm. Toothrow 4·1–4·6 mm.

Key to the races of Mus mayori

1	(2) The underparts pure white	<i>M. m. pococki</i>
2	(1) The underparts dark, or at most with white coloration only suggested, or mixed with a considerable proportion of brown	<i>M. m. mayori</i>

Doubtless these two types might be found to intergrade if more specimens for the former came to hand. One specimen of the typical race has a white spot on the chest, and two others have some ventral white colouring present, but the other skins, about eight in number, have the belly dark.

(i) **Mus mayori mayori** (Thomas)

1915. *Coelomys mayori* Thomas, *J. Bombay nat. Hist. Soc.*, **23**, 3, 416.

Type-locality.—Pattipola, Central Ceylon, 6,120 ft.

Range.—Specimens examined from CEYLON: Pattipola and West Haputale.

(ii) **Mus mayori pococki** Ellerman

1915. *Coelomys bicolor* Thomas, *J. Bombay nat. Hist. Soc.*, **24**, 1, 49. Not of Tichomirow and Kortchagin, 1889.

1947. *Mus mayori pococki* Ellerman, *J. Mamm.*, **28**, 382. New name for *bicolor* Thomas, preoccupied.

Type-locality.—Kottawa, Southern Province, Ceylon, 250 ft.

Range.—Specimens from CEYLON: Kottawa, Mousekande.

Underparts white, lighter than in the typical race.

I named this race for the late Mr. R. I. Pocock who did such good work for Indian mammalogy.

(iiia) **Mus guhai** Nath

See Appendix.

Genus 41. Acomys Geoffroy

1838. *Acomys* I. Geoffroy, *Ann. Sci. nat. Paris, Zool.*, **10**, 126.

Type-species.—*Mus cahirinus* Desmarest.

Distribution.—South, East, Northern, West, and North

Africa, in which continent the genus is commonest. Islands of Crete and Cyprus. Parts of South-West Asia, from Arabia, Israel, South Persia, eastwards to WEST SIND.

Apparently this genus has only once been taken in Indian territory. It is a valid and distinct genus, which mostly inhabits deserts. The dentition is essentially as in *Rattus* (i.e. lacking the posterointernal cusp), but the foremost space between the pterygoid bones is roofed in by bone, a most unusual character, and the fur is always spiny, sometimes densely so.

The best known Palaearctic members of this genus are *A. russatus* Wagner, 1840, a distinct species from Egypt and Arabia, with the soles of the hands and feet black, *A. cahirinus*, the type-species and earliest named form, and *A. dimidiatus* Cretzschmar, 1826, from Sinai. Typical *cahirinus* is normally a very dark form which may well be a commensal or house-dwelling race, and it is probable that *dimidiatus* is a lighter coloured wild race of it. Thomas separated the solitary specimen from India as *flavidus*, but it is only a nominal form and a possible synonym of *dimidiatus*.

112. *Acomys cahirinus* (Desmarest)

The Spiny Mouse

1819. *Mus cahirinus* Desmarest, *Nouv. Dict. Hist. nat.*, 29, 70.

Type-locality.—Cairo, Egypt.

Typically a dark, slate-coloured, and apparently commensal form. The characters, apart from those indicated above, will be dealt with below; the soles of the hands and feet are not black; compare *A. russatus*.

This species is difficult to divide satisfactorily into races. The Indian race was formerly referred to *A. (c.) dimidiatus* Cretzschmar, 1826, unquestionably a valid race, averaging larger than the typical race, and of a different colour. Unfortunately the Indian race was one of the last to be named, and based on a single specimen is nearly unclassifiable. The length of the tail, it may be noted, is curiously unreliable in this genus; there is great individual variation and there seems a marked tendency for the tail to be lost in life.

External characters.—(*Acomys cahirinus dimidiatus*, based on specimens from Sinai, Israel, and Chahabar in South Persia): Size of a mouse, head and body length varying between 94 and 120 mm. Tail variable in length individually, sometimes longer than head and body, sometimes

shorter, moderately clad with short bristle-like hairs, but the scales plainly visible and rather thick. Fur of back densely and sharply spiny throughout, but not so on the head. Ear large, usually tending to be slightly longer than or as long as hindfoot. Feet rather broad and short. Hand with four functional fingers, all bearing claws, sometimes the thumb is also apparent. Foot with five toes, all clawed, the hallux the shortest. The head, sides, limbs and belly are hairy, not sharing in the spiny specialization of the back. Colour above sandy brown, below white. Soles of hands and feet not black (but brown as usual). Tail bicolor, near white below, darker above, or rarely nearly palish throughout.

The type of *A. c. flavidus* is in spirit. Thomas stated that it is like *dimidiatus* but 'colour paler and no line of demarcation on sides' 'Colour above very pale yellowish sandy, about as in *A. russatus aegyptiacus*, decidedly paler than *dimidiatus*. This colour gradually lightens on the sides, without sharp line of demarcation, to yellowish white.'

Head and body 90 mm., tail 101 mm., hindfoot $19\frac{1}{2}$ mm.

This specimen must have been in alcohol for very many years if it is the one written up by Blanford in 1891, and Thomas states that it is. I would doubt whether colour characters on such a specimen could altogether be trusted, and this name is by no means to be regarded as a guaranteed race until more specimens come to hand. If it differs from *dimidiatus*, it is on rather smaller size. But until more specimens come to hand, the status of the Indian *Acomys* must remain in doubt.

Cranial characters (based upon specimens from Arabia, Israel, Sinai, Persia, etc.).—The occipitonasal length in *A. c. dimidiatus* and immediate allies usually approximates to or exceeds 31 mm. in length, but the Sind skull is apparently just below this measurement. The nasals are narrow, long and pointed; the frontals prominently ridged and considerably constricted. The ridges tend to continue backward each side over the parietals, which are very wide; their suture with the frontals is broadly U-shaped, extending furthest forward on the sides. Interparietal very large and wide. The palatal foramina are very long, penetrating between the toothrows, usually more than 23% of the occipitonasal length. The length of the palate is much more than half the occipitonasal as a rule, but this is probably due to the unusual pterygoid structure. Bullae rather well inflated and large, usually apparently about 16-17% of the occipitonasal length. Posterior palatal structure highly abnormal, described by Miller, *Cat. Mamm. W. Europe*, 1912, 'The

anterior half of the mesopterygoid fossa closed by plate-like outgrowth from the palatines, which meet and form a distinct longitudinal ridge in median line, the open part of the fossa thus reduced to a small triangular space bounded chiefly by the hamulars.' The hamulars join the bullae, and the pterygoid fossae are shallow and rather flat. The zygomatic plate is rather projected forward and cut back above, anteriorly. Mandible with coronoid process extremely low and reduced, almost vestigial sometimes. The jugal tends to be rather long.

Dental characters.—The upper incisors narrow, yellow and plain. Molars rather broad. M. 1 with eight cusps, the posterointernal one absent, the anterointernal one rather distorted inwards, as in *Mus*; the outer cusps tending to be projected outwards somewhat; M. 2 with seven cusps traceable (the front lamina lacking the centre cusp only, but the anteroexternal one very small); M. 3 reduced in size, its elements not very clear, apparently more or less bilaminate. Lower molars as usual; biserially cuspidate, with two laminae on M. 2 and M. 3 and three on M. 1; M. 3 small and reduced.

Cranial measurements.—

	Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow
<i>Acomys cahirinus flavidus</i>					
91.11.1.11 Laki Hills, Sind. Type	30.3	16.1	7.0	4.8	4.6

Dimensions of Acomys cahirinus, all Palaearctic races (including Africa north of about 20° N.) included.—The occipito-nasal length varies between 25.9 and 33.3 mm. Toothrow 3.7–4.7 mm. Head and body length varies between 82 and 120 mm. Tail between 71 and 138 mm. Hindfoot 15–20 mm.

(i) *Acomys cahirinus flavidus* Thomas

1917. *Acomys flavidus* Thomas, *J. Bombay nat. Hist. Soc.*, 25, 2, 205.

Type-locality.—Laki Hills, Sehwan, Sind.

The type examined.

Not distinguishable with certainty from *Acomys cahirinus dimidiatus* Cretzschmar, 1826, Rüppell, Atlas, 37, from Sinai. Apparently slightly smaller than is normal for that race;

slightly smaller than the Cyprus race, slightly larger than the Cretan race, and the race *A. c. hunteri* (de Winton, 1901), which occurs in South Egypt. Slightly smaller than the Aden race and larger than the typical Egyptian race. (Size, as here understood, based on length of skull.) All these races, except one, antedate this name, so its retention is a matter of difficulty and doubt, based, as it is, on only one specimen.

Genus 42. *Golunda* Gray

1837. *Golunda* Gray, *Charlesworth's Mag. nat. Hist.*, 1, 586.

Type-species.—*Golunda ellioti* Gray.

Distribution.—At present only known from Indian territory, where it is common (Burma excepted). CEYLON, the PENINSULA of INDIA, northwards to West SIND, the NORTH-WEST FRONTIER, the PUNJAB, NEPAL, east to BHUTAN DUARS and NORTH KAMRUP.

This genus contains a mouse with highly abnormal dentition. The upper incisors are broad and prominently grooved. The cusps of the upper molars are most abnormally and peculiarly enlarged and raised up, particularly in the centre and inner rows. M. 3 is large and lacks the outer row of the cusps. Occasionally in worn teeth M. 1 may tend to become the smallest tooth, a most unusual occurrence in Murinae. The outer digits of the hindfoot, and the fifth finger are shortened. The toothrow is long and may sometimes be as much as one-fifth of the occipitonasal length. The zygomatic plate may, individually, be concave anteriorly. The supraorbital ridges are strong, the palate (usually about half the occipitonasal length or slightly less) is narrow. The foramina are long but less than 20% of the occipitonasal length, the bullae rather large, and the tail is usually shorter than the head and body. The peculiar dentition indicates specialization towards some kind of special diet. There is one species.

113. *Golunda ellioti* Gray

The Indian Bush-Rat

1837. *Golunda ellioti* Gray, *Charlesworth's Mag. nat. Hist.*, 1, 586.

Vernacular names.—(Blanford)—Gulandi, *Can.*; Utuelli, *Tam.*; Cofee-watte-meyo, *Cing.*

Type-locality.—Dharwar, India.

With the characters as indicated above. The peculiar enlargement of the cusps of the molars appears unique in

Asiatic genera. An Australian genus, *Mastacomys*, is similar to a certain extent though differing widely in detail, and some African genera present a certain resemblance to the present genus but are easily distinguished in detail, and on the whole are less aberrant. There is no posterointernal cusp in M. 1 and M. 2 in this genus.

Apart from the form *nuwara*, the races of this species are most doubtful and the others retained might just as well be placed in synonymy of the typical form.

External characters.—Rather thickset and heavy, smallish rats, with soft fur as a rule. Tail shorter than head and body normally, well haired for a Murine, with a good growth of hairs throughout its length under which the scales can be seen. Hand with four functional fingers. The fifth (outer) finger is very short, though clawed, scarcely reaching past base of D. 4. Second finger (D. 2) tends to be a little shorter than the two central ones. Foot with five toes; the two outer ones about equal to each other in length and very short, considerably shorter than the three central toes. All digits bearing claws. Apparently six plantar pads. Ear moderate in size. Mammae 8.

Colour.—General colour above yellowish brown speckled with black; sometimes varying to grey, as in *watsoni* and individual specimens of other races; sometimes the black tint predominates and sometimes the back can be coffee brown (light brown) but always speckled. Dorsal fur darker basally. Feet vary from darkish to whitish, individually at least in the typical race. Underparts usually drab grey, varying to yellowish; or, in some individuals of most of the commoner races and nearly constantly in *gujerati*, white or whitish. Tail clearly bicolor; near black above, near white below.

External measurements.—As in Table 103, below.

TABLE 103.—*External measurements of the Indian races of Golunda ellioti*

	Head and body	Tail	Hind- foot	Ear
<i>Golunda ellioti ellioti</i>				
M. Kardibetta Forest, Mysore	135	124	27	16
Gwalior	115	100	24	16
M. Morar, Gwalior	123	91	22	16
F. Morar, Gwalior	123	?	22	16
F. Binenganj, Gwalior	170	125	25	17
M. Binenganj, Gwalior	130	99	23	16
M. Binenganj, Gwalior	114	91	23	14
F. Hawbshavi, Dharwar	125	?	25½	16

TABLE 103.—*External measurements of Golunda ellioti (contd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Golunda ellioti ellioti</i> (concl'd.)					
M. Hawbshavi	150	120	26	16	
M. Hawbshavi	122	?	23½	17	
F. Hawbshavi	131	119	24	16	
F. Chettiri Range, Eastern Ghats	120	108	26	18	Mammae 8
Chettiri Range	116	116	24	19	
F. Chettiri Range	115	110	26	18	Mammae 8
F. Kurumbapatti, Salem, E. Ghats	100	115	25	19	
M. Paresnath, Hazaribagh	115	108	24	18	
F. South of Poona	121	100	23	17	
M. Ratnagiri, Konkan	128	106	25	17	
F. Ratnagiri, Konkan	120	74	23	16	
F. Sonawahnee, Balaghat	126	106	23	17	Mammae 8
M. Cumbum, Madura	130	112	25	17	
F. Shernduri, East Khandesh	109	95	25	16	
M. Ghodesgaon, East Khan- desh	129	106	25	17	
M. Asirgarh, Nimar	130	112	24	16	
F. Asirgarh, Nimar	140	118	24	16	Mammae 8
M. Asirgarh, Nimar	116	102	25	16	
M. Mundra, Sangor	108	107	24	17	
F. Mundra, Sangor	125	86	23	17	
M. Sakot, Hoshangabad	119	105	25	17	
F. Sakot, Hoshangabad	115	101	24	17	
M. Sakot, Hoshangabad	118	95	24	16	
M. Sakot, Hoshangabad	112	90	23	17	
M. Chikalda, Berar	125	115	25	?	
M. Chanda	117	?	23	17	

Golunda ellioti 'coraginis' = ellioti

F. Virajpet, South Coorg	140	c. 100	26	18½
M. Wotekolli, Coorg. Type	137	112	26	16½

Golunda ellioti 'bombax' = ellioti

F. Andheri, Salsette Island. Type	116	97	24	15
F. Andheri, Salsette Island	127	105	23	15

Golunda ellioti nuwara

M. Pattipola, Ceylon	147	119	26	16
M. Ambawela, Ceylon	135	101	27	16
F. West Haputale, Ceylon	138	100	25	18
M. West Haputale	136	97	26	18.

TABLE 103.—*External measurements of Golunda ellioti (contd.)*

	Head and body	Tail	Hind- foot	Era	
<i>Golunda ellioti gujerati</i>					
M. Dhrangadhra, Kathiawar	117	108	25	16	
F. Dhrangadhra	121	107	25	16	Mammae 8
M. Dhrangadhra	119	94	24	16	
M. Danta, Gujerat	124	122	25	16	
F. Danta	125	111	23	17	Mammae 8
M. Lunwa, Palanpur	123	120	25	15	
F. Lunwa	118	?	23	15½	Mammae 8
F. Lunwa	131	108	23	?	Mammae 8
F. Mount Abu, Rajputana	134	103	25	16	Mammae 8
M. Mount Abu	132	121	25	16	
M. Charwar, Cutch	116	?	23	15	
M. Motimijoti, Kathiawar	124	110	24	16	
M. Lunwa, Palanpur. Type	128	107	24	15	
<i>Golunda ellioti paupera</i>					
M. Handisera, Punjab. Type	123	95	21	15	
M. Ambala, Punjab	106	95	22	17	
M. Ambala	118	98	22	16	
<i>Golunda ellioti watsoni</i>					
M. Sukkur, Sind	120	122	25	17	
F. Jacobabad, Sind	115	107	24	17	
F. Gambat, Khairpur, Sind	119	116	23	16	
M. Naundero, Sind	120	115	25	20	
Also seen from Habb Valley, Sind.					
<i>Golunda ellioti myothrix</i>					
F. Sitabani, Ramnagar, Ku- maon	134	114	24	18	
M. Dela, Kumaon	120	111	25	16	
F. Bageswar, Kumaon	125	?	25	17	
M. Siluni, Chamba, Punjab	121	108	27	18	
F. Dharmsala, Punjab . .	121	103	25	19	
F. Damthal, Kangra, Punjab	124	112	25	18	
M. Damthal, Kangra	110	105	23	18	
F. Siluni, Chamba	127	115	27½	18	
F. Damthal, Kangra	120	124	25	18	
F. Gopalpur, Kangra Valley	124	100	24	18	
F. Kangra Fort	125	109	25	19	
M. Damthal, Kangra	131	122	26	18	
F. Kangra Fort	125	112	26	18	
M. Gopalpur, Kangra	150	106	26	18	
M. Damthal, Kangra	120	115	24	17	
F. Damthal, Kangra	105	93	25	18	
M. Damthal, Kangra	118	109	24	16	

TABLE 103.—*External measurements of Golunda ellioti (concl'd.)*

	Head and body	Tail	Hind foot	Ear
<i>Golunda ellioti myothrix</i> (concl'd.)				
Kangra	118	117	26	19
Gopalpur, Kangra	131	129	27	24
M. Sakesar, Salt Range, Punjab	139	127	25	17
F. Dhalwal, Salt Range	129	112	24	17
M. Damthal, Kangra	130	107	25	19

Golunda ellioti coenosa

M. Hasimara, Bhutan Duars	107	98	26	16
M. Hasimara	113	105	25	18
F. Hasimara	125	90	25	13
M. Hasimara	97	?	25	19
F. Hasimara	120	?	24	17
F. Hasimara	120	100	25	17
F. Locality ?	105	?	25	17
M. Bharnabhari, Bhutan Duars	113	100	25	17
M. Bharnabhari	107	98	25	16
F. Angarekhata, Kamrup	116	90	22	19
M. Hasimara. Type	116	102	26	17

The type of '*limitaris*', from the North-West Frontier (head and body 4 inches, tail 4.02, hindfoot 0.99 and ear 0.72 inches, 'shot amongst rocks where it had a kind of nest'), has very thick fur. A possible synonym of *watsoni*. Skull broken in only known specimen.

Notes from skins.—*G. e. myothrix*: Dharmsala, Punjab; five foetuses. Bageswar; mammae 8; $2\frac{3}{4}$ oz.

G. e. paupera: Ambala, Punjab; trapped in cactus hedge.

G. e. ellioti: Asirgarh, Nimar; trapped in hedge near cultivation, weight $2\frac{3}{4}$ oz., also $1\frac{3}{4}$ oz.; mammae 8; $3\frac{3}{8}$ oz.; mammae 8. Sakot, Hoshangabad; $2\frac{1}{8}$ oz. trapped in hedge, 2 oz. Sonawahnee, Balaghat; mammae 8; $2\frac{1}{4}$ oz. and 2 oz., caught in field. Mundra, Sangor; trapped under bush, mammae 8; $2\frac{1}{4}$ oz. Bineganj, Gwalior; trapped in a small garden near cultivation and jungle. Chettiri Range; mammae 8. Chikalda, Berar; $2\frac{1}{4}$ oz.; trapped under old wall. Shernduri, Khandesh; trapped on bank near water, 2 oz. Kardibetta Forest, Mysore; $2\frac{1}{4}$ oz. Hawbshavi, Dharwar; weight 2 oz. Chanda; trapped in hedge, weight 2 oz. Paresnath; $2\frac{1}{4}$ oz.

G. e. nuwara: West Haputale, Ceylon; caught at 10 a.m. in high grass and 'high grass, with coconut' Pattipola;

shot in tree in the jungle, nest quite 20 ft. from ground. Ambawela; 'caught by coolie with his hand'

G. e. gujerati: Danta; mammae 8; $2\frac{5}{8}$ oz. Dhrangadhra: mammae 8; $2\frac{1}{4}$ oz. in weight, $2\frac{3}{4}$ oz., 2 oz. Lunwa; mammae 8; $2\frac{1}{4}$ oz., $2\frac{3}{4}$ oz.; mammae 8; $2\frac{1}{8}$ oz. Motimijoti; $2\frac{3}{4}$ oz. Mt. Abu; mammae 8; $2\frac{3}{4}$ oz., $3\frac{1}{4}$ oz.

Cranial characters.—The occipitonasal length is about 29–35 mm. The nasals are rather heavy and tend to be somewhat narrowed behind. The frontals are considerably constricted just behind the lachrymal, and there are prominent supraorbital ridges; these ridges extend backwards over the sides of the parietals as well as the frontals. Suture of frontals and parietals tends to be broadly V-shaped; the interparietal is well developed and prominent. Occiput quite prominent and well ridged in the centre. Bullae large, usually about 16–17% of the occipitonasal length. The pterygoid fossae are deep. The toothrow is very long, most often more than one-fifth of the occipitonasal length, though not always so. The palate approximates to half the occipitonasal length or a little more or less. Palatal foramina long, mostly about 18% of the occipitonasal length on average in the various races. Zygoma powerful, with shortened jugal. Zygomatic plate well cut back above; occasionally there is a slight tendency for it to be concave in front individually (specimens with this formation suggested, from Bhutan Duars, Chikalda (Berar), Palanpur, Hoshangabad and Kathiawar, about half-a-dozen in number). The palate is narrow. Mandible with the lower outer border well ridged and the coronoid process quite well developed.

Dental characters.—Upper incisors wide, red and one-grooved, the groove placed slightly externally. Upper molars extremely heavily cuspidate. The centre row and inner row of the cusps are much enlarged, particularly, in the case of the inner row, in M. 2 and M. 3. M. 1 has eight cusps, lacking only the posterointernal, the centre ones the largest. M. 2 has two very large inner cusps, two centre cusps which are even larger, one moderately large and two small or vestigial outer cusps. M. 3 lacks the outer row and has a large anterointernal cusp, a largish cusp behind it, a very large centre cusp (which is external as the outer row has gone) and a small posterior central cusp. There are thus four functional cusps in this tooth. With wear, M. 3 tends to become the longest tooth and M. 2 tends to be longer than M. 1, a most unusual character. Lower molars; M. 1 with six approximately equal-sized cusps, the front pair tending to be smaller than those behind; M. 2 with four

approximately equal-sized cusps; M. 3 with two cusps on the front lamina and one only on the hinder lamina. Terminal heel of M. 1 and M. 2 strongly reduced. Lower incisors ungrooved. The dental characters of this genus are quite unique among Indian genera.

Cranial measurements.—As in Table 104, below.

TABLE 104.—*Cranial measurements of the Indian races of Golunda ellioti*

	Occipito-nasal	Palate	Palatal foramina	Bullae	Toothrow	Frontals width
<i>Golunda ellioti ellioti</i>						
M. 12.3.8.20 Chikalda, Berar	32.1	16.4	5.5	5.3	6.5	4.1
F. 12.6.28.41 Asirgarh, Nimar	30.7	15.3	5.7	5.1	6.4	4.0
M. 12.6.28.39 Asirgarh, Nimar. Old	32.6	16.1	5.5	5.2	6.7	4.1
M. 12.6.28.40 Asirgarh, Nimar	30.3	14.9	5.4	5.5	6.2	4.3
M. 12.6.29.120 Dharwar district	30.8	15.7	5.9	5.1	6.4	3.9
M. 12.6.29.121 Dharwar district. Old	31.3	15.5	5.6	5.3	6.0	4.4
Foramina measurement represents the longer side.						
F. 12.6.29.122 Dharwar	31.4	15.4	6.4	5.2	6.3	4.3
M. 12.11.28.120 Kardibetta Forest, Mysore	31.2	15.8	5.6	5.1	6.4	4.2
F. 12.6.29.123 Dharwar district. Old	32.2	16.2	6.5	5.1	6.3	4.6
Foramina measurement represents the longer side						
12.11.29.172 Sakot, Hoshangabad	30.5	15.5	5.2	5.3	6.2	4.4
M. 12.11.29.173 Sakot, Hoshangabad	31.1	15.7	5.8	5.4	6.3	4.2
M. 12.11.29.174 Sakot, Hoshangabad	29.8	14.9	5.0	5.2	6.3	4.3
F. 12.11.29.175 Sakot, Hoshangabad	29.5	14.5	5.5	5.1	6.4	4.0
M. 12.4.29.176 Sangor, Central Provinces	30.2	15.2	5.5 c.	5.0	6.3	4.3
M. 12.11.29.178 Sonawahnee, Balaghat	30.2	15.4	5.4	5.0	6.2	4.2
F. 15.7.3.65 Helwak, Satara	29.9	15.0	5.2	5.0	6.1	4.1
M. 15.4.3.154 Paresnath	31.4	15.8	5.7	5.2	6.3	4.1
F. 19.6.73.75 Poona	28.8	14.5	4.8	5.3	6.0	4.0

TABLE 104.—*Cranial measurements of Golunda ellioti (contd.)*

		Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Frontals width
<i>Golunda ellioti ellioti</i> (concl'd.)							
M.	23.3.27.1 Cumbum, Madura	33.0	?	6.5	5.5	6.7	4.6
F.	23.4.7.11 Bineganj, Gwalior. Old	33.1	16.9	5.1	5.5	6.7	4.6
	406b South India	31.4	15.0	6.0	5.2	6.2	4.4
F.	7.11.22.30 Bombay	30.1	14.8	5.4	5.4	6.0	4.2
The type has the occipitonasal length about 28.7 mm.							
<i>Golunda ellioti ellioti</i> ('bombax')							
F.	12.9.17.1 Andheri, Salsette Island	31.2	15.6	5.3	c. 5.2	6.3	4.8
F.	12.9.17.2 Andheri, Salsette Island. Type	31.4	15.8	5.7	5.2	6.0	4.5
<i>Golunda ellioti ellioti</i> ('coraginis')							
M.	13.8.22.66 Wotekolli, Coorg. Type	33.3	15.8	6.3	c. 4.8	6.7	4.5
<i>Golunda ellioti myothrix</i>							
M.	14.7.10.216 Dela, Ramnagar, Kumaon	31.4	15.3	5.7	5.3	6.2	4.6
F.	14.7.10.219 Bageswar, Kumaon	31.4	15.9	6.2	5.0	6.5	4.4
M.	23.4.6.9 Kangra Valley, Punjab	31.4	15.0	6.1	5.5	6.2	4.4
<i>Golunda ellioti watsoni</i>							
M.	15.11.1.118 Naundero, Sind	32.2	16.6	6.1	5.6	6.3	4.3
F.	15.11.1.120 Gambat, Sind	32.5	16.2	6.0	6.0	6.4	4.5
M.	91.11.1.12 Habb Valley, Sind. Old	35.2	17.6	6.5	?	6.7	4.7
F.	91.11.1.13 Habb Valley, Sind	31.8	16.0	6.2	5.4	6.6	4.5
M.	91.10.7.111 Habb Valley, Sind	33.0	16.6	6.3	5.6	6.7	4.9

TABLE 104.—*Cranial measurements of Golunda ellioti (concl'd.)*

		Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Frontals width
<i>Golunda ellioti gujerati</i>							
M.	13.9.18.44	31.6	15.9	5.7	5.5	6.5	4.6
	Lunwa, Palanpur.	Foramina measurement represents the longer side					
F.	13.9.18.45	33.1	16.2	5.9	5.8	6.3	4.6
	Lunwa, Palanpur						
F.	13.9.18.46	30.5	15.1	5.1	5.1	6.3	4.2
	Lunwa, Palanpur						
M.	13.9.18.47	31.6	16.2	6.1	5.8	6.3	4.5
	Mount Abu, Rajputana						
F.	13.9.18.50	31.7	15.5	5.6	5.8	6.0	4.7
	Palanpur. Old						
M.	13.8.8.68	29.6	15.1	5.3	5.3	6.1	4.2
	Dhrangadhra, Kathiawar.	Foramina measurement represents the longer side					
M.	13.8.8.69	31.1	15.3	5.2	?	6.2	4.3
	Dhrangadhra, Kathiawar						
M.	13.8.8.70	31.2	15.5	5.0	5.4	6.3	4.0
	Dhrangadhra, Kathiawar						
M.	12.10.4.91	31.1	15.6	5.5	5.2	6.2	4.8
	Charwar, Cutch						

The type has the occipitonasal 31.6 mm., the toothrow 6.4 mm.

Golunda ellioti coenosa

M.	16.7.29.74	. c. 32.1	16.0	5.2	?	6.0	4.4
	Bhutan Duars						
F.	16.7.29.77	33.3	17.3	6.2	c. 5.2	6.3	4.5
	Hasimara, Bhutan Duars. Old						
F.	16.7.29.78	32.0	16.1	5.6	5.4	6.0	3.9
	Bhutan Duars						
M.	16.7.29.79	31.1	15.4	4.8	5.3	6.4	4.3
	Bharnabari, Bhutan Duars						

The type has the occipitonasal 31.2 mm., the toothrow 6.3 mm.

Dimensions of Golunda ellioti, in British Museum material.—The occipitonasal length varies between 28.7 and 35.2 mm. Toothrow 5.6–7.0 mm. (only once under 6 mm. and only once reaching 7 mm.). The head and body length varies between 97 and 170 mm. (only once under 100). Tail varies between 74 and 129 mm. Hindfoot 21–27 mm.

Races.—In 1920, Wroughton recognized only three forms of *Golunda*, to all of which he gave specific rank; *ellioti* (including '*coffaesus*' and '*myothrix*'), with more or less the range of the species; 'darker, grizzled black and tawny'; 'grizzle

coarse'; *nuwara*, one of the two named forms from Ceylon, 'grizzle very fine'; and *watsoni*, Sind (including apparently the forms later called *limitaris*, *gujerati* and *paupera* by Thomas), 'paler, grizzled black and buff'

In 1923, Thomas worked through the species and recognized the following forms: *G. e. limitaris* Kohat, NW Frontier, 'nearly uniformly grey, as in *watsoni*; hairs much longer and softer than in *watsoni*—orbital rings, nasal spot and yellow spot at base of ear scarcely perceptible' Based on one specimen, the skull of which is hopelessly broken. *G. e. watsoni*, Sind, 'nearly uniformly grey—distinct, buffy eyerings, a buffy spot on each side of nose, and another at base of ear' *G. e. gujerati*, Palanpur and district, 'buffier and not so grey as *watsoni*'—'about the palest of genus, the foreback pale buffy, the hinder back ochraceous buff. Below buffy white—eyerings, nosepatches and earspots, ochraceous buffy, all well marked' *G. e. paupera*, Punjab, size less than in other races, hindfoot 21-22 mm. as compared with 23-25 mm. in most of the others. Tail less than 100 mm. in length. Undersurface less whitish than *gujerati*. Nosespot and eyerings present, but no spots at base of ears. *G. e. ellioti*, colour 'in general a greyish olive, darker than previous races, lighter than in those that follow—undersurface heavily mixed with slaty; 'facepatches generally distinct' *G. e. bombax*, 'a dark, strongly coloured, hot country race—general colour strong heavily lined greyish buffy, more or less tawny on the hinder back. Undersurface buffy or whitish, chest washed with buffy ochraceous. Facespots ochraceous' From Salsette Island, and Ratnagiri, Konkan. *G. e. coraginis*, Coorg, 'distinguished from *bombax* by its larger size, darker colour and less contrasted undersurface'. Supposed to be a large dark local race. The facespots dull ochraceous, not conspicuous. The two Ceylonese named races, *coffaeus* and *nuwara*, Thomas did not attempt to define but he added two more names on the mainland: *G. e. myothrix*, Kangra eastwards to Nepal, 2,000-6,700 ft. 'Colour in summer varying from greyish to buffy, the hinder back more or less tawny, undersurface washed with buffy. Nosespots, eyerings and earspots ochraceous. Hands and feet buffy. In winter the whole animal is greyer, hands and feet whitish.' *G. e. coenosa*, from Bhutan Duars and Kamrup. 'Pelage decidedly shorter and crisper' than in *myothrix*. 'Colour showing less seasonal change, a dull greyish brown with comparatively fine ticking. Summer specimens tending to be a little more buffy than winter, and all tending to be of duller hue than the corresponding forms of *myothrix*. Below muddy whitish with

little buffy suffusion. Facepatches scarcely perceptible.' Hands and feet brownish white.

On the material examined, I find it quite impossible to distinguish *coraginis* from *elliotti*. If it is desired to divide *myothrix* and *coenosa* (northern India) from *elliotti*, etc. (southern India), the clearest distinction seems to me to be in the proportions of the hindfoot and ear. These average longer in *myothrix*, *coenosa* and *watsoni* than in the other races, and it seems that some note must be taken of these characters if races are to be retained, as colour (as usual) is extremely variable individually. The characters noted by Thomas of the various facemarkings, eyespots, noserings, and patch below ear, seem to be based on very little marked and individual characters rather than characters which have any importance for racial discrimination.

G. e. watsoni seems to have a longer tail proportionately than in the other races. So far as I can see, it is quite impossible to distinguish *bombax*, *coraginis* and *coffaesus* from the typical race on colour.

Perhaps the more retainable races may be keyed as below :

Provisional key to the races of Golunda elliotti

1 (6)	The ear usually longer, more than 14% of the head and body length	2
2 (3)	Length of the tail is well over 90% of head and body in our specimens or can exceed head and body length. Back usually greyer in colour	
	<i>G. e. watsoni</i>	
3 (2)	Length of the tail is more often less than 90% of head and body. Back usually less grey in colour .	4
4 (5)	Colour as a general rule tends to be less dark	
	<i>G. e. myothrix</i>	
5 (4)	Colour as a general rule tends to be darker.	
	<i>G. e. coenosa</i>	
6 (1)	The ear usually shorter, less than 14% of the head and body length	7
7 (8)	Length of the hindfoot 22 mm. and less. (Very few skins available)	
	<i>G. e. paupera</i>	
8 (7)	Length of the hindfoot very rarely as low as 22 mm.	9
9 (10)	Dorsal coloration markedly darker (Four Ceylon skins can be retained on this character when compared with the remainder)	
	<i>G. n. nuwara</i>	
10 (9)	Dorsal coloration less dark .	11
11 (12)	Very slightly paler on average, more noticeably so below .	
	<i>G. e. gujerati</i>	
12 (11)	Less pale on average .	<i>G. e. elliotti</i> (and the remainder)

When all skins are taken into account, I am very doubtful about the retention of *gujerati* compared with *elliotti*, because individuals of both are quite indistinguishable. There is, perhaps, an average colour difference, but it is little marked.

(i) *Golunda elliotti elliotti* Gray

1837. *Golunda elliotti* Gray, *Charlesworth's Mag. nat. Hist.*, 1, 586.
 1839. *Mus hirsutus* Elliot, *Madras J. Litt. Sci.*, 10, 213.
 1850. *Golunda coffaeus* Kelaart, *J. Ceylon Br. Asiat. Soc.*, 2, 213.
 1923. *Golunda elliotti bombax* Thomas, *J. Bombay nat. Hist. Soc.*, 29, 375.
 1923. *Golunda elliotti coraginis* Thomas, *J. Bombay nat. Hist. Soc.*, 29, 375.

Type-locality.—Of *elliotti*, Dharwar; of *hirsutus*, southern Mahratta country; of *coffaeus*, Ceylon; of *bombax*, Andheri, Salsette Island, Bombay; of *coraginis*, Wotekolli, 2,000 ft., Coorg.

Range.—Specimens seen from Cumbum, Madura; Kardi-betta Forest, MYSORE; Dharwar and Hawbshavi, DHARWAR district; EASTERN GHATS: Chettiri Range, Salem; Kurumbapatti, Salem. BOMBAY STATE: Helwak, Satara; Poona, and south of it; Ratnagiri, KONKAN. KHANDESH: Ghodesgaon, Shernduri. CENTRAL PROVINCES: Asirgarh, Nimar. Chikalda, Berar; Mundra, Sangor; Sakot, Hoshangabad; Sonawahnee, Balaghat. BIHAR, Paresnath, Hazaribagh. GWALIOR, Bineganj, Morar; Chanda; Andheri, SALSETTE ISLAND. COORG, Wotekolli and Virajpet. CEYLON, Paradeniya, one skin labelled '*coffaea*', which is not distinguishable from the others.

(ii) *Golunda elliotti gujerati* Thomas

1923. *Golunda elliotti gujerati* Thomas, *J. Bombay nat. Hist. Soc.*, 29, 2, 374.

Type-locality.—Lunwa, Palanpur, Gujerat, 150 ft.

Range.—Specimens seen from KATHIAWAR: Dhrangadhra; Motimijoti. GUJERAT: Danta. Lunwa, Palanpur. RAJPUTANA, Mount Abu. CUTCH, Charwar.

Possibly but doubtfully distinguishable from the typical race on average paler colour, particularly below.

(iii) *Golunda elliotti paupera* Thomas

1923. *Golunda elliotti paupera* Thomas, *J. Bombay nat. Hist. Soc.*, 29, 2, 374.

Type-locality.—Handisera, near Ambala, Punjab, 500 ft.

Range.—Specimens seen from PUNJAB: Handisera, Ambala.

Possibly retainable owing to the fact that the hindfoot is shorter than is normal for all other races.

(iv) **Golunda ellioti nuwara** (Kelaart)

1850. *Mus newara* Kelaart, *J. Ceylon Br. Asiat. Soc.*, 2, 213.

1887. *Mus nuwara* Kelaart, *loc. cit.*, 327. (Emendation in reprint of the 1850 publication.)

Type-locality.—Nuwara Eliya, Ceylon.

Range.—Specimens seen from CEYLON: Ambawela, Patti-pola and West Haputale.

Distinguishable in material examined from those above owing to the unusually dark colour of the back.

(v) **Golunda ellioti myothrix** (Hodgson)

1845. *Mus myothrix* Hodgson, *Ann. Mag. nat. Hist.*, 15, 267.

Type-locality.—Kahulia Powa, Nepal.

Range.—Specimens examined from KUMAON: Bageswar, Sitabani, Dela (Ramnagar). PUNJAB: Kangra district; Dhamtal, Gopalpur, Kangra Fort, Chamba district; Dharm-sala, Siluni. Salt Range; Dhalwal and Sakesar.

Apparently distinguishable from those races above by having the ear averaging proportionately slightly longer.

(vi) **Golunda ellioti coenosa** Thomas

1923. *Golunda ellioti coenosa* Thomas, *J. Bombay nat. Hist. Soc.*, 29, 2, 376.

Type-locality.—Hasimara, Bhutan Duars, 300 ft.

Range.—Specimens seen from BHUTAN DUARS: Bharnabhari, Hasimara. KAMRUP: Angarakhata.

Possibly distinguishable from *myothrix* by the fact that the back tends to be slightly darker.

(vii) **Golunda ellioti watsoni** (Blanford)

1876. *Pelomys watsoni* Blanford, *Proc. Asiat. Soc. Beng.*, 181.

(1923. *Golunda ellioti limitaris* Thomas, *J. Bombay nat. Hist. Soc.*, 29, 373. Eleven miles west of Kohat, 2,200 ft., North-West Frontier.)

Type-locality.—Kirthar Range, Sind.

Range.—Specimens examined from SIND: Gambat; Habb Valley; Jacobabad; Naundero; Sukkur. One specimen from the North-West Frontier (type of *limitaris*). Averaging

greyer in colour than the last two races and with usually proportionately longer tail.

Genus 43. *Nesokia* Gray

1842. *Nesokia* Gray, *Ann. Mag. nat. Hist.*, 10, 264.

1860. *Spalacomys* Peters, *Abh. K. Akad. Wiss. Berlin*, 139.
Spalacomys indicus Peters ? = *Arvicola indica* Gray.

Type-species.—*Arvicola indica* Gray.

Range.—Northern INDIA; KUMAON, PUNJAB, RAJPUTANA, SIND, BALUCHISTAN, Afghanistan, Persia, Iraq, Arabia (where it is rare), Israel, Syria, Egypt, southern Russian Turkestan, Chinese Turkestan.

Highly specialized fossorial rats, in which the incisors are very proodont and the condylobasal length exceeds the occipitonasal length. Palatal foramina strongly shortened, 12–14% of the occipitonasal length as a rule. The palate is lengthened, averaging well over 60% of the occipitonasal length, the bullae are enlarged, averaging 18–22% of the occipitonasal length. The nasals are about 29–31% of the occipitonasal length. The tail is short, less than three-quarters of the head and body length. The size is medium, occipitonasal 34.6–45.5 mm. in our material, but the type skull of *N. i. brachyura* from Lob-nor in Chinese Turkestan is broken but probably exceeds 47 mm.

All the Bandicoot rats were formerly referred to the genus *Nesokia*, as by Blanford. Later, Thomas divided them into three genera, *Nesokia*, *Bandicota* (of Gray, 1873) and '*Gunomys*'. There is not the least excuse for retaining '*Gunomys*', which is a pure synonym of *Bandicota*, but it is reasonable to restrict the name *Nesokia* to the highly specialized Palaearctic Bandicoot rats of the species *Nesokia indica* (*Nesokia hardwickei* of Blanford) and to use *Bandicota* for the more generalized Indo-Malayan species.

There is only one species in restricted *Nesokia*.

114. *Nesokia indica* (Gray)

The Short-tailed 'Mole-Rat' or Bandicoot-Rat

1830. *Arvicola indica* Gray, *Illustr. Ind. Zool.*, 1, pl. xi.

With the characters of the genus, as described above. The chief generic character is the strongly shortened palatal foramina. The lower incisor root forms a prominent knob beside the condylar process of mandible.

External characters.—Rather heavily built rats; fur often rather short and harsh, but not always so. Tail shortened, usually about 70% of the head and body or slightly less; very poorly haired, nearly naked. Hand with four functional fingers, with quite large claws. Foot with five toes; the outer digits shorter than the central three; D. 5 slightly longer than the hallux which is clawed, as usual. Apparently six plantar pads. Mammae 2-2 = 8. The ear is usually more than one-tenth of head and body.

Colour.—There are two rather marked types of coloration in this species in India and it is likely that they represent two races. In the typical race, the back is rather dull brown; in *huttoni*, the back is paler, sand-coloured to rufous brown. Underparts, lighter or darker, are grey. Tail normally wholly dark.

External measurements.—As in Table 105, below.

TABLE 105.—*External measurements of the Indian races of Nesokia indica*

	Head and body	Tail	Hind- foot	Ear	
<i>Nesokia indica indica</i>					
M. Chak, Sukkur, Sind	175	115	33	19	
F. Rawalpindi, Punjab	138	97	30	17	
M. Rawalpindi	161	105	34	18	
F. Rawalpindi	160	113	30	18	
F. Sambhar, Rajputana	211	109	34	16½	
M. Frost Coll. 142, Uman- kot, Sind	160	110	30	18	
F. Kallarkahar, Salt Range, Punjab	183	126	35	21	Mammae 2-2 = 8
F. Kallarkahar	167	127	32	18	Mammae 2-2 = 8
F. Gandhala, Salt Range	146	107	31	18½	
F. Khojdar, Baluchistan, 27°45' N., 65°36' E.	153	118	34	19	
M. Kurram Valley	181	97	32	18	
M. Jerna, Ramnagar, Kumaon	159	105	30	18	
The last six were identified as ' <i>griffithi</i> '. Other skins from Ladha, South Waziristan; Tong, Sind; Quetta, Baluchistan; Kohat, NW.F.					
M. Pithoro, Sind, ' <i>beaba</i> '	175	116	32	17	
F. Type of ' <i>beaba</i> ', Pithoro	164	113	30	16	
Frost collections—					
F. 57. Panoaqil, Sind	145	105	25	15	
M. 90. Umankot, Sind.	130	95	27	14	

TABLE 105.—*External measurements of Nesokia indica (concl'd.)*

	Head and body	Tail	Hind- foot	Ear
<i>Nesokia indica huttoni</i>				
M. Pangjur, Baluchistan	169	129	36	22
F. Pangjur	150	117	34	19
M. Pangjur	180	127	27	20
F. Pangjur	156	118	33	20
M. Pangjur	158	118	35	18
M. Pangjur	190	130	35	20
M. Fittak, Pasht-i-kuh, Baluchistan	190	120	35	17

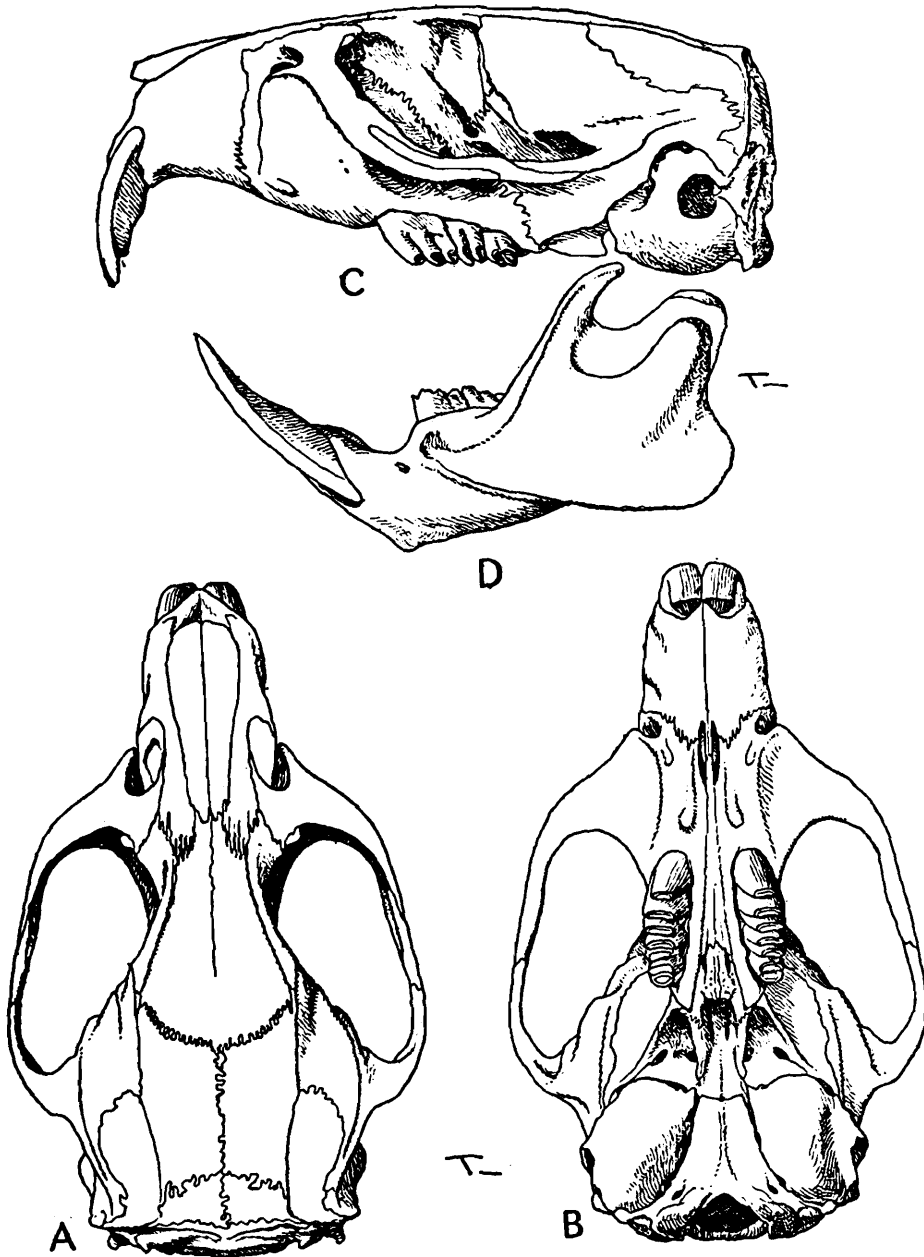
Also seen from Kalegar, Baluchistan.

Notes from skins.—*N. i. indica*: Kallarkahar, Salt Range; weight 6.75 oz.; mammae 2-2 = 8. Kohat; 'shot on burrow in a bank, common' Kurram Valley; 'trapped at burrow immediately outside verandah. Makes an open burrow' Gandhala, Salt Range; weight 4.5 oz.; mammae 2-2 = 8. Kallarkahar; weight 8 oz.; mammae 2-2 = 8. Jerna, Ramnagar, Kumaon; weight 6 oz.

N. i. huttoni: Fittak, Pasht-i-kuh; 'shot in burrow beside isolated spring; below limestone hills of 4,000 ft.' (This specimen was identified as *N. i. buxtoni*; its skull is broken.) Two specimens, Sind, no exact locality, not typical, colour more as *indica*, but not adult? 'Caught in burrow, field embankment, very common.'

Cranial characters.—The skull is massive, powerful, and fossorial in type. The nasals are short, less than one-third of the occipitonasal length. Frontals considerably constricted and braincase rather narrow; powerful supraorbital ridges are present and continue backwards from the frontals throughout the length of the parietals until they reach the occiput. Interparietal well developed. Occiput high, tending to be sloped forwards, and strong. Bullae large, usually but not always more than one-fifth of the occipitonasal length, well inflated. Pterygoid fossae very deep; palate raised up above general level of base of skull. The palate length is well over 60% of the occipitonasal. It is rather narrow, and the molars are rather wide. Palatal foramina very strongly shortened (6.2 mm. in length at most in Indian specimens), 14% or less of the occipitonasal length, but in Indian races usually less. They are situated about midway between the toothrows and the incisors, and the roots of the upper incisors usually show behind them. Zygomatic plate well cut back

above; zygoma powerful, and jugal shortened. Mandible with high recurved coronoid process, and with the lower incisor root extending outwards on to outer side of the jaw, forming a very high and conspicuous knob beside and almost as high as the condylar process. Lower border of angular portion wide and well ridged.



TEXT-FIG. 46. *Nesokia indica indica* Gray. A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. ($\times 4$).

Dental characters.—Upper incisors proodont, wide, plain, and either whitish or yellow in colour. Their roots, as

indicated above, usually show in the palatal aspect of the skull, behind the foramina. These teeth are very powerful. Molars simple, more or less a series of straight transverse plates, of which there are three on M. 1, two on M. 2, and two on M. 3. M. 3 is smaller than M. 2. There are, evidently, no traces of the original front lamina of M. 2; I have seen no specimens in which the anterointernal cusp, which is the one most often retained in this tooth, is suggested, except in one specimen as a minute vestige. M. 1 is 5-rooted. Lower molars a series of transverse plates, three laminae M. 1, two on the other teeth.

Cranial characters.—As in Table 106, below.

TABLE 106.—*Cranial measurements of the Indian races of Nesokia indica*

	Occipito-nasal	Palate	Palatal foramina	Bullae	Toothrow	Nasals
<i>Nesokia indica indica</i>						
The condylobasal length exceeds the occipitonasal length in all specimens; maximum about 48 mm.						
M. 27.7.15.10 Sind	34.6	21.9	4.1	7.6	6.6	10.4
F. 27.7.15.11 Sind	34.7	21.7	4.6	7.6	6.8	10.4
Both of the above specimens were identified as <i>huttoni</i> , but, although neither appears fully adult, their colour agrees with <i>indica</i> .						
M. 7.6.7.1 Kurram Valley, Punjab.	39.0	24.5	5.0	7.7	7.4	11.9
F. 19.11.8.44 Khojdar, Baluchistan.	40.8	?	4.9	8.3	8.3	12.4
81.5.30.3 Abdul Hassan, Punjab.	39.0	24.6	4.3	8.4	7.2	12.6

A '*griffithi*' skull also seen from Jerna, Ramnagar, Kumaon.

Frost collections—

M. 142 Umankot, Sind	38.2	24.2	4.9	8.0	7.3	11.2
F. Rawalpindi, Punjab 5.4.2.14. Young	35.2	22.2	4.9	7.4	6.9	10.7
M. 15.11.1.116 Chak, Sind	39.9	26.2	5.0	9.1	7.7	11.2
M. 21.7.14.7 Ladha, South Waziristan. 5,500 ft.	41.4	26.6	5.0	8.5	7.9	12.9
M. 21.1.14.8 Ladha, South Waziristan. Old. Condylobasal 48.2 mm.	45.4	29.5	4.8	8.9	7.9	15.2

TABLE 106.—*Cranial measurements of Nesokia indica (concl'd.)*

	Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Nasals
<i>Nesokia indica indica</i> (concl'd.)						
80.12.5.5 Jacobabad, Sind	37.4	24.6	4.7	8.0	7.1	10.9
81.5.30.1 Fategarh	37.5	23.5	5.0	7.8	7.1	11.0
M. 85.8.1.299 Sambhar, Rajputana	41.9	26.8	5.2	8.8	7.3	12.0
M. 85.8.1.300 Jeypur, Rajputana	39.6	26.2	4.8	8.9	7.8	11.2
91.10.7.116 Tong, Sind	42.7	26.9	5.4	9.2	7.6	12.6
8.9.13.8 Sind. ('beaba'). 5 roots M. 1	c. 36.1	22.6	4.5	c. 7.9	6.9	10.8
<i>Nesokia indica huttoni</i>						
M. 19.11.7.76 Pangjur, Baluchistan	44.0	28.5	6.1	8.9	7.9	13.8
M. 19.11.7.77 Pangjur. Young	38.6	23.7	5.1	8.2	7.5	11.8
M. 19.11.7.78 Pangjur	42.6	?	5.1	8.5	7.4	13.8
M. 19.11.7.79 Pangjur	40.9	25.5	5.0	8.5	7.6	12.3
M. 19.11.7.80 Pangjur	42.0	26.5	6.2	8.2	7.5	13.2
F. 19.11.7.83 Pangjur	c. 37.6	24.2	4.8	8.2	6.8	11.0
74.11.21.35 Kalegar, Baluchistan	40.7	25.6	5.4	8.2	8.0	12.7

Dimensions of Nesokia indica, in British Museum material, all subspecies included.—The occipitonasal length varies between 34.6 and 45.5 mm. But the type of *brachyura* (from Lob-nor), broken and not fully measurable, probably exceeds 47 mm. It is very old. Toothrow 6.6–8.7 mm. The head and body length varies between 130 and 211 mm. Tail varies between 95 and 130 mm. Hindfoot 27–36 mm.

In *huttoni*, I include a series of light coloured *Nesokia* from Pangjur, Baluchistan. Wroughton in the Summary stated that the coat was 'harsh' in *beaba*, 'soft and silky' in the other races; but I cannot detect the slightest difference in this texture between *beaba* duplicate skin and numerous specimens of *indica*. He also stated that *indica* had the fore-claws 'long and sharp', and '*griffithi*' has them short and

blunt, but this is surely an individual character peculiar to the types, if it exists, as it is not borne out in the duplicate series in the least. There are specimens which are more or less intermediate in colour even between *indica* and *huttoni*, but on average, *huttoni* seems retainable.

Other races of the species, in the British Museum include *N. i. bacheri* from Israel, and *N. i. brachyura* from Lob-nor, both extremely large forms apparently; *N. i. buxtoni*, in colour like *huttoni* but with a lighter belly as a rule (from Iraq), and *N. i. suilla*, the Egyptian race; colour like *indica*, but apparently differing in some cranial details.

Provisional key to Indian races of Nesokia indica

		[<i>ithi</i> ' and ' <i>beaba</i> ')
1	(2) Dorsal coloration darker. . .	<i>N. i. indica</i> (with ' <i>griff</i> -
2	(1) Dorsal coloration paler, more sandy or varying to light reddish	<i>N. i. huttoni</i>

(i) ***Nesokia indica indica* (Gray)**

Text-fig. 46

1830. *Arvicola indica* Gray, *Illustr. Ind. Zool.*, 1, pl. xi.
 1837. *Mus hardwickei* Gray, *Charlesworth's Mag. nat. Hist.*, 1, 585.
 1851. *Nesokia griffithi* Horsfield, *Cat. Mamm. Mus. East Ind. Co.*, 145. (Pushut, North-West Frontier.)
 1860. *Spalacomys indicus* Peters, *Abh. K. Akad. Wiss. Berlin*, 143.
 1908. *Nesokia beaba* Wroughton, *J. Bombay nat. Hist. Soc.*, 18, 741. (Pithoro, 25°30' N., 69°30' E., Central Sind Desert.)

Type-locality.—'India'.

Range.—Specimens examined from SIND: Umankot, Pano Aqil, Chak (Sukkur), Tong, Pithoro, Jacobabad. NORTH-WEST FRONTIER, Ladha, South Waziristan; Kohat, Pushut. RAJPUTANA, etc. Sambhar, Jeypur, Delhi, Fategarh. BALUCHISTAN: Khojdar, Quetta. PUNJAB: Abdul Hassan, Kurram Valley; Gandhala and Kallarkahar, both in Salt Range. Kurram Valley, Gandhala, Rawalpindi. KUMAON: Jerna, Ramnagar.

(ii) ***Nesokia indica huttoni* (Blyth)**

1846. *Mus huttoni* Blyth, *J. Asiat. Soc. Beng.*, 15, 139.

Type-locality.—Kandahar in Afghanistan.

Range.—Specimens examined from BALUCHISTAN: Pangjur; Fittak, Pasht-i-kuh; Kalegar; Afghanistan: Kandahar.

Turkmenia, Merv, representing *N. i. satunini*, Nehring, 1899, which is said to be a synonym of *huttoni*.

Genus 44. **Bandicota** Gray

1873. *Bandicota* Gray, *Ann. Mag. nat. Hist.*, 12, 418.

1907. *Gunomys* Thomas, *Ann. Mag. nat. Hist.*, 20, 203. (*Arvicola bengalensis* Gray.)

Type-species.—*Bandicota gigantea* Hardwicke = *Mus indicus* Bechstein.

Range.—Indo-Malayan Region; practically throughout INDIAN TERRITORY except that it does not occur west of the Indus River. In addition, known from Yunnan, Formosa, Indo-China, the Malay States, Siam, Sumatra, and Java. Northwards to KASHMIR and south to CEYLON, and east to BURMA.

Essentially like *Nesokia*, but less specialized cranially, and particularly with the palatal foramina long and unreduced. The palate is proportionately a little shorter on average than in *Nesokia*, and the tail is a little less shortened, but the real generic distinction lies in the length of the palatal foramina.

This genus was formerly referred to *Nesokia*, as by Blanford. It is, however, reasonable to retain Gray's name *Bandicota*. When Thomas revived that name in 1907, he also erected '*Gunomys*' for the smaller *Bandicota* Rats, based on vague and inconstant characters. For lack of distinguishing characters of '*Gunomys*', see Ellerman (1941, 277).

It appears also that there are only two valid species in the present genus, which are equivalent to Thomas's two genera. These two were variously split by Wroughton and Thomas, and in my former publication on the genera of Rodents, I thought there were five species in *Bandicota*. Subsequent detailed work, which indicates there is considerable overlap in measurements between the large *B. indica*, the medium-sized *B. nemorivaga*, and the small *B. savilei*, led me to the conclusion that in reality all these forms are one widely ranging species, different races of which differ in size, but are connected by intermediate types. I referred all named forms in the *B. bengalensis* group except *gracilis* to one species in my former work, the latter retained on a mammary character which (as usual with mammary characters) proves not valid when other races of *bengalensis* are looked at in detail.

The genus *Bandicota* is, in both species, reminiscent of *Rattus norvegicus* or *Rattus rattus* in some external characters, such as the wholly dark tail, the numerous mammae (12 or

more), and the dull underparts. The short tail, also, parallels *norvegicus*. It appears that *Bandicota* can be parasitic to a degree, which could account, as suggested by Thomas, for the occurrence of *B. i. nemorivaga* in Formosa; and possibly for the occurrence of *B. b. varius* in Penang. One wonders whether these rats take the place, to a large extent, of *Rattus norvegicus* in India, where that species is rare. Cranially, of course, *Bandicota* is entirely distinct from any *Rattus*. It always has a proportionately longer palate than in that genus, as well as normally the longer condylobasal. *Bandicota bengalensis* has its largest race, *B. b. varius*, and *Bandicota indica* has its smallest race, *B. i. savilei*, in South Burma. Specimens of *varius* can be larger than specimens of *B. i. savilei*. They may be distinguished best from each other by the palate measurement. The palate is always under 60% of occipitonasal in our small series for *B. i. savilei*, as normal for *Bandicota indica*; always approximating to or exceeding 60% of the occipitonasal in our small series for *B. bengalensis varius*, as normal for that species.

Key to the species of *Bandicota*

- 1 (2) The bullae are smaller, normally less than one-fifth of the occipitonasal length. The nasals are more than one-third of the occipitonasal length, as a rule. The length of the palate is less than 60% of the occipitonasal length. (Occipitonasal length 46-68 mm. Braincase proportionately narrower. The condylobasal length usually, but not always, is longer than the occipitonasal length) *Bandicota indica*
- 2 (1) The bullae are larger, usually more than one-fifth of the occipitonasal length. The nasals are as a rule less than one-third of the occipitonasal length. The length of the palate is normally more than 60% of the occipitonasal length. (Occipitonasal length about 35½-49 mm. Braincase usually proportionately wider. The condylobasal length always exceeds the occipitonasal length) *Bandicota bengalensis*

I refer to the condylobasal length in the key not because the two species differ in this character, but to indicate that *Bandicota indica* may occasionally have that length not

exceeding the occipitonasal, indicating that it is the least specialized cranially of the Bandicoot-Rats. Elsewhere in Asia among Murinae it is very rare that the condylobasal length is as long as the occipitonasal length (*Diomys* excepted). *Bandicota indica* is perhaps partly a commensal species.

115. *Bandicota bengalensis* (Gray)

The Indian 'Mole-Rat' or Lesser Bandicoot-Rat

1835. *Arvicola bengalensis* Gray, *Illustr. Ind. Zool.*, 2, pl. 21.

Vernacular names (Blanford).—Yenkrai, *Beng. Kok*, *Can. Golatta koku*, *Tel. of Yanadis*. ? Rekywek, *Burmese*.

Type-locality.—Bengal.

Distribution.—CEYLON northwards to KASHMIR: NEPAL eastwards to parts of BURMA. Penang Island off the Malay Peninsula, Sumatra, and Java.

This species is cranially like *Nesokia* in its very proodont incisors (condylobasal length always exceeds occipitonasal length), and its unusually long palate. It differs, however, in its long palatal foramina. The bullae are usually over one-fifth of the occipitonasal length. The nasals are proportionately shorter than in *Bandicota indica*. The size is usually, but not always, smaller than in *B. indica*. The tail is slightly less shortened than in *Nesokia*, as it is on average over three-quarters of head and body length in all races apparently. The mammae are very variable, but most often numerous, varying from 12 to 18.

External characters.—Generally but not always smaller than in *B. indica*. Fur usually short and harsh, but quite full and soft in *wardi*, the Kashmir race. The tail short, but usually over three-quarters of the head and body length (often over 80% of it). Hand with four fingers, all clawed, and foot with five toes, all clawed, the outer digits shorter than the central three, but the hallux is not so long as D. 5; fifth finger shorter than the other fingers. Mammae very variable; apparently 12 at lowest, 18 at highest; specimens examined with 12, 14, 15, 16, 17, and 18.

Colour.—Above dark brown, occasionally blackish, very rarely pale brownish or almost reddish. Feet usually dark, sometimes with the digits pale. Tail wholly dark, normally; occasionally very slightly paler below. Below grey, lighter or darker; rarely inclined to whitish, and rarely very dark grey.

External measurements.—As in Table 107, below.

TABLE 107.—*External measurements of the Indian races of Bandicota bengalensis*

	Head and body	Tail	Hind- foot	Ear	
<i>Bandicota bengalensis bengalensis</i>					
Angarakhata, Kamrup	193	154	35	23	
M. Angarakhata	190	145	34	22	
Angarakhata	210	157	37	24	
M. Angarakhata	182	129	33	21	
F. Angarakhata	192	144	35 ?	22	
F. Angarakhata	193	164	33	22	
F. Angarakhata	202	160	33	21	
M. Angarakhata	208	167	34	25	
F. Angarakhata	204	142	33	22	
Angarakhata	192	155	37	22	
F. Angarakhata	175	140	33	22	
F. Angarakhata	203	150	32	21	
F. Hasimara, Bhutan Duars	186	162	33	21	
Hasimara	170	142	30	22	
Hasimara	188	163	35	21	
M. Hasimara	170	155	35	22	
M. Golohat, Naga Hills, Assam	191	137	34	23	
F. Golohat	190	150	33	21	Mammae 14
F. Golohat	167	127	31	21	Mammae 14
M. Golohat	160	125	31	20	
Calcutta	180	145	32	20	
F. Tatkon, West Burma	158	144	37	20	
F. Pashok, Sikkim	163	154	34	22	Mammae 17
M. Pashok	201	145	33	22	
F. Pashok	178	143	33	22	
M. Pashok	194	166	32	23	
M. Pashok	195	165	33	23	
M. Pashok	194	152	33	23	
F. Pashok	161	137	30	20	
F. Pashok	164	140	32	21	
F. Pashok	169	143	30	22	
F. Nimbong, Darjeeling	165	130	33	21	
F. Ghoom, Darjeeling	196	157	33	20	Mammae 15
M. Narbong, Darjeeling	170	128	33	20	
F. Nimbong, Darjeeling	157	127	32	22	
Kalimpong, Darjeeling	170	145	32	22	
M. Kalimpong, Darjeeling	195	175	35	23	
M. Hazaria, Patheghatta, Nepal	174	155	35	23	
M. Gorkha, Nepal	180	160	35	23	
F. Bairia, Patheghatta, Nepal	158	153	34	23	
F. Takula, Kumaon	212	186	35	24	
F. Bageswar, Kumaon	204	161	34	24	Mammae 14
M. Bageswar	188	173	35	22	
M. Bageswar	195	160	37	24	
F. Salbani, Bengal	182	153	33	23	Mammae 12
F. Salbani	181	166	33	22	Mammae 15
F. Salbani	190	165	34	23	Mammae 14

TABLE 107.—*External measurements of Bandicota bengalensis (contd.)*

	Head and body	Tail	Hind- foot—	Ear	
<i>Bandicota bengalensis bengalensis</i> (concl'd.)					
M. Daltongunj, Bihar	164	148	34	23	
F. Daltongunj	181	157	34	24	Mammae 14
M. Daltongunj	163	158	36	22	
M. Daltongunj	185	172	36	24	
F. Daltongunj	193	178	35	23	Mammae 15
F. Rothai, Gwalior	232	180	34	25	
F. Morar, Gwalior	187	163	33	21	
M. Morar, Gwalior	225	202	39	26	
M. Guna, Central India	237	168	32	22	
M. Sangajata, Chaibassa, Orissa	191	168	34	23	
F. Luia, Chaibassa	179	147	33	22	Mammae 14
M. Luia, Chaibassa	179	156	34	23	
M. Luia, Chaibassa	211	178	35	24	
Bageswar, Kumaon	201	166	35	24	Mammae 16
F. Near Kalimpong, Sikkim	152	135	31	20	

Bandicota bengalensis kok

F. Ghodesgaon, East Khan- desh	162	142	33	22	
M. Ghodesgaon	178	157	38	24	
F. Ghodesgaon	173	148	34	23	
F. Ghodesgaon	148	129	32	19	
M. Ghodesgaon	174	155	34	24	
F. Vijayanagar, Bellary	195	166	35	22½	
F. Vijayanagar	190	174	35	22	
M. Vijayanagar	168	150	35	21	
M. Vijayanagar	190	155	35	21½	
F. Hawbshavi, Dharwar	193	163	35	23	
F. Hawbshavi	200	163	34	22½	
F. Devikop, Mahratta	184	165	35	24	
F. Gadag, Mahratta	204	171	33	24	
M. Gadag	182	167	34	22	
M. Gadag	200	175	36	24	
M. Gadag	185	154	33	23	
F. Gadag	181	149	32	22½	
F. Balapalli Range, Cudda- pah	165	145	32	22	
M. Balapalli Range	170	166	37	23	
M. Kodura, Balapalli Range	175	156	35	22	
Kodura, Balapalli Range	192	177	36	25	
M. Kodura, Balapalli Range	159	158	35	24	
F. Kodura, Balapalli Range	165	153	32	22	
F. Junagadh, Kathiawar	177	167	34	21	Mammae 16
M. Rajkot, Kathiawar	165	151	33	20	
F. Rajkot, Kathiawar	173	148	32	21	Mammae 14
M. Talala, Junagadh, Kathi- awar	157	149	34	20	

TABLE 107.—*External measurements of Bandicota bengalensis (contd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Bandicota bengalensis kok (concl'd.)</i>					
F. Srimangala, Coorg	175	144	33	22	
M. Ganoor, Nimar	177	?	35	23	
F. Chandgarh, Nimar	198	174	33	25	Mammae 16
F. Ganoor, Nimar	184	160	33	23	Mammae 16
M. Surat district	157	144	32	20	
M. Trivandrum, public gar- dens	185	143	35	21	
M. Ootacamund, Nilgiris	176	130	34	21	
F. Madha, Satara district	162	150	32	24	
M. Coonoor, Nilgiris	150	110	29	20	
M. Coonoor	160	117	31	21	
M. Kukhal, 77°25'E., 10°16'N.	193	143	34	22	
F. Kotagiri, Nilgiris	143	113	29	20	
M. Parola, East Khandesh	181	163	34	22	
M. Kolar, Mysore	192	159	35	22½	
F. Kolar	175	134	30	21½	
F. Dhain, Hoshangabad	158	131	35	23	
M. Kolar, Mysore	186	142	31½	21½	
F. Kolar	211	155	34½	23	
M. Dhain, Hoshangabad	212	182	39	24	
<i>Bandicota bengalensis kok ('sindicus')</i>					
F. Pithoro, Sind	200	176	35	22	
M. Pithoro	201	173	35?	24	
F. Pithoro	196	156	35	24	
F. Pithoro	184	145	33	20	
F. Pithoro. Type	199	165	33	23	Mammae 16
Frost collections—					
M. Umankot, Sind	180	145	35	22	
M. Umankot	225	180	35	20	
M. Umankot	195	160	35	20	
F. Umankot	190	160	33	23	
F. Dagshai, Simla Hills, Punjab	188	153	34	22	
F. Dagshai	128?	152	37	22	Mammae 15
M. Dagshai	223	174	36	25	
<i>Bandicota bengalensis kok ('lordi')</i>					
F. Bombay	225	217	40	21	
M. Bombay	225	140	35	24	
F. Bombay	190	165	36	23	
M. Shirgaon, Ratnagiri	150	?	33	21	
M. Konkan. Type	243	195	44	24	

TABLE 107.—*External measurements of Bandicota bengalensis (concl'd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Bandicota bengalensis kok</i> ('lordi') (concl'd.)					
M. Umankot, Sind	160	139	29	20	
F. Umankot	160	153	37	20	
F. Umankot	145	135	36	18	
F. Umankot	170	155	32	22	
M. Umankot	195	180	36	22	
<i>Bandicota bengalensis wardi</i>					
M. Chakothi, Kashmir	140	108	32½	21	
M. Manashal Wooler Lake, Kashmir	173	127	34	23	
M. Srinagar, Kashmir	165	136	36	22	
F. Siul River, Chamba	179	137	35	22	
F. Siluni, Chamba	167	137	35	23½	
M. Chamba	198	157	36	20	
M. Siluni, Chamba	180	156	34	22½	
F. Pandritton, Kashmir	195	132	35	23	
M. Pandritton. Type	198	155	37	25½	
<i>Bandicota bengalensis gracilis</i>					
M. Ammanewa, Ceylon	195	154	34	20	
F. Kandy, Ceylon	173	135	35	22	
F. Daltotta, Central Ceylon	167	121	31	21	Mammae in 6 pairs
<i>Bandicota bengalensis 'insularis'</i> (= <i>gracilis</i>)					
Thinney, near Jaffna, Ceylon	158	132	33	23	
F. Thinney. Type	186	142	34	21	
<i>Bandicota bengalensis varius</i>					
F. Toungoo, Burma	185	164	34	20	Mammae 9 pairs
M. Toungoo	226	175	37	22	
F. Toungoo	202	158	38	22	
M. Mergui Town	224	176	41	23½	
M. Mergui	255	165	41	25	
M. 12 miles SE. of Pegu	220	196	39	24	
F. 12 miles SE. of Pegu	180	?	35½	22	Mammae 6 pairs
M. 12 miles SE. of Pegu	216	175	38½	23	
M. Prome, Burma	244	192	41	22	

Notes from skins.—*B. b. kok*: Ghodesgaon; weight 4 oz., 5 oz. and 6¼ oz. Chandgarh; 9 oz. Mammae 16. Vijayanagar; 6¼ oz., 4¾ oz. and 5½ oz. Srimangala; 5¾ oz. Ganoor;

7½ oz. and 7 oz.; mammae 16; trapped among bushes bordering cotton field. Junagadh; 6¼ oz. and 6 oz.; mammae 16. Dhain, Hoshangabad; trapped in hut; 13 oz. and 5¼ oz. Rajkot; mammae 14; 7½ oz. Parola; 6 oz. Coonoor; burrowing in Botanical Gardens. Surat district; cultivation; their mounds are everywhere.

B. b. wardi: Siluni, Chamba; 7.25 oz. Tissa, Chamba; 6.25 oz. Manashal Wooler Lake; along river banks on margin of rice-fields. Kurram Valley; shot in fallow rice-field at river bank, at mouth of hole. Chakothi, Kashmir; trapped in garden.

B. b. indicus: Sind; caught in burrow, rice land, very common. Dagshai, Simla; caught in garden close to house; and mammae 15. And trapped in stone wall in garden. Eight pairs mammae, five young in uterus.

B. b. insularis: Thinney; dug out in paddy field.

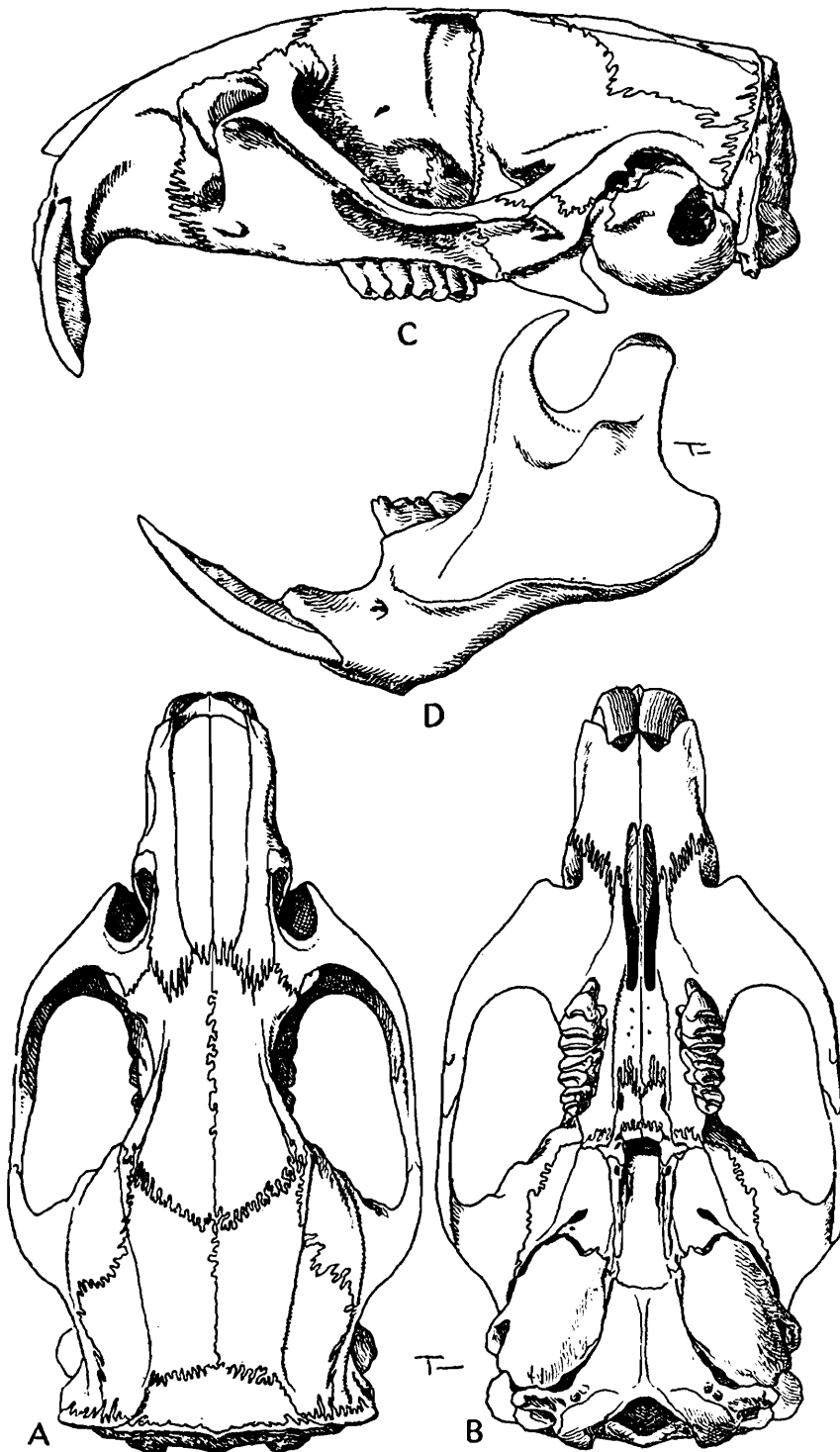
B. b. gracilis: Trapped in native house in village; Tammawewa, Kandy; caught in a sweet potato garden.

B. b. varius: Vitkangale, Pegu; mammae 6 pairs; weight 5½ oz. Dug up in paddy fields. Toungoo; trapped in garden. Prome; weight 17 oz.

B. b. bengalensis: Pashok; mammae 17. Weight 6 oz. Bageswar; 9½ oz. and 11 oz.; mammae 16; mammae 14; 11½ oz. and 12½ oz. Salbani; mammae 14; 10 oz.; mammae 15; 7½ oz.; mammae 12; 8 oz. Luia, Chaibassa; 12 oz. and 8½ oz. Daltongunj; mammae 14; 8 oz.; mammae 15; 9 oz.; 7½ oz. Takula, Kumaon; 11 oz. Angarakhata; 7.30 oz. and 7 oz. Rothiai, Gwalior; trapped in jungle. Guna; trapped in crops near burrow. Ghoom; mammae 15; 8 oz. Sangakata; 8 oz. Luia; mammae 14 (right 6, left 8); 8 oz. Narbong, 6 oz.

Cranial characters.—Differing, on average, from *B. indica* in proportionately shorter nasals, longer palate, and larger bullae. Also in relatively less narrowed braincase. Differing from *Nesokia* in much longer palatal foramina, and slightly shorter palate. Nasals of medium length, approximating to a third of the occipitonasal length, or less than this measurement, never much more. Frontals and parietals well ridged, the ridges often extending back to the occiput; interparietal usually well developed. The occiput quite strong, and tending to slope forwards. Bullae large, well inflated, normally over one-fifth of the occipitonasal. Pterygoid fossae deep. Palate long, usually more than 60% of the occipitonasal length, therefore proportionately longer than in the related *B. indica*, and indicating that the incisors are more proodont. Palatal foramina long and narrow, extending between the tooththrows, usually over one-fifth of

the occipitonasal length. Their length exceeds 7 mm. Zygomatic plate well cut back above; very occasionally the



TEXT-FIG. 47. *Bandicota bengalensis bengalensis* (Gray). A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. ($\times 5$).

anterior border may be concave. Zygoma powerful, jugal short. Mandible with high coronoid process, and with the root of the lower incisor forming a prominent knob beside the condylar process, often nearly as high as this process.

Dental characters.—Upper incisors broad and powerful, proodont, plain, and usually brown, sometimes whitish or pale. The molars are, with wear, a series of transverse plates, three on each lamina in M. 1, upper and lower, two on each lamina in M. 2, upper and lower, and the same on M. 3, which is in the upper series smaller than M. 2. Traces of the original front lamina in M. 2, i.e. the anterointernal cusp, are often lost in the adult, but this cusp space is traceable often in younger specimens, and it may also sometimes be traced in M. 3. In young specimens, the molars may be sometimes cuspidate, or more *Rattus*-like than *Nesokia*-like. M. 1 with 5 roots.

Cranial measurements.—As in Table 108, below.

TABLE 108.—*Cranial measurements of the Indian races of Bandicota bengalensis*

	Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Nasals
<i>Bandicota bengalensis bengalensis</i>						
Condylbasal constantly exceeds occipitonasal in this species.						
9.4.25.7 Purneah (? Bengal)	40.6	24.5	8.9	8.5	7.0	13.5
9.4.25.8 Calcutta. Rather young	38.3	23.2	8.0	8.0	6.4	12.5
M. 14.7.10.212 Bageswar, Kumaon	42.1	25.4	8.0	c. 9.2	7.4	13.3
M. 15.4.3.140 Daltongunj, Bengal	39.3	24.8	8.4	9.4	6.7	12.3
M. 15.4.3.142 Daltongunj, Bengal.	.. 39.1	23.9	8.0	8.9	7.3	12.4
F. 15.4.3.143 Daltongunj, Bengal.	40.2	25.2	8.7	9.2	c. 7.4	13.0
F. 15.4.3.145 Midnapur, Bengal	40.8	24.2	8.5	c. 8.8	7.0	12.5
F. 15.4.3.146 Midnapur, Bengal. Old	.. 43.9	27.3	9.0	9.8	7.4	14.5
M. 15.4.8.148 Luia, Chaibassa, Orissa	43.6	27.1	10.2	9.2	7.6	15.0
F. 15.4.3.150 Luia, Chaibassa	41.3	25.9	8.9	8.9	7.8	13.8
M. 15.4.3.151 Chaibassa	42.2	26.2	8.9	9.5	7.4	?

TABLE 108.—*Cranial measurements of Bandicota bengalensis (contd.)*

	Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Nasals
<i>Bandicota bengalensis bengalensis (contd.)</i>						
F. 15.9.1.195 Pashok, Sikkim	37.8	22.6	7.6	8.6	6.6	12.1
F. 15.9.1.196 Ghoom, Darjeeling	39.6	24.0	7.8	8.4	6.8	12.0
M. 15.9.1.197 Narbong, Darjeeling. 5-rooted M. 1	37.6	22.7	8.5	8.5	c. 7.3	11.0
F. 15.5.5.239 Tatkon, Burma. 5-rooted M. 1	37.6	22.8	8.3	7.7	?	11.8
M. 16.7.29.69 Hasimara, Bhutan Duars. 5-rooted M. 1	43.4	26.0	8.7	9.7	7.4	13.9
M. 16.7.29.70 Hasimara	41.3	25.2	8.7	9.3	7.3	13.5
M. 16.3.25.100 Pashok, Sikkim	41.7	25.7	8.7	9.4	7.5	13.2
M. 16.3.25.101 Pashok	40.2	24.7	8.5	8.6	6.7	13.2
F. 16.3.25.105 Pashok. Young	38.0	22.8	7.7	8.7	7.0	12.4
F. 16.3.25.106 Pashok. Young	36.7	22.0	7.5	8.8	6.6	12.1
F. 16.3.25.107 Pashok	37.2	22.7	7.6	8.6	7.5	11.7
M. 17.4.23.27 Kalimpong, Darjeeling	41.9	25.0	8.6	8.6	6.9	13.1
F. 17.4.3.28 Kalimpong, Darjeeling	38.9	24.4	8.8	8.6	6.7	12.3
F. 17.4.23.29 Nimbong, Darjeeling	37.4	22.1	7.7	9.0	6.7	11.8
F. 17.4.23.30 Nimbong, Darjeeling	39.1	23.2	7.9	8.7	6.6	12.8
M. 20.6.7.53 Golaghat, Assam	38.7	22.2	7.3	9.1	5.9	11.9
F. 20.6.7.55 Golaghat	38.2	22.2	7.5	8.7	c. 6.5	11.2
F. 20.7.6.56 Golaghat	38.5	23.4	7.8	8.7	6.4	11.0
M. 21.7.8.108 Angarakhata, Kamrup	40.4	24.7	8.2	9.5	7.2	12.4
M. 21.7.8.109 Angarakhata	38.9	22.7	7.8	8.8	6.4	12.5
M. 21.7.8.110 Angarakhata	39.7	24.3	8.3	9.1	7.2	12.6
M. 21.7.8.111 Angarakhata	38.6	23.2	7.9	9.4	7.0	11.5
M. 21.7.8.113 Angarakhata	41.4	25.0	c. 9.1	9.2	6.7	12.7

TABLE 108.—*Cranial measurements of Bandicota bengalensis (contd.)*

		Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Nasals
<i>Bandicota bengalensis bengalensis</i> (concl'd.)							
F.	21.7.8.119 Angarakhata	39.8	23.6	7.3	?	6.6	12.5
M.	25.7.3.14 Guna, Central India	40.5	24.5	8.8	8.4	7.2	13.2
	80.10.12.2 Calcutta. Old. Foramina measurement represents longer side	40.2	25.3	8.8	8.5	6.4	c. 13.4
	80.11.11.7 Calcutta	40.8	25.0	8.7	9.0	7.3	12.1
	409a Nepal	38.2	24.2	9.1	8.7	7.2	c. 11.6
	14.7.10.214 Bageswar, Kumaon. Old	45.5	27.9	9.6	9.7 (worn out)		14.0
<i>Bandicota bengalensis gracilis</i>							
F.	15.3.1.225 Kandy, Ceylon	40.3	24.5	8.1	8.7	?	14.4
M.	15.3.1.226 Tammanewa, Ceylon	41.4	25.1	8.8	8.8	6.7	14.3
M.	28.10.27.1 Galaha, Ceylon. (Subsp. ?)	36.7	22.2	7.2	7.6	6.2	12.0
F.	58.10.19.1 Ceylon	35.8	21.5	7.6	8.2	6.8	11.4
<i>Bandicota bengalensis 'insularis'</i> (? = <i>gracilis</i>)							
M.	35.10.6.1 Thinney, near Jaffna, North Ceylon. Young	35.5	21.6	7.5	7.8	6.5	?
F.	35.10.6.2 Thinney, near Jaffna. Type	c. 37.6	c. 23.6	?	8.1	6.3	c. 11.6
<i>Bandicota bengalensis kok</i>							
F.	9.4.25.9 Bombay	41.0	25.1	8.9	8.3	7.5	c. 13.2
M.	11.12.21.27 Ghodesgaon, Khandesh	39.4	23.8	8.5	8.7	7.5	12.2
M.	12.6.28.36 Asirgarh, Nimar	40.4	24.3	8.8	9.4	7.5	13.2
F.	12.6.28.37 Asirgarh	42.9	24.7	8.0	9.9	7.6	14.5
F.	12.6.28.38 Asirgarh	40.0	24.5	7.7	8.8	8.0	12.0
M.	12.6.29.109 Dharwar district	40.4	24.2	7.9	8.8	7.5	12.8
M.	12.6.29.110 Dharwar district	38.2	23.6	7.7	8.5	7.5	12.2

TABLE 108.—*Cranial measurements of Bandicota bengalensis (contd.)*

	Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Nasals
<i>Bandicota bengalensis kok (contd.)</i>						
M. 12.6.29.111 Dharwar district	40.1	23.9	8.1	9.5	7.8	12.7
F. 12.6.29.112 Dharwar district	40.4	25.2	8.5	9.2	7.6	12.8
F. 12.6.29.113 Dharwar district	42.0	25.6	8.4	?	7.4	13.7
F. 12.6.29.114 Dharwar district	39.0	22.7	8.0	?	7.2	11.8
F. 12.6.29.116 Dharwar district	39.9	24.9	8.5	8.7	7.3	13.3
M. 12.11.29.164 Dhain, Hoshangabad	45.4	27.2	9.8	9.6	7.3	14.7
M. 13.4.10.48 Vijayanagar, Bellary	38.9	24.4	8.6	8.7	7.2	12.1
M. 13.4.10.49 Vijayanagar	36.8	22.8	7.7	8.5	7.5	11.9
F. 13.4.10.50 Vijayanagar. Old	40.5	24.8	8.3	8.8	7.6	12.8
F. 13.4.10.51 Vijayanagar. Old	42.1	25.2	8.9	8.9	7.5	13.5
M. 13.8.8.64 Rajkot, Kathiawar. ..	37.4	22.7	7.6	8.3	c. 6.9	11.7
F. 13.8.22.64 Wotekolli, Coorg	40.8	25.8	9.2	c. 8.2	7.5	13.9
F. 13.8.22.65 Srimangala, Coorg. ..	37.1	23.4	8.5	8.7	6.5	11.3
F. 13.8.8.65 Rajkot, Kathiawar	38.0	22.6	8.2	8.4	7.0	11.4
F. 13.8.8.67 Junagadh, Kathiawar	40.5	23.7	8.6	9.4	7.6	12.3
M. 13.4.11.68 Kolar, Mysore	37.8	23.0	7.8	8.2	6.8	11.6
F. 13.4.11.69 Kolar	40.7	24.6	8.4	9.1	7.4	13.5
F. 13.4.11.70 Kolar	37.9	23.4	7.7	8.1	7.2	12.3
M. 11.12.21.26 Parola, Khandesh	39.6	23.7	8.9	8.8	7.5	12.4
M. 11.12.21.28 Ghodesgaon, Khandesh	40.6	24.6	8.5	8.8	7.5	13.0
F. 11.12.21.29 Ghodesgaon, Khandesh	39.4	23.0	7.8	8.7	7.4	12.8
F. 11.12.21.30 Ghodesgaon, Khandesh	37.2	22.2	7.8	8.4	7.5	11.3
F. 11.12.21.31 Ghodesgaon, Khandesh	37.5	22.4	8.1	8.7	7.2	12.1
F. 15.7.3.61 Madha, Satara. Young	36.0	21.6	7.3	8.2	7.0	10.8

TABLE 108.—*Cranial measurements of Bandicota bengalensis (contd.)*

	Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Nasals
<i>Bandicota bengalensis kok (concl'd.)</i>						
F. 15.7.3.60 Madha, Satara	39.2	23.4	8.3	?	7.1	12.8
F. 19.6.2.58 Ootacamund	36.9	23.2	8.3	8.8	6.9	11.3
M. 46.11.22.255 Madras	40.2	24.2	9.0	8.2	c. 6.8	13.5
M. 67.11.14.6 Madras	35.8	22.7	7.5	7.8	6.6	11.7
M. 80.9.20.4 Ootacamund	41.0	?	9.3	9.3	6.7	?
F. 94.9.6.1 Nilgiri Hills	39.6	24.4	7.6	7.9	7.0	13.9
94.7.1.17 Trivandrum, Travancore	40.8	25.2	8.8	8.2	6.7	13.3
M. 13.8.8.66 Talala, Junagadh, Kathiawar	37.3	22.4	7.7	8.3	6.9	11.4
M. 13.4.11.67 Kolar, Mysore	38.3	23.0	7.5	9.0	7.3	12.8
F. 95.3.8.1 Guynd, Nilgiri Hills. Old; teeth much worn	39.8	25.2	8.4	8.3	7.2	12.2
M. 99.2.21.1 Trivandrum, Travancore	37.3	22.9	7.7	7.6	6.3	?

A lectotype from Mahratta has the occipitonasal 38.9 mm.

Bandicota bengalensis kok ('sindicus')

F. 8.9.13.4 Sind	39.3	24.4	7.9	8.9	7.7	12.2
F. 8.9.13.6 Pithoro, Sind	42.0	25.7	8.9	?	7.8	13.2
M. 27.7.15.8 Sind. 5 roots M. 1	40.5	24.1	8.6	9.3	?	12.0
F. 27.7.15.9 Sind	41.0	24.6	8.3	8.9	6.7 c.	13.3
91.11.1.59 Shahbunder, Sind	40.1	24.5	7.8	8.8	c. 6.5	13.0
F. 8.9.13.7 Pithoro, Sind. Type	40.9	25.8	9.1	9.1	7.6	12.4
Frost collections—						
M. 92 Umankot, Sind	40.4	23.8	8.4	9.1	7.6	12.5
M. 87 Umankot	43.2	26.2	8.8	10.1	7.5	13.6
F. 100 Umankot	40.3	24.5	c. 8.6	?	7.7	12.8

TABLE 108.—*Cranial measurements of Bandicota bengalensis (concl'd.)*

	Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Nasals
<i>Bandicota bengalensis kok ('sindicus') (concl'd.)</i>						
M. 80 Umankot	39.5	23.1	7.5	8.0	7.1	12.1
M. 11.9.3.1 Dagshai, Simla	44.1	26.3	8.5	9.9	8.5	13.9
F. 11.9.3.4 Dagshai, Simla	43.0	25.6	9.2	9.6	8.5	13.6
<i>Bandicota bengalensis kok ('lordi')</i>						
M. 8.9.13.2 Kolaba district	39.3	24.0	8.1	c. 8.6	6.6	12.6
F. 12.9.17.4 Kadra, Kanara	44.2	26.5	9.0	c. 9.3	7.2	15.3
M. 15.7.3.62 Khed, Ratnagiri	45.5	27.8	9.7	9.5	7.3	15.2
M. 15.7.3.63 Shirgaon, Ratnagiri. Rather young	39.8	24.2	9.0	8.5	6.9	13.7
<i>Bandicota bengalensis kok ('sindicus')</i>						
Frost collections—						
M. Umankot, Sind	42.1	25.4	8.7	9.8	7.5	13.3
F. Umankot	35.1	22.0	7.4	c. 8.6	7.2	11.0
F. Umankot	38.3	22.7	7.5	8.7	7.1	11.1
F. Umankot	39.4	25.1	9.2	8.9	7.3	12.6
<i>Bandicota bengalensis varius</i>						
M. 14.12.8.214 Mergui Town, Tenasserim	45.8	27.5	10.1	?	7.0	16.2
M. 17.4.24.27 Vitkangale, south of Pegu, Burma. 5 roots M. 1. Occiput not quite complete	c. 45.2	28.0	10.6	?	7.7	15.3
M. 17.4.24.28 Vitkangale, south of Pegu	44.2	?	?	8.8	7.2	14.7
27.11.18.43 Prome, Burma	49.4	30.6	10.4	9.7	?	17.2
F. 27.11.18.44 Toungoo, Burma	44.8	26.7	9.2	9.2	7.3	14.1
<i>Bandicota bengalensis wardi</i>						
M. 8.7.6.33 Chakothei, Kashmir	36.6	22.2	c. 7.5	8.5	7.3	11.7
M. 26.9.2.17 Siluni, Chamba, Punjab	39.9	24.8	c. 8.0	8.4	7.5	12.3

Dimensions of Bandicota bengalensis, in British Museum material.—The occipitonasal length varies between 35.1 and 49.4 mm. Toothrow 5.9–8.5 mm. The head and body length varies between 140 and 266 mm. Tail varies between 108 and 217 mm. Hindfoot 29–44 mm.

The difficulty with this species is that one is dealing with two races which cover a very wide area of ground, and for which there are very many specimens indeed; and half a dozen subsidiary races, with not so many specimens. The two main races, *kok* and *bengalensis*, are very like each other, and whatever way one tries to classify them, there are numerous individual overlaps among the specimens. Therefore, it seems, the difference between them could only be average, never absolute. As regards the texture of the fur, used by Wroughton in his key to the Rodents in the Mammal summary, there is a certain difference between *wardi* from Kashmir, and the rest. I can detect no difference between *kok* and *sindicus*, although Wroughton states that *sindicus* has the coat 'coarse and harsh', *kok*, 'fine and soft'

Different individuals of *kok* vary from the close, harsh fur of '*sindicus*' almost to the soft full fur of *wardi*.

B. b. varius seems to stand apart from the others on size; but I do not believe '*lordi*', which Wroughton thought was a large race, is based on anything but large (and possibly over-stuffed) skins of *kok*. I cannot include *insularis* in the key as I have seen only the type and one more or less juvenile specimen. I do not believe that material seen for it is wholly adult.

Provisional key to the races of Bandicota bengalensis

1	(2) Large, the occipitonasal length exceeds 44 mm.	<i>B. b. varius</i>	
2	(1) Occipitonasal length rarely reaches 44 mm. (About 5 specimens out of about a hundred).		3
3	(6) Toothrow as a rule relatively longer; most often 7 mm. at least or exceeding 7 mm. (About 14 individual exceptions in 64 skulls)		
4	(5) Fur thick and soft.	<i>B. b. wardi</i> [' <i>lordi</i> ' and ' <i>sindicus</i> ']	
5	(4) Fur usually shorter and harsher	<i>B. b. kok</i> (including	
6	(3) Toothrow as a rule relatively shorter; most often below 7 mm. or 7 mm. at most. (About 17 individual exceptions in 44 skulls.)		7
7	(8) Tail less than 80% of head and body. So far as known, mammae 12 only	<i>B. b. gracilis</i>	

- 8 (7) Tail averages over 80% of head and body. Mammae usually more than 12. *B. b. bengalensis*

Our material for *gracilis* is very poor, and its characters must be taken as provisional.

This is how I visualize the races of this widely distributed and common species; i.e. an unusually large race, *varius*, from South Burma, and Penang; a medium-sized widely distributed race, *bengalensis*, from Orissa, Bengal, Nepal, Assam, Bhutan Duars, etc., in which the teeth tend to remain small; a very closely allied medium-sized widely distributed race, *kok*, from the whole of the Peninsula, Sind, and northwards to the Punjab, very closely allied but the teeth tend to become a little larger; a similar but thicker-furred Palearctic offshoot, *wardi*, in Kashmir; and a small-toothed race curiously like the typical race (*gracilis*) in Ceylon. Some specimens from Dagshai, Simla Hills, Punjab, labelled '*bengalensis*' have unusually large teeth and cannot be authentic *bengalensis*, nor are they *wardi* as their fur is very close and harsh. They seem nearest '*sindicus*', which I cannot on material examined separate from *kok*.

(i) *Bandicota bengalensis bengalensis* (Gray)*

Text-fig. 47

1835. *Arvicola bengalensis* Gray, *Illustr. Ind. Zool.*, 2, pl., 21. (Bengal.)
 1855. *Mus tarayensis* Horsfield, *Ann. Mag. nat. Hist.*, 16, 112. (Nepal.)
 1855. *Mus plurimammis* Horsfield, *Ann. Mag. nat. Hist.*, 16, 112. (Nepal.)
 1855. *Mus morungensis* Horsfield, *Ann. Mag. nat. Hist.*, 16, 112. (Nepal.)
 1878. *Mus* (*Nesokia*) *blythianus* Anderson, *J. Asiat. Soc. Beng.*, 47, 2, 227. (Bengal.)
 1878. *Mus* (*Nesokia*) *barclayanus* Anderson, *J. Asiat. Soc. Beng.*, 47, 2, 229. (Guna, Central India.)

Type-locality.—Bengal.

Range.—Specimens from WEST BURMA: Tatkon. ASSAM: Golaghat in Naga Hills. NORTH KAMRUP: Angarakhata. BHUTAN DUARS: Hasimara. SIKKIM and district; Ghoom,

* For ecological notes and body- and skull-measurements of specimens from Central Manipur and Western Burma, see M. L. Roonwal, 1949, *Trans. nation. Inst. Sci. India*, Calcutta, 3 (2), pp. 86-87, Pl. VI, Fig. 1; and 1950, *Rec. Indian Mus.*, Delhi, 47 (1) [1949], pp. 19; and 24-27.—EDITOR.

Kalimpong, Narbong, Nimbong, Pashok, near Kalimpong. NEPAL: Bairia, Gorkha, Hazaria. KUMAON: Bageswar, Takula. BIHAR and BENGAL: Calcutta, Daltongunj, Luia (Chaibassa), Orissa, Midnapur, and Salbani. CENTRAL INDIA: Guna. GWALIOR: Morar, Rothiai.

Medium size. Toothrow as a general rule 7 mm. and less, rarely much over 7 mm.

(ii) *Bandicota bengalensis kok* (Gray)

1837. *Mus kok* Gray, *Charlesworth's Mag. nat. Hist.*, **1**, 585. (Dharwar.)
 1839. *Mus* (*Neotoma*) *providens* Elliot, *Madras J.*, **10**, 209. (Southern Mahratta Country.)
 1854. *Mus daccaensis* Tytler, *Ann. Mag. nat. Hist.*, **14**, 173. (Deccan.)
 1908. *Gunomys lordi* Wroughton, *J. Bombay nat. Hist. Soc.*, **18**, 746. (Kolaba district, Konkan, Bombay.)
 1908. *Gunomys indicus* Wroughton, *J. Bombay nat. Hist. Soc.*, **18**, 746. (Pithoro, Central Sind Desert.)

Range.—Specimens examined from TRAVANCORE: Kukhal, Trivandrum. NILGIRIS: Coonoor, Kotagiri, Ootacamund. COORG: Srimangala, Wotekolli. MYSORE, Kolar. CUDDAPAH: Balapalli Range. BELLARY, Vijayanagar; DHARWAR district; Devikop, Gadag, Hawbshavi, Dharwar. KHANDESH: Ghodesgaon, Parola. CENTRAL PROVINCES: Dhain, Hoshangabad. Asirgarh, Nimar, also Chandgarh, Ganoor, and Sival, Nimar. BOMBAY: Ahmednagar; Madha, Satara, Poona; Surat district. KATHIAWAR: Rajkot and Talala, Junagadh. Kolaba district, BOMBAY, Khad and Shirgaon, Ratnagiri. KONKAN ('*lordi*'), which on zoogeographic grounds is most likely to belong in this race, and to be based on some overgrown individuals of it. SIND: Pithoro, and Umankot. PUNJAB: Dagshai, Simla Hills ('*sindicus*').

Much like the last race, but toothrow as a general rule 7 mm. and more, rarely below 7 mm.

(iii) *Bandicota bengalensis gracilis* (Nehring)

1902. *Nesokia gracilis* Nehring, *S.B. Ges. nat. Fr. Berlin*, 116. (Ceylon.)
 1850. *Mus dubius* Kelaart, *J. Asiat. Soc. Ceylon*, **2**, 2, 319. Not of Hodgson, 1845.
 1936. *Gunomys kok insularis* Phillips, *Spolia Zeylan*, **20**, 95. (Thinney, near Jaffna, North Province, Ceylon.)

Range.—Specimens from CEYLON: Daltota, Kandy, Tammanewa.

Much like the typical race, but tail apparently proportionately shorter. Few specimens available.

Note on Ceylonese races of Bandicota bengalensis.—The tail character which I gave in the key for *B. b. gracilis* is not entirely borne out by Phillips measurements for this species in the description of *B. b. insularis*. Figures given by this author are:

	Head and body	Tail	Hind- foot	Ear	
<i>B. b. gracilis</i>					
2 males, average	184	168	33½	22½	
4 females, average	167	133	32	19½	
<i>B. b. insularis</i>					
2 males, average	157	131	34	22	(young animals)
2 females, average	177	144½	33½	21	
<i>B. b. kok</i>					
3 males, average	197½	159	36	23	
Skulls	Greatest length	Tooth- row			
<i>B. b. gracilis</i>					
1 male	42·7	7·0			
2 females, average	38·8	4·5			
<i>B. b. insularis</i>					
1 young male	37	6·5			
2 females, average	39·6	6·5			
<i>B. b. kok</i>					
4 males	41·2	7·6			

Note that the toothrow given for *kok* is longer than *gracilis* and *insularis*, as was to be expected.

(iv) *Bandicota bengalensis wardi* (Wroughton)

1908. *Gunomys wardi* Wroughton, *J. Bombay nat. Hist. Soc.*, 18, 745.

Type-locality.—Pandritton, Kashmir, 5,500 ft.

Range.—Specimens seen from PUNJAB: Siul Lake and Siluni, Chamba. KASHMIR: Pandritton, Chakothi, Manashal Wooler Lake, Srinagar, Thelum Banku.

Much like *B. b. kok*, but the fur is thick, most often noticeably thicker above and below than in the other races.

(v) ***Bandicota bengalensis varius* (Thomas)**

1907. *Gunomys varius* Thomas, *Ann. Mag. nat. Hist.*, 20, 204.

Type-locality.—Georgetown, Penang, off Malay Peninsula.

Range.—Specimens seen from PENANG Island, also TENASERIM: Mergui. SOUTH BURMA: Prome, Toungoo, 12 miles south-east of Pegu.*

Large race, as judged by the skull; the adult normally exceeding 44 mm. in occipitonasal length, this measurement only rarely reached in the allies.

116. ***Bandicota indica* (Bechstein)**

The Bandicoot-Rat (or Large Bandicoot-Rat)

1800. *Mus indicus* Bechstein, *Ueber Vierf. Thiere*, 2, 497.

Vernacular names (Blanford).—Indur, *Sanscr.* Ghous or Ghus, *H.* and *Mahr.* Haggin, *Can.* Panki koku, *Tel.* of tank-diggers (pig-rat, whence the term bandicoot); Ura-miyo, *Cing.*? Mye-kvwek, *Burm.* (nemorivaga), Guru, *Kol.*

Distribution.—RAJPUTANA southwards through the PENINSULA to CEYLON: NEPAL eastwards to BURMA: Yunnan, Formosa, Indo-China, Siam, Java and Sumatra.

This species is a little less specialized cranially in some ways than its ally *B. bengalensis*. Thus the incisors are less proodont, and the palate is as a rule proportionately shorter. The bullae are proportionately smaller, which may, however, be due to the fact that very generally the species is larger than in *bengalensis*. The nasals are proportionately longer, as a rule, and the braincase is usually more narrowed. The occipitonasal length is usually, but not always, larger than in *B. bengalensis*. At extreme development, with an occipitonasal length exceeding 68 mm., these rats are the largest rats of the Asiatic mainland, though they do not compare in size with some of the giant rats of the Philippine Islands,

* Also probably Western Burma (Kalewa on R. Chindwin) whence I recorded a large male, with head and body length 224 mm., tail 106 mm., hindfoot 41 mm.; weight 377 gms.—*vide* M. L. Roonwal, 1949, *Trans. nation. Inst. Sci. India*, Calcutta, 3 (2), p. 87; and 1950, *Rec. Indian Mus.*, Delhi, 47 (1) [1949], p. 20.—EDITOR.

as *Crateromys* or *Phloeomys*, or of some of the New Guinea giant rats. Occasionally, individually, the occipitonasal length may exceed the condylobasal length slightly, though this is the exception rather than the rule (perhaps about eleven specimens in sixty-three skulls, all races included). The tail tends less to be shortened, as a rule, than in other Bandicoot-Rats, and may sometimes be longer than the head and body.

External characters.—Very large rats, head and body normally exceeding 200 mm., and at maximum about 345 mm. Tail usually but not always shorter than head and body, proportionately shorter apparently in the eastern races (*nemorivaga* and *savilei*); relatively longer in the western *indica*. It is naked with a certain growth of short hairs traceable throughout its length. The fur is generally rather harsh in this species although there are plenty of long hairs developed on the back. Hand with four functional fingers, all clawed; foot with five toes, all bearing claws; the fifth toe shorter than the central three, the hallux rather shorter than the fifth toe; hindclaws rather more prominent than foreclaws often; apparently six plantar pads. The ear appears to be more than one-tenth of head and body in length as a rule, therefore not reduced as so often happens in largish rats. Mammae 12.

Colour.—*B. i. indica*; above blackish or blackish brown, sometimes with a profusion of whitish hairs intermixed; general effect dark; many long hairs present on the back, the fur sparse and harsh; underfur lighter, greyish at base often, the ends of the hairs mostly black. Feet dark. Underparts dark; greyish or brownish. Tail wholly dark throughout.

Smaller races, *nemorivaga* and *savilei*: Colour above blackish or brownish, tail wholly dark; underparts light, almost whitish in *savilei* and some specimens of *nemorivaga*; in other specimens of *nemorivaga*, the underparts are drab and dull. Feet usually dark. In some specimens of *nemorivaga*, the fur is thick, but it is not so in others.

External measurements.—As in Table 109, below.

Notes from skins.—*B. i. malabarica*: Samasgi, Dharwar; weight 3 lb. Balapalli Range; weight $1\frac{1}{2}$ lb.; mammae 12. (Palkonda Hills), and 2 lb. Ghatmatha, Satara; weight 4 lb. Sonawahnee, Balaghat; weight 21 lb. Mammae 12; 1 lb.; 13 oz.; mammae 12. Virajpet, Coorg; weight $2\frac{1}{4}$ lb. Sagar, Mysore; weight $2\frac{1}{2}$ lb. and $2\frac{1}{2}$ lb. Sasan, Junagadh; trapped in hut; weight 1 lb., $6\frac{1}{2}$ oz., and $2\frac{1}{2}$ lb. Mammae 12. Kolar, Mysore; weight $2\frac{1}{2}$ lb. and $2\frac{1}{4}$ lb. and $2\frac{3}{4}$ lb. Udugama,

TABLE 109.—*External measurements of the Indian races of Bandicota indica*

	Head and body	Tail	Hind- foot	Ear	
<i>Bandicota indica nemorivaga</i>					
M. Katmandu, Nepal .	290	210	46	29	
M. Nan Glepany, Gorkha, Nepal	224	205	49	29	
F. Calcutta	245	187	55	40	
M. Calcutta .	275	235	51	21	
F. 30 miles south of Pegu, Burma .	255	220	50	21	
F. Vitkangale, 12 miles SE. of Pegu .	282	241	53	29	Mammae 12
F. 12 miles SE. of Pegu .	258	202	48½	28	
F. 30 miles SE. of Pegu .	253	204	47	28	Mammae 6 pairs
M. 12 miles SE. of Pegu	280	250	50	27	Mammae 12
F. Toungoo, Burma	209	179	47	26	
M. Angarakhata, N. Kamrup	275	238	55	29	
M. Hasimara, Bhutan Duars	280	228	50	31	
	226	255	52	29	

Also seen from Khasi Hills, Assam.

Bandicota indica savilei

F. Pagan, Burma	223	211	39	26	
M. Mount Poppa, Burma	228	198	39	26½	
M. Mount Poppa	224	201	37	26	
F. Mount Poppa	216	189	40	25	
F. Mount Poppa	230	222	40	27½	Mammae 12
Mount Poppa	180	167	38	23	
Mount Poppa. Type	240	230	43.25	26½	Weight 1½ lb.

Bandicota indica indica

F. Ootacamund	245	266	45	30	

Other skins from Nellore, East Madras (hindfoot 54 mm.); and Coonoor, Nilgiri Hills.

Bandicota indica ('malabarica')

F. Kolar, Mysore	290	?	53	40	
M. Kolar, Mysore	315	317	62	33	
F. Kolar, Mysore	290	315	58	32	
F. Kolar, Mysore	305	285	57	31	
F. Kolar, Mysore	345	320	58	34	
M. Sagar, Mysore	295	315	59	31	
F. Sagar, Mysore	300	300	52	32	
M. Chichpalli, Chanda	325	300	61	34	
F. Chanda . .	305	275	59	34	Mammae 12
M. Chanda	257	287	59	34	

TABLE 109.—*External measurements of Bandicota indica (concl'd.)*

	Head and body	Tail	Hind- foot	Ear	
<i>Bandicota indica</i> ('malabarica') (concl'd.)					
F. Chanda .	325	305	58	34	Mammae 12
M. Bangalore, Mysore	220	210	48	30	
M. Bangalore	205	215	50	29	
F. Bangalore . .	235	235	53	30	
F. Trivandrum, Travancore	330	305	70	40	
F. Trivandrum	320	340	60	40	
M. Devikop, South Mahratta. (26 miles S. of Dharwar)	255	278	60	32	
F. Samasgi, Dharwar	305	315	58	34	
F. Devikop .	270	286	57	32	
M. Andheri, Salsette Island	305	300	58	43	
Kodura, Balapalli Range, South Cuddapah	290	320	61	31	
F. Kodura, Balapalli	290	320	59	30	
M. Kodura, Balapalli	290	310	59	34	
F. Virajpet, Coorg	305	292	58	31	
M. Danta, Gujerat	305	310	63	33	
F. Sonawahnee, Balaghat	305	289	57	34	Mammae 12
F. Sonawahnee, Balaghat	295	300	57	34	
F. Ghatmatha, Satara .	324	245	54	35	
F. Sasan, Junagadh, Kathia- war .	320	298	58	36	Mammae 12
M. Sasan, Kathiawar	267	295	61	33	
M. Horton Plains, Ceylon	210	257	58	30	
F. Anasigalla, Matugama, Ceylon .	252	240	50	29	
Anasigalla, Ceylon	298	253	54	31	
F. Bangalore, Mysore	255	250	58	31½	
F. Udugama, Ceylon	329	290	59½	31	
M. Bahri, Hazaribagh	272	266	57½	33	
Gajhundi, Hazaribagh	288	275	58	32	

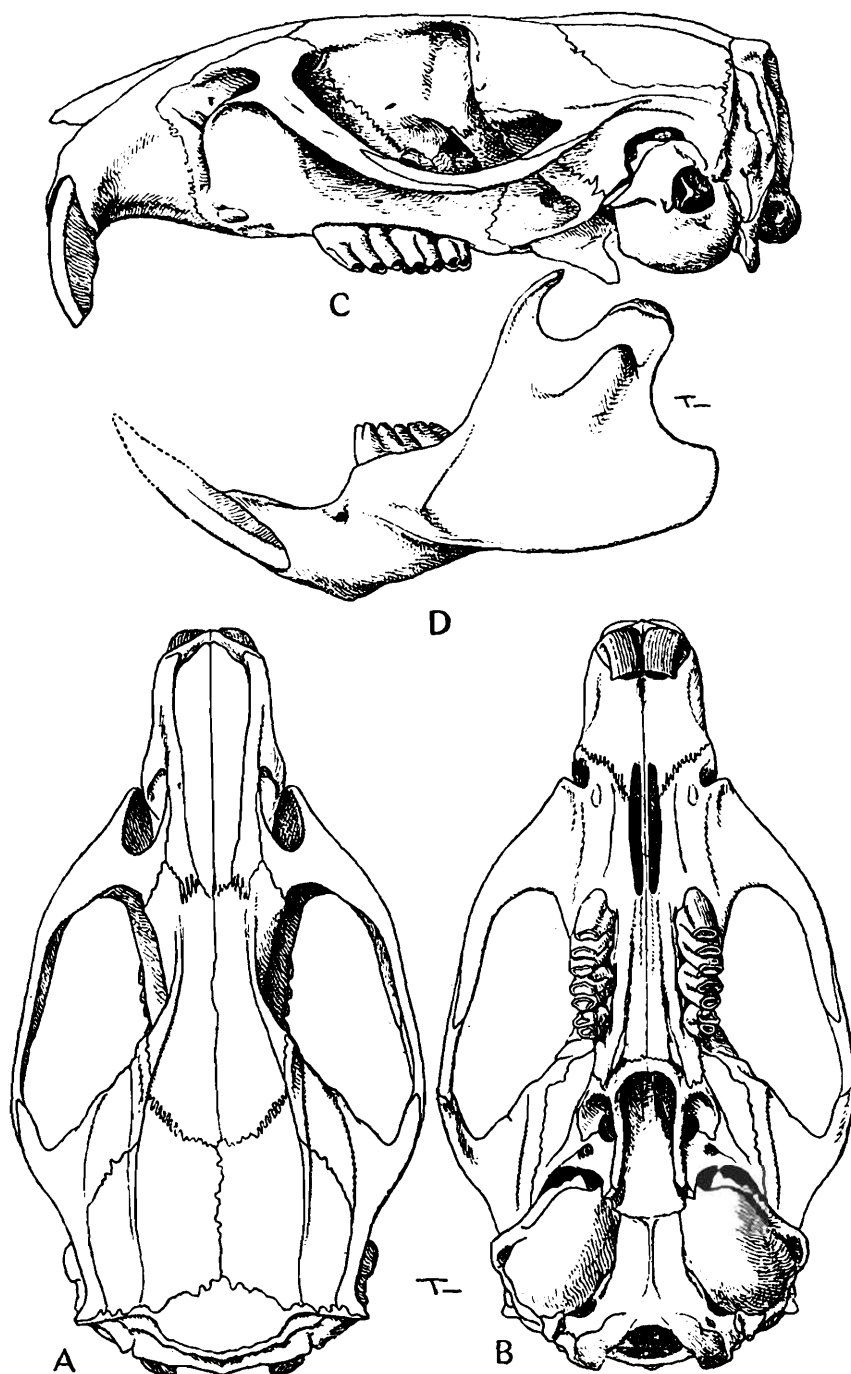
Ceylon; shot in Yam patch; weight 2 lb. Kodura, Balapalli Range; weight 2 lb. Chanda; trapped in hut; mammae 12; 2 lb. and 2¼ lb.; mammae 12, and 1 lb. 4 oz. Danta, Gujerat; 2 lb. Horton Plains, Ceylon; trapped in jungle. Bangalore; 14 oz. Bahri, Hazaribagh; 1 lb. 12 oz. Chichpalli, Chanda; 2½ lb. Trivandrum; caught in a boxtrap; not uncommon. Anasigalla, Ceylon; 1¾ lb. Hunted by dogs from grass and farm bordering a small river.

B. i. indica: Ootacamund; caught in bazaar.

B. i. savilei: Mt. Poppa; weight 10½ oz., 11¾ oz., 14 oz. and mammae 3-3 = 12. 12¾ oz. Pagan; weight 12¾ oz.

B. i. nemorivaga: Katmandu; caught in trap in garden, was stealing young cucumbers. Nanglepany, Gorkha; weight

1 lb. Angarakhata, Kamrup; weight 1.12 lb. Caught at edge of pond. 30 miles south-east of Pegu; mammae 12, weight 22 oz. Vitkangale, Pegu; mammae 6 pairs (2 specimens); 30 miles south-east of Pegu; 12 mammae; weight 21 oz.



TEXT-FIG. 48. *Bandicota indica nemorivaga* (Hodgson). A, B, C, dorsal, ventral and lateral views of the skull. D, lower jaw of the same. ($\times 2$).

B. i. savilei, type: 'G.C.S. says this has absolutely parasitic habits of Bandicoot, not of *Gunomys*'

Cranial characters.—The skull becomes very large in this species, largest of Asiatic rats. Although forms like *savilei* are quite small, and appear like a miniature of the large *indica*, *nemorivaga* is intermediate. The nasals are very long in this species, easily more than one-third of the occipitonasal length, and sometimes as much as 40%. The skull is narrow, with a very narrow braincase, and the powerfully developed supraorbital ridges usually extend backwards to the occiput, though varying in development as far as their clearness on the parietals is concerned. The interparietal is clear, but sometimes in *indica* tends to be rather small. Occiput high and prominent, particularly in the large race. Pterygoid fossae very deep. The length of the palate is less than 60% of the occipitonasal length as a rule, so proportionately shorter than in the other species. The bullae are, as usual in Bandicoot-Rats, quite well developed and inflated, but they are proportionately smaller than in the other species, being less than one-fifth of the occipitonasal length. The palatal foramina are long, approaching or reaching the toothrows, as a rule more than 18% of the occipitonasal length, and not under 8.7 mm. in length. The zygomatic plate is cut back above, and the zygoma is rather powerful, and with jugal shortened. Mandible with well developed coronoid process, and with the root of the lower incisor showing prominently on its outer side, but rather less high than in *Nesokia*, not tending to be as high as the condylar process.

Dental characters.—Upper incisors thick and powerful, usually brown or yellow but rarely whitish, and plain. Worn upper molars as in *Nesokia*, with a series of nearly straight transverse plates, three on M. 1, two on the other teeth; but most often there is an anterointernal cusp in M. 2 traceable, representing the remnants of the original front lamina, and very often this cusp is present in M. 3 as well; the general effect is often more *Rattus*-like than *Nesokia*, less strictly simplified and less specialized. Lower molars more or less as in *Nesokia*. Five roots in first upper molar.

Cranial measurements.—As in Table 110, below.

Dimensions of the species *Bandicota indica*, all races included, in *British Museum material*.—The occipitonasal length varies between 46.4 and 68.7 mm. Toothrow 7.8–11.4 mm. The head and body length varies between 180 and 345 mm. (only once under 200). The tail length varies between 167 and 340 mm. Hindfoot 37–70 mm.

TABLE 110.—*Cranial measurements of the Indian races of Bandicota indica*

		Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Nasals
<i>Bandicota indica indica</i>							
In this species, the condylobasal length exceeds the occipitonasal length, except where stated to the contrary.							
	94.10.3.2	c. 52.7	31.7	10.8	8.8	9.2	22.0
	Coonoor, Nilgiri Hills						
F.	98.3.15.19	55.5	31.9	10.2	9.3	9.5	20.9
	Ootacamund, South India						
<i>Bandicota indica indica</i> ('malabarica')							
	9.12.3.4	62.0	36.6	11.6	10.5	?	25.8
	Payangadi, Malabar.	5 roots	M. 1				
F.	12.6.29.118	56.6	?	11.1	9.5	9.4	22.5
	Dharwar district						
M.	12.11.28.121	60.5	35.6	11.7	10.1	10.9	24.4
	Sagar, Mysore.	M. 1 with 5 roots					
F.	12.11.28.122	59.0	34.5	10.9	9.8	9.9	22.9
	Sagar, Mysore						
F.	12.11.29.166	60.3	35.6	11.3	9.6	10.2	23.5
	Sonawahnee, Balaghat						
F.	12.11.29.167	61.4	36.3	11.2	9.4	10.8	24.1
	Sonawahnee, Balaghat.	Old					
M.	12.11.29.168	63.7	38.1	12.1	10.0	10.4	25.7
	Chanda, Central Provinces						
F.	12.11.29.170	61.0	35.8	11.1	9.9	10.2	23.8
	Chanda						
F.	12.11.29.171	62.5	37.0	10.9	10.2	10.0	25.1
	Chanda						
M.	13.4.11.116	63.8	37.8	12.1	10.0	9.9	26.4
	Kolar, Mysore.	M. 1 5-rooted.	Condylobasal	63.7 mm., shorter			
		than occipitonasal					
F.	13.4.11.117	58.5	34.5	12.0	9.6	10.5	24.1
	Kolar.	Condylobasal	58.3 mm., shorter	than occipitonasal			
F.	13.4.11.118	58.5	35.2	12.2	9.5	?	23.8
	Kolar.	M. 1 5-rooted					
F.	13.4.11.119	61.4	36.3	12.7	10.0	10.4	25.0
	Kolar						
F.	13.4.11.120	60.1	35.2	10.5	9.8	9.9	25.3
	Kolar.	M. 1 5-rooted					
M.	13.8.8.130	58.7	34.2	10.4	9.6	9.5	23.3
	Sasan, Kathiawar						
F.	13.8.8.131	65.2	38.9	12.1	10.7	?	26.4
	Sasan, Kathiawar.	M. 1 5-rooted					
F.	15.7.3.64	66.3	39.6	12.6	9.6	10.2	26.8
	Ghatmatha, Satara district						
M.	15.4.3.152	62.9	37.2	10.6	10.3	10.5	24.8
	Hazaribagh.	5 roots	M. 1				

TABLE 110.—*Cranial measurements of Bandicota indica (concl'd.)*

	Occipito- nasal	Palate	Palatal foramina	Bullae	Toothrow	Nasals
<i>Bandicota indica nemorivaga</i> (concl'd.)						
42.1.12.128	57.0	33.4	10.6	9.1	10.5	20.1
Nepal. Old. Condylobasal, 55.9 mm., shorter than occipitonasal						
43.1.12.68	c. 52.7	32.0	9.4	9.4	8.9	c. 17.9
Nepal. Lectoparatype. Occiput incomplete						
80.11.11.8	53.6	32.0	9.0	10.0	9.2	18.6
Khasi Hills, Assam. (' <i>elliottana</i> ')						
81.5.30.5	49.7	29.4	9.0	9.7	8.2	16.4
Calcutta						

A lectotype, Nepal, has the occipitonasal about 58.4 mm. and the condylobasal slightly shorter than this measurement.

Bandicota indica savilei

M. 14.7.19.212	48.8	28.5	9.1	8.9	7.8	17.8
Mount Poppa, Burma. 5 roots M. 1						
M. 14.7.19.213	49.9	29.1	9.1	c. 8.7	c. 7.9	18.3
Mount Poppa. Old. Condylobasal, 49.5 mm., shorter than occipitonasal. Foramina measurement represents the longer side						
F. 14.7.19.214	47.2	27.9	9.1	c. 8.7	8.4	17.5
Mount Poppa						
F. 14.7.19.215	46.4	27.2	8.8	8.8	8.7	16.6
Mount Poppa						
F. 14.7.19.216	48.9	28.4	9.6	c. 9.4	8.3	18.6
Pagan, Burma						

The type has the occipitonasal length about 51.4 mm.

As regards subspecies, there are apparently clearly in India a large western race, a very small south Burmese race, and a medium race. They may be keyed as follows:—

Key to the subspecies of Bandicota indica in India

- 1 (2) Small race, occipitonasal length only reaches 50 mm. in one specimen.....
- Larger races, in adult, the occipitonasal length is under 50 mm. in only one individual in more than 40 specimens.....
- B. i. savilei*

- 2 (3) Length of nasals 20·8 mm. and less, but most often less than 20 mm. Medium sized race, occipitonasal length varying between 49·7 and 57 mm..... *B. i. nemorivaga*
 Length of nasals approximates or exceeds 21 mm. Medium or large in size, occipitonasal length 52–68 mm..... *B. i. indica*

Wroughton retained the name '*gigantea*' on size of hind-foot, thinking it was even larger than '*malabarica*' (cf. his key, Mammal Summary, p. 786), and he retained the name '*elliottana*' which was supposed to be 'almost black' like *indica*, whereas *nemorivaga* was supposed to be brown. I do not find these names retainable in any way when the British Museum series is looked through with care, nor can I see any difference in colour between *indica* and *nemorivaga*. Nor do I think there is more than one race to the west of the Bay of Bengal.

(i) *Bandicota indica indica* (Bechstein)

1800. *Mus indicus* Bechstein, *Ueber Vierf. Thiere*, 2, 497.
 1800. *Mus bandicota* Bechstein, *Ueber Vierf. Thiere*, 2, 498.
 1801. *Mus malabarica* Shaw, *Gen. Zool.*, 2, 54. (Malabar.)
 1801. *Mus perchal* Shaw, *Gen. Zool.*, 2, 55. (India, said to be numerous about Pondicherry.)
 1804. *Mus giganteus* Hardwicke, *Trans. Linn. Soc. Lond.*, 7, 306. (Hardwar, Uttar Pradesh.)

Type-locality.—Pondicherry, India.

Range.—Specimens examined from CEYLON: Anasigalla, Ambawela, Horton Plains, Pundul-bya, Udugama. TRAVANCORE, Trivandrum. MALABAR, Payangadi. MYSORE: Bangalore, Kolar, Sagar. COORG, Virajpet. DHARWAR district; Devikop, south Mahratta, Samasgi, Dharwar. CENTRAL PROVINCES: Chichpalli, Chanda; Sonawahnee, Balaghat. CUDDAPAH: Kodura, Balapalli Range; Palkonda Hills. BOMBAY: Andheri, Salsette Island. BIHAR and ORISSA: Gajhundi and Bahri, Hazaribagh; Chilka Lake, Orissa. Ghatmatha, SATARA district. GUJERAT, Danta. KATHIAWAR, Sasan, Junagadh. RAJPUTANA, Sambhar. U.P. Delhi, and Hardwar. MADRAS, Nellore. NILGIRI HILLS, Coonoor, Ootacamund.

Large race. Head and body 205–345 mm., tail 210–340 mm., hindfoot 45–70 mm., occipitonasal length 52·7–68·7 mm. Minimum nasals length about 21 mm.

(ii) **Bandicota indica nemorivaga** (Hodgson)

Text-fig. 48

1836. *Mus (Rattus) nemorivagus* Hodgson, *J. Asiat. Soc. Beng.*, 5, 234.
 1845. *Mus macropus* Hodgson, *Ann. Mag. nat. Hist.*, 15, 268. (Nepal.)
 1878. *Mus (Nesokia) elliotanus* Anderson, *J. Asiat. Soc. Beng.*, 46, 4, 231. (Calcutta.)

Type-locality.—Nepal.

Range.—Specimens seen from BURMA: Toungoo; 12–30 miles south-east of Pegu. ASSAM: Khasi Hills; KAMRUP: Angarakhata; BHUTAN DUARS: Hasimara; BENGAL: Calcutta; NEPAL: Katmandu; Gorkha (Nan Glepany); Formosa, no exact locality; Yunnan: Tengueh.

Medium in size; head and body 209–290 mm. Tail 179–255 mm., hindfoot 46–55 mm. Occipitonasal length 49·7–57 mm. in adults (only once under 50 mm. in our material); nasals shorter than the last apparently; 16·4–20·5 mm., most often below 20 mm.

(iii) **Bandicota indica savilei** Thomas

1916. *Bandicota savilei* Thomas, *J. Bombay nat. Hist. Soc.*, 24, 4, 641.

Type-locality.—Mount Poppa, Burma. About 2,500 ft.

Range.—Specimens examined from BURMA: Mount Poppa and Pagan.

Smallest race. Head and body 180–240 mm. Tail 167–230 mm. Hindfoot 37–43 mm. Occipitonasal length 46·4 *circa* 51·4 mm. but only once over 50 mm.

Genus 45. **Diomys** Thomas

1917. *Diomys* Thomas, *J. Bombay nat. Hist. Soc.*, 25, 2, 203.

Type-species.—*Diomys crumpi* Thomas.

Range.—INDIA; originally described from Paresnath, Hazaribagh, Bihar. A considerable series of skulls in the Frost Collection, Manipur.

This genus was based on a single broken skull, with much worn teeth, the external characters of which were unknown. In this genus the incisors are proodont or the base of skull is so lengthened that the condylobasal length is, with three

exceptions in twenty, at least as long as and often longer than the condylobasal length. This is such a rare character in Australian and Asiatic and European Murinae that I regard it as of generic value. The palate is long, about 55% of the occipitonasal length (therefore not so elongated as in *Bandicota* and *Nesokia*). The diastema, however, works out at only about 30% of the occipitonasal length, which is not so long as in some *Rattus*. The palatal foramina are extremely elongated, about 23% on average of occipitonasal length as in *Millardia*, to which it makes an approach in some cranial characters (very long foramina plus long palate).

The bullae are large, averaging 19% of the occipitonasal length. Supraorbital ridges very strong proportionately. No posterointernal cusp in the first and second upper molars. Lower incisor root scarcely showing on the outer side of the jaw, or forming a weak knob. These characters will sum up the species sufficiently for identification. There is one species.

117. *Diomys crumpi* Thomas

Crump's Mouse

1917. *Diomys crumpi* Thomas, *J. Bombay nat. Hist. Soc.*, 25, 2, 204.

Type-locality.—Paresnath, Hazaribagh, Bihar (a skull, said to be from this place, mixed with a skin of *Rattus meltada*).

Range.—Specimens examined from MANIPUR, Bishampur, 3,000–4,000 ft., and the type skull, said to be from Paresnath, BIHAR, 4,300 ft.

External characters.—Fur thick and soft. Tail usually a little longer than the head and body, sharply bicolor, and not very well haired, or moderately haired. Ear rather large. Hand with four clawed fingers, the outer one considerably shortened, though possibly less so than is usual in *Hadromys*. Foot with five toes, all clawed; the hallux and the fifth toe roughly equal in length, much shorter than the centre three.

Colour of the back blackish grey, the middle dorsal area sometimes darker than the head and shoulders; rump blackish as a rule (lacking the reddish tinge of *Hadromys*). Feet white. Underparts whitish grey, the hairs dark basally, whiter terminally. Tail very sharply bicolor, black above, whitish below.

External measurements of Diomys crumpi.—

		Head and body	Tail	Hind- foot	Ear
Frost collections—					
F.	375				
	Bishampur, Manipur	115	125	28	25
F.	379				
	Bishampur	103	125	26	22
F.	381				
	Bishampur	110	120	25	22
F.	385				
	Bishampur	115	120	26	22
F.	384				
	Bishampur	135	128	28	23
F.	386				
	Bishampur	115	122	25	22
F.	387				
	Bishampur	118	125	26	21
M.	388				
	Bishampur	100	115	24	19
F.	389				
	Bishampur	102	120	25	21
F.	390				
	Bishampur	105	120	27	22
M.	391				
	Bishampur, 3,000 ft.	125	135	28	23
M.	393				
	Bishampur	108	115	25	23
F.	460				
	Bishampur, 4,000 ft.	130	120	26	23
M.	465				
	Bishampur	130	130	26	23
F.	473				
	Bishampur	110	110	25	20
M.	479				
	Bishampur	130	135	28	22
F.	480				
	Bishampur	125	120	26	22
F.	481				
	Bishampur	130	130	27	22
M.	482				
	Bishampur	100	115	25	20
M.	483				
	Bishampur	107	112	26	21
M.	484				
	Bishampur	120	120	26	21
M.	485				
	Bishampur	105	117	24	20
M.	486				
	Bishampur	105	112	25	20
M.	488				
	Bishampur	130	128	27	27

External measurements of Diomys crumpi—(concl'd.)

	Head and body	Tail	Hind- foot	Ear
Frost collections (<i>concl'd.</i>)				
M. 487 Bishampur	110	115	25	20
M. 489 Bishampur	.. 120	121	25	26
M. 530 Bishampur, 4,000 ft.	128	123	25	20
M. 531 Bishampur	132	126	27	20
M. 532 Bishampur	102	109	25	20
M. 533 Bishampur, 3,700 ft.	110	112	25	21

Cranial characters.—Smallish size; occipitonasal length 29.4–33.2 mm. Nasals quite long (about 10–11.8 mm.), somewhat receded anteriorly sometimes; interorbital constriction not excessive; suture of frontals and parietals nearly straight; frontals with strong ridges, these ridges tending to extend back on to the parietals; the ridges very prominent in old specimens. Interparietal well developed. Occiput medium to rather high. Bullae large and well inflated, roughly 19% of the occipitonasal length. Pterygoid fossae rather deep; hamulars approaching or joining bullae. Palate long, 55–56% as a rule of the occipitonasal length. Palatal foramina very long, about 23% of the occipitonasal, and penetrating well between the toothrows. Zygomatic plate strongly thrown forwards, well cut back above. Mandible with well developed coronoid process. The lower incisor root shows on the outer side of the jaw, but only forms a feeble knob.

Dental characters.—Upper incisors proodont, rather pale, and often faintly grooved. (Much less clearly so than *Golunda*.) Lower incisors rather long. Molars moderately cuspidate; spaces for eight cusps in M. 1, but the antero-internal one is very shortened; spaces for six cusps in M. 2 (the antero-internal being all that remains of the second lamina); M. 3 quite largish, with an antero-internal cusp and traces of two lamina behind it. Second lamina of M. 1 much wider than front one. M. 1 apparently with five roots (in an unmeasurable skull). Lower molars without peculiarity; biserially cuspidate; three lamina on M. 1, two on the other teeth; first and second molars with terminal heel, well marked.

Cranial measurements of Diomys crumpi.—

		Occipito- nasal	Palate	Diastema	Palatal foramina	Bullae	Toothrow
(In all but three, the condylobasal approximates to or exceeds the occipitonasal length; maximum, 32.9 mm., No. 488; the three exceptions are numbers 375, 388 and 483.)							

Frost collections—

F.	375						
	Bishampur, Manipur	32.1	17.9	9.8	7.6	6.2	5.4
F.	379						
	Bishampur	30.4	16.8	9.0	7.0	6.2	5.3
F.	384						
	Bishampur	32.3	18.2	9.9	7.9	6.2	5.4
F.	385						
	Bishampur	31.9	17.7	9.6	7.3	6.2	5.4
F.	386						
	Bishampur	31.5	17.8	9.5	7.3	6.3	5.4
M.	388						
	Bishampur	29.6	16.3	8.6	7.0	6.0	5.2
M.	391						
	Bishampur	32.2	18.2	10.0	7.9	6.4	5.6
F.	460						
	Bishampur	32.2	17.8	9.9	7.7	c. 6.2	5.5

The foramina measurement represents the longer side.

F.	471						
	Bishampur. Old	32.6	17.9	10.0	7.5	6.5	?
M.	473						
	Bishampur	30.5	17.4	9.3	7.5	5.6	5.2
M.	479						
	Bishampur	31.6	17.8	9.5	7.6	c. 6.0	5.5
F.	480						
	Bishampur	31.9	17.8	c. 9.9	7.4	6.3	5.5
M.	483						
	Bishampur	31.0	17.2	9.2	7.4	c. 5.9	5.3
M.	485						
	Bishampur	29.6	16.8	8.9	7.3	5.8	5.4
M.	488						
	Bishampur	32.6	18.3	9.9	7.9	6.4	5.4
M.	489						
	Bishampur	32.3	17.7	9.6	7.8	6.4	5.3
M.	532						
	Bishampur	29.4	16.6	8.9	7.2	5.8	5.1
M.	533						
	Bishampur	31.2	17.5	9.4	7.6	6.0	5.2
F.	381						
	Bishampur	32.3	18.2	10.0	7.6	6.1	5.5
M.	487						
	Bishampur	29.9	16.8	9.1	7.0	?	5.2
M.	465						
	Bishampur	33.2	18.5	10.2	7.6	6.0	5.5

Dimensions of *Diomys crumpi*, in *British Museum material*.—The occipitonasal length varies between 29.4 and 33.2 mm. Toothrow 5.1–5.6 mm. Head and body 100–135 mm. Tail 109–135 mm. Hindfoot 24–28 mm. Ear 19–27 mm.

The following genus, recorded from northern Burma, is unavailable to me for examination.

Genus 46. *Vernaya* Anthony

1941. *Vernaya* Anthony, *Field. Mus. Pub. Zool.*, 27, 110 (8th December). *Chiropodomys fulvus* G. Allen (type-species).
1941. *Octopodomys* Sody, *Treubia.*, 18, 2, 261, with same type.

118. *Vernaya fulva* (G. Allen)

1927. *Chiropodomys fulvus* G. Allen, *Amer. Mus. Nov.*, 270, 11. From Yinpankai, Mekong River, Yunnan, China.
1940. *Vandeleuria dumeticola* G. Allen, *Mamm. China and Mongolia*, 2, 1048. Not of Hodgson, 1845.

This is evidently a small climbing mouse which still requires detailed comparison with *Apodemus*, although it has from descriptions a much longer tail than that. It has a larger skull than *Micromys*, and according to Anthony its molars resemble those of *Chiropodomys*, and it should have the posterointernal cusp in the first and second upper molars. The fact that it possesses a clawed hallux distinguishes it at once from *Vandeleuria* and *Chiropodomys*, with which Anthony compares it. G. Allen gave the measurements of the type as head and body 75 mm., tail 133 mm., hindfoot 18.5 mm., skull, greatest length 22.3 mm., upper cheekteeth 3.3 mm. Anthony (1941) recorded it from Hpawte and Hpimaw, northern Burma.

APPENDIX

ADDITIONS TO J. R. ELLERMAN'S VOLUME ON MAMMALIA (2ND EDITION), VOL. 3, RODENTIA, IN THE " FAUNA OF INDIA " SERIES

By

M. L. ROONWAL and B. BISWAS
Zoological Survey of India, Calcutta

Pages 851 to 867

and

With Text-figures 49 to 54 and Tables 111-115

CALCUTTA

1960

APPENDIX

ADDITIONS TO J. R. ELLERMAN'S VOLUME ON MAMMALIA (2ND EDITION), VOL. 3, RODENTIA, IN THE " FAUNA OF INDIA " SERIES

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J. R. Ellerman's manuscript for the volume on the *Rodentia* was ready many years ago and ten new species and subspecies of Indian Rodents have meanwhile been described. These are given in the present Appendix. The species are :

Family I. SCIURIDAE

- (1) *Callosciurus macclellandi collinus* (Moore)
- (2) *Callosciurus flavimanus heinrichi* Tate
- (3) *Dremomys lokriah pagus* Moore

Family II. MURIDAE

Subfamily (a) MICROTINAE

- (4) *Alticola bhatnagari* Biswas and Khajuria

Subfamily (b) MURINAE

- (5) *Rattus rattus bullocki* Roonwal
- (6) *Rattus rattus khumbuensis* Biswas and Khajuria
- (7) *Rattus manipulus kekrimus* Roonwal
- (8) *Mus mus pygmaeus* Biswas and Khajuria
- (9) *Mus cervicolor imphalensis* (Roonwal)
- (10) *Mus guhai* Nath

The numbering of the various taxonomic categories, tables and text-figures in this Appendix are in consonance with the numerical arrangement in the main part of this volume.

The help received from Dr. K. C. Jayaramakrishnan in the preparation of this Appendix is thankfully acknowledged.

FAMILY I. SCIURIDAE

Genus 6. Callosciurus Gray

Subgenus (a) Tamiops J. Allen

15. Callosciurus maclellandi (Horsfield)

(iii) Callosciurus maclellandi collinus (Moore)

Moore's Squirrel

1958. *Tamiops maclellandi collinus* Moore, *Amer. Mus. Novit.*, New York, No. 1879, p. 1.

Type-locality.—Maymyo (alt. 800 metres), Mandalay district, Upper Burma.

Distribution.—UPPER BURMA, western Yunnan, northern and north-eastern Siam and Laos.

Description.—Compared with *C. m. maclellandi*, the outer pair of light stripes broader (5–7 mm. against 3–4 mm.) and brighter, and venter generally brighter and more yellow-orange, instead of cream or pale buff. Stripes of *collinus* even more markedly bright and broad than those of *inconstans*. In comparison with *kongensis*, *collinus* has the crown, nape and sides darker agouti, that is, buffy brown, instead of drab, and has narrower outer light stripes (5–7 mm. against 7–12 mm.). Compared with *barbei*, *collinus* lacks the general reddish infusion on the dorsal pelage, has the outer light stripes pale ochraceous buff, instead of salmon, and the ventral pelage much yellower than vinaceous tawny.

Measurements.—External and cranial measurements are given in Tables 111 and 112 respectively.

TABLE 111.—Range of external measurements of *Callosciurus maclellandi collinus* (Moore), in mm.

	Head and body	Tail	Hind- foot	Ear
4 ad. ♂	118–125	107–113	27–28	11
5 subad. ♂	104–116	77–123	27–28	11
1 imm. ♂	107	107	28	11
3 parous ♀	112–121	55–111	27–28	11
2 imm. (?) unsexed	105–108	104–105	28	11

TABLE 112.—Range of cranial measurements of *Callosciurus maclellandi collinus* (Moore), in mm.

	Greatest length of nasals	Greatest length of skull	Zygomatic breadth	Condyl- basal length	Palatal length	Maxillary toothrow
4 ad. ♂	8.9–9.1	32.5–33.1	19.8–20.6	29.1–30.3	14.9–15.6	5.1–5.3
3 ad. ♀	8.9–9.4	32.7	20.1	—	15.3–15.7	5.3–5.4

Subgenus (b) **Callosciurus** Gray18. **Callosciurus flavimanus** (Geoffroy)(viii) **Callosciurus flavimanus heinrichi** Tate

Heinrich's Squirrel

1954. *Callosciurus griseimanus heinrichi* Tate, *Amer. Mus. Novit.*, New York, No. 1676, p. 1.

Type-locality.—Maymyo, Mandalay district, Upper Burma.

Distribution.—BURMA.

Description.—Colour above a rather clear grey grizzle of black, buffy and whitish, continued forward on to the face and backward for one-half of the length of the tail. Cheeks just above mouth and on either side of rhinarium dull whitish. Ears rounded, grey. Chin dull greyish buff. Hands, feet, and underparts buffy yellow. Face coloured like body. Tail tipped black.

Skull typically as in the genus.

External measurements of holotype, in mm.—1 ad. ♀ : Head and body 228, tail 222, hindfoot 50.

Cranial measurements of holotype, in mm.—1 ad. ♀ : Occipitonasal length 52.6, palate 25.9, toothrow (p^3-m^3) 10.3, interorbital breadth 18.3.

Genus 7 **Dremomys** Heude23. **Dremomys lokriah** (Hodgson)(iii) **Dremomys lokriah pagus** Moore

The Peak Squirrel

1956. *Dremomys lokriah pagus* Moore, *Amer. Mus. Novit.*, New York, No. 1816, p. 1.

Type-locality.—Mt. Victoria (1,400 metres), Pakokku Chin Hills, Magwe district, western Burma.

Distribution.—INDIA (Assam) and UPPER BURMA : Forests of Pakokku Chin Hills, Chin Hills, Lushai Hills, and probably the Arakan Yomas.

Description.—This form is distinguished from the nominate subspecies 'by much paler and more yellowish ventral pelage color, from its nearest conspecific neighbor *macmillani* by lack of a black middorsal stripe on the back and lack of a distinct anal color patch, and from *garonum* by paler, more yellowish ventral pelage color'

Dorsally, from rostrum to tail, pelage about brownish olive. Eye ring present but not prominent. Ventrally, pelage slate grey and ochraceous buff on tips. Ventral aspect of tail pelage isabelline. Dorsal tail hairs with two black bands, ventral ones with three.

The range of measurements given below are of the holotype and paratypes, all collected from Sangan, Lushai Hills, Assam, and Mt. Victoria, Chin Hills, W. Burma.

External measurements, in mm.—19 ♂ ♀: Head and body 170–200, tail 95–146, hindfoot 41–45, ear 18–20.

Cranial measurements, in mm.—12 ♂ ♀: Greatest length 48.4–51.3, right maxillary tooththrow without pm^3 7.7–8.5, mastoid breadth 18.6–20.0.

FAMILY VI. MURIDAE

Subfamily (c) MICROTINAE

Genus 26. *Alticola* Blanford

61a. *Alticola bhatnagari* Biswas and Khajuria

Bhatnagar's Vole

Text-fig. 49

1955. *Alticola bhatnagari* Biswas and Khajuria, *Proc. zool. Soc.*, Calcutta, 8, p. 29.

1957. *Alticola bhatnagari* Biswas and Khajuria, *Proc. zool. Soc.*, Calcutta, Mookerjee memor. Vol., pp. 247–248.

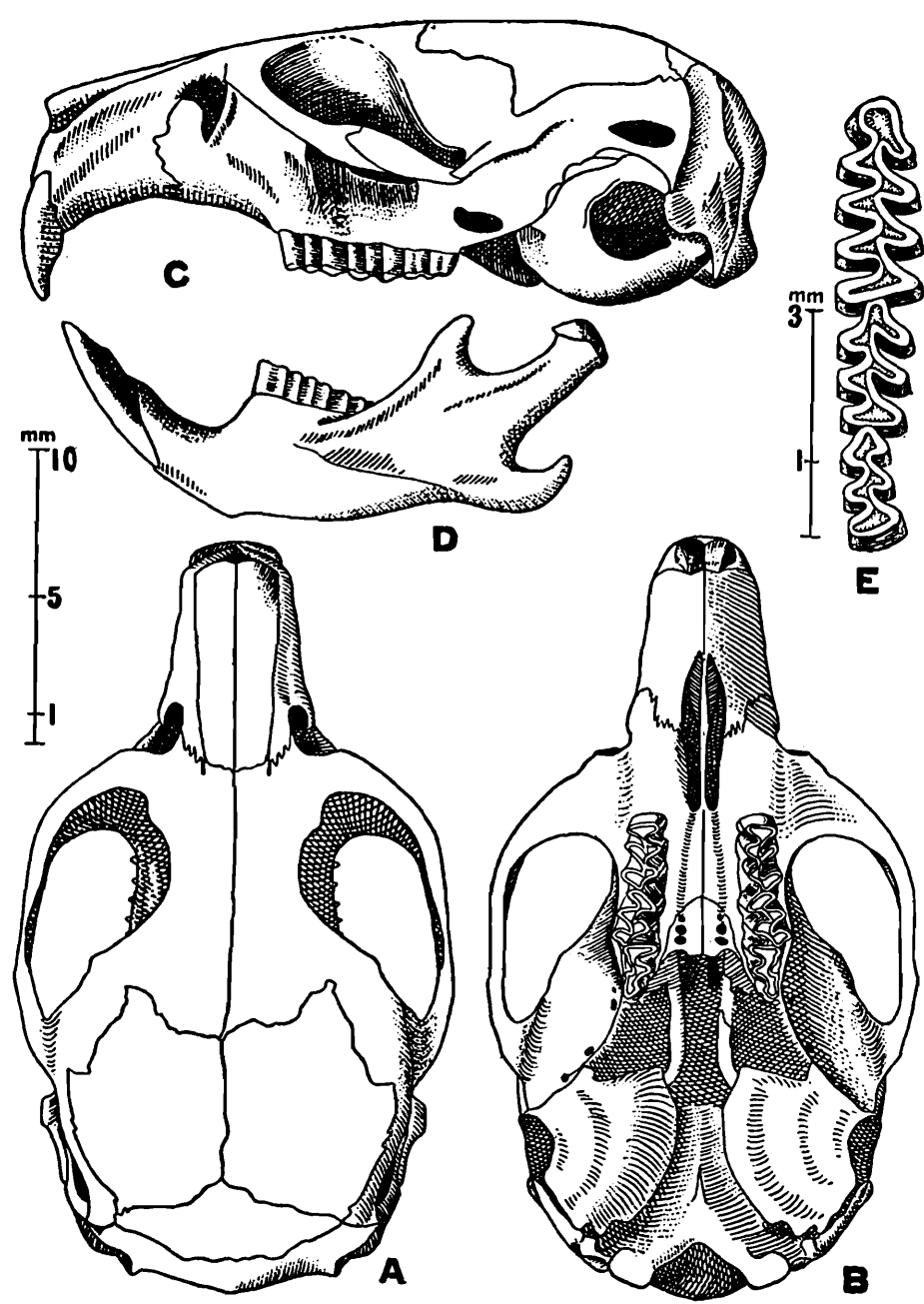
Type-locality.—Mingbo (c. 4,500 metres), Langmoche Valley, Khumbu, Nepal.

Distribution.—NEPAL: Langmoche Valley (Mingbo) and the Lobuje Valley (Pheriche and Thugla) in Khumbu.

Description.—This species is separable from all other species of the genus by the following combination of characters: Tail subequal to hindfoot and bicoloured. Skull not flattened. Third upper molar with only two salient angles on inner side and with posterior loop long and narrow (Text-fig. 49).

General colour of dorsal surface light pinkish cinnamon. Ventral surface white with dark grey on base of hairs. Tail light pinkish cinnamon above and white below.

Cranial measurements of the holotype, in mm.—1 ♀: Occipitonasal length 24.9, palate 13.3, palatal foramina 5.0, diastema 7.5, bullae 5.8, tooththrow 6.0.



TEXT-FIG. 49. *Alticola bhatnagari* Biswas and Khajuria. A, B, C, dorsal, ventral and lateral views of the skull of the holotype. D, lower jaw of the same. E, lower cheekteeth of the same. (After Biswas and Khajuria, 1957, p. 248.)

TABLE 113.—*External measurements of Alticola bhatnagari Biswas and Khajuria, in mm.*

	Head and body	Tail	Hind- foot	Ear
1 ♂	95	20	17.5	13
1 ♀	82	24	18	11.5

Subfamily (*d*) MURINAEGenus 37. **Rattus** FischerSubgenus (*a*) **Rattus** Fischer76. **Rattus rattus** (Linnaeus)(xxi) **Rattus rattus bullocki** Roonwal

The Common Manipur White-bellied Rat

Text-fig. 50

1948. *Rattus rattus bullocki* Roonwal, *Proc. nation. Inst. Sci. India*, Calcutta, **14**, p. 385.

1950. *Rattus rattus bullocki* Roonwal, *Rec. Indian Mus.*, Delhi, **47** [1949], pp. 20-23 and pls. 1-2.

Type-locality.—16 miles north-east of Imphal on Dimapur Road, Manipur, c. 1,070 metres altitude.

Distribution.—INDIA (Central Manipur): the Imphal Valley up to about 22 miles north and 37 miles south-east of Imphal.

Description.—This form can be separated from the allied '*R. r. khyensis* Hinton, *R. r. tatkonensis* Hinton, *R. r. tistae* Hinton, and *R. r. brunneusculus* Hodgson (syn. *sikkimensis* Hinton) by having the largest head and body (over 160 mm.), and the shortest tail (subequal to or even shorter than head and body) and hindfoot; and only moderately large tympanic bullae (length 7.2 mm., or 17.9% of occipitonasal length).

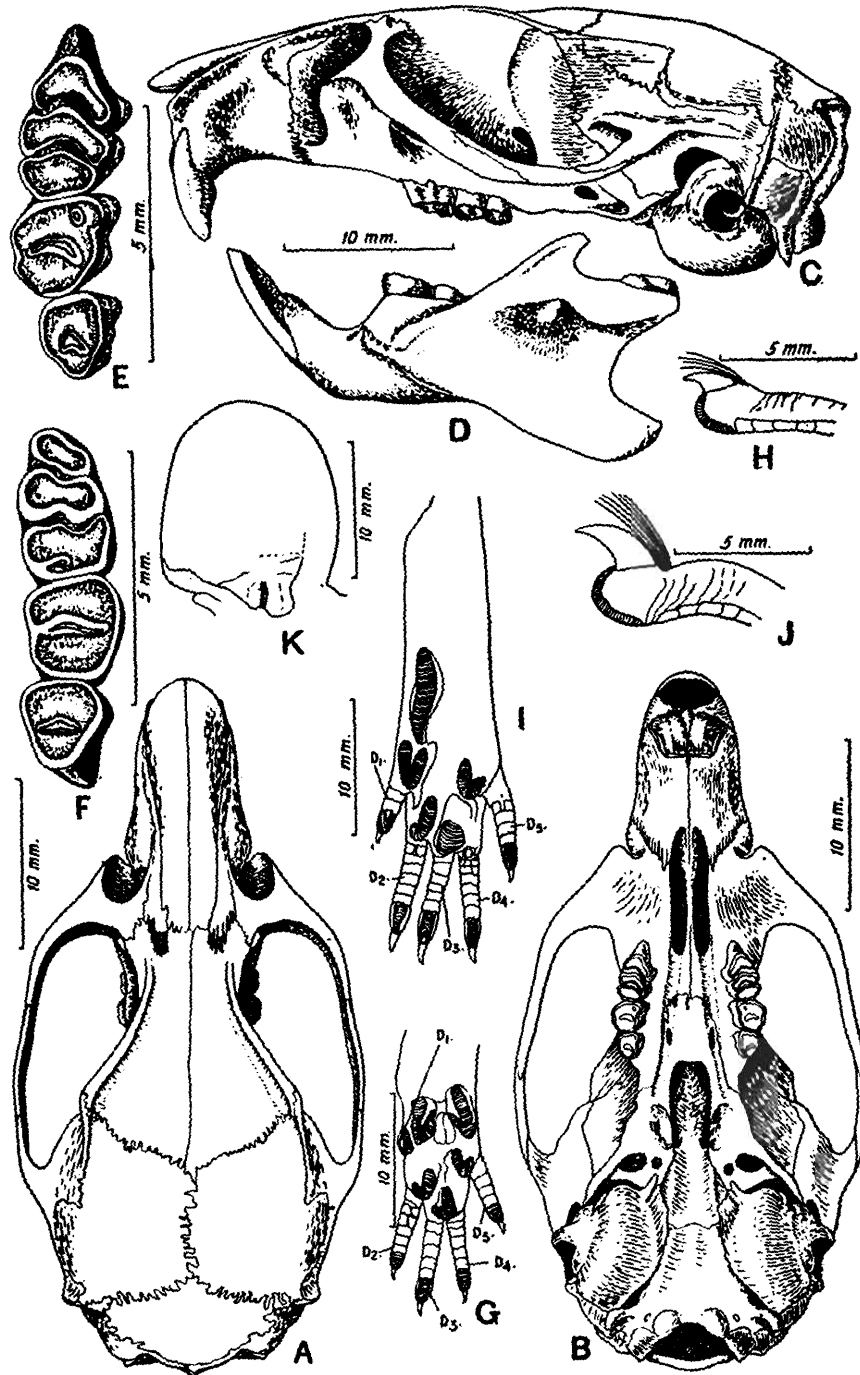
Skull typical of the wild forms of *Rattus rattus* group. Tympanic bullae moderately large. Upper incisors opisthodont (Text-fig. 50).

'Dorsum dark grey to ochraceous tawny; ground colour more grey than tawny. Venter pure to ivory white, frequently with hoary, buff or pale yellow streaks or patches.'

External measurements, in mm.—11 ♂ ♀: Head and body 148-197, tail 130-216, hindfoot 28-36, ear 15-26.

Mammae: thoracic 3, abdominal 3.

Cranial measurements, in mm.—26 ♂ ♀: Occipitonasal length 37.0-43.5, palate 16.6-20.5, palatal foramina 6.3-8.0, nasals 12.2-16.7, diastema 8.9-12.7, bullae 6.6-7.7, toothrow 6.2-7.5.



TEXT-FIG. 50. *Rattus rattus bullocki* Roonwal. A to F—holotype, adult ♀, Z.S.I. Reg. No. 11,228. A, B, dorsal and ventral view of the skull; C, left side-view of the skull; D, outer side-view of the left mandible; E, upper molar crowns of right side, in surface view; F, lower molar crowns of right side, in surface view. G to K—adult ♀, Z.S.I. Reg. No. 11,210. G, lower view of right hand; H, side-view of mid-finger of right hand; I, lower view of right hindfoot; J, side-view of mid-toe (D_3) of right hindfoot; K, left ear. (After Roonwal, 1950, Pl. II.)

(xxii) **Rattus rattus khumbuensis**

Biswas and Khajuria

The Khumbu House Rat

Text-fig. 51

1955. *Rattus rattus khumbuensis* Biswas and Khajuria, *Proc. zool. Soc.*, Calcutta, 8, p. 27.
 1957. *Rattus rattus khumbuensis* Biswas and Khajuria, *Proc. zool. Soc.*, Calcutta, Mookerjee memor. Vol., pp. 244–246.

Type-locality.—Phorcha (c. 4,300 metres), Dudh Kosi Valley, Khumbu, Nepal.

Distribution.—Khumbu, NEPAL (known only from the type-locality).

Description.—This form differs from all other known subspecies of the species by the possession of the following combination of characters:—Underside greyish white with a brownish tinge on belly, the grey being more pronounced than in any other Indian subspecies; fur long; tail approximately 121.6% of the head and body length; size very small; upper toothrow lengthened; bullae shortened; skull with zygomatic plate highly obtuse on its anterior upper edge (Text-fig. 51). It appears to be close to *R. r. tistae* Hinton.

External measurements of the holotype, in mm.—1 ad. ♂: Head and body 139, tail 169, hindfoot 29, ear 22.

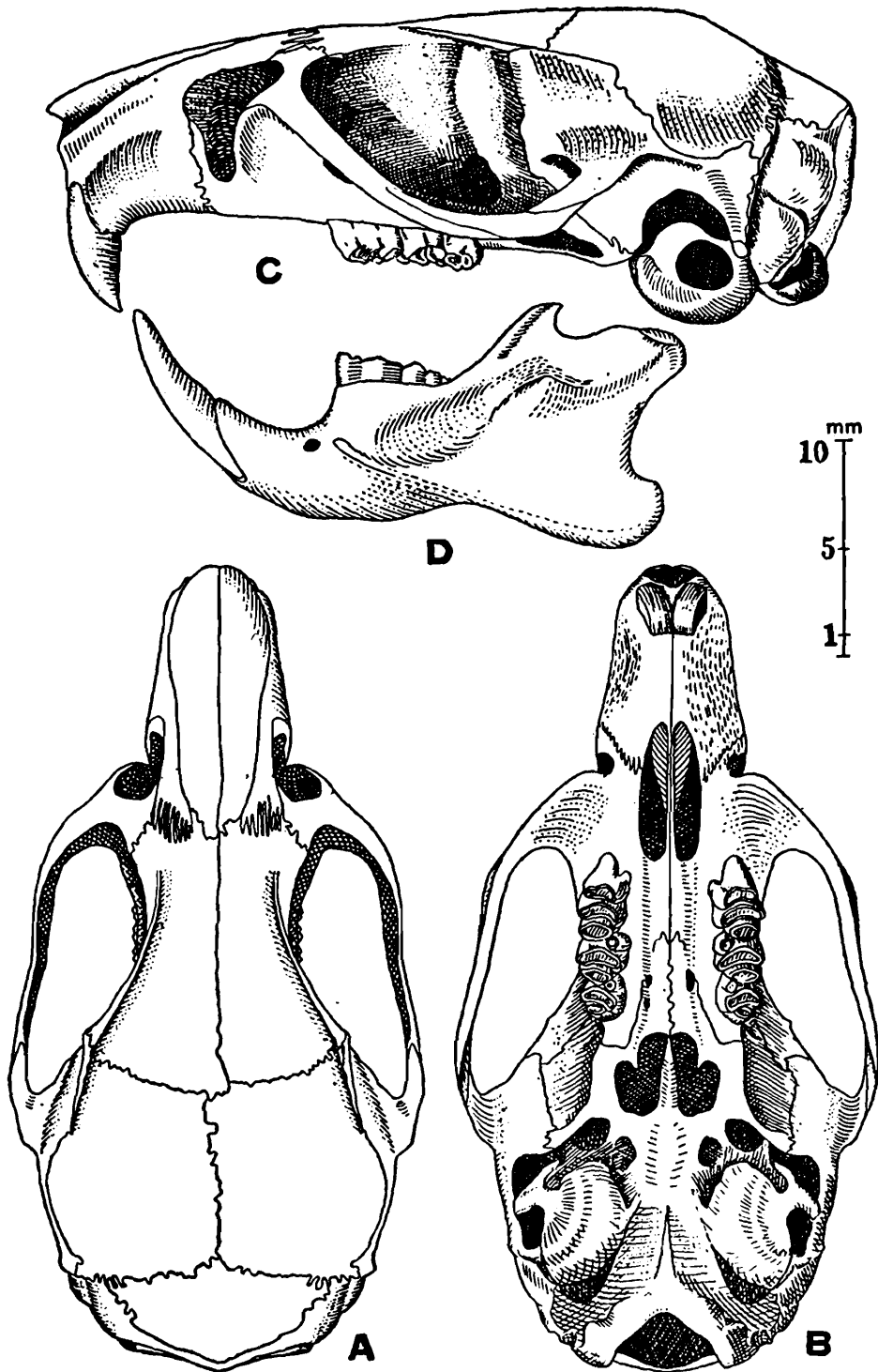
Cranial measurements of the holotype, in mm.—1 ad. ♂: Occipitonasal length 37.1, palate 19.6, palatal foramina 6.0, diastema 10.0, bullae 5.9, toothrow 7.0.

Subgenus (c) **Berylmys** Ellerman86. **Rattus manipulus** (Thomas)(ii) **Rattus manipulus kekrimus** Roonwal

The Naga Hills Race of Manipur Rat

1948. *Rattus manipulus kekrimus* Roonwal, *Proc. nation. Inst. Sci. India*, Calcutta, 14, p. 386.
 1950. *Rattus manipulus kekrimus* Roonwal, *Rec. Indian Mus.*, Calcutta, 47 [1949], pp. 45–47 and pl. 5.

Type-locality.—Kekrima (= Chekrimi), c. 1,635 metres altitude, about 10 miles (air distance) south-east of Kohima, Naga Hills and Tuensang Administration, India.



TEXT-FIG. 51. *Rattus rattus khumbuensis* Biswas and Khajuria. A, B, C, dorsal, ventral and lateral views of the skull of the holotype. D, lower jaw of the same. (After Biswas and Khajuria, 1957, p. 245.)

Distribution.—INDIA: Kekrima, Naga Hills and Tuensang Administration (known only from the type-locality).

Description.—Similar to *Rattus m. manipulus* (Thomas) but differing in the following respects:—Colour of dorsum paler, with less grey and more brown. Tail longer, being on an average about 105% as against 93% of the head and body length. Skull smaller, post-molar length shorter, palatal length greater; anterior palatine foramina much smaller; and length of upper molar crowns much greater than in the nominate race. Dorsum paler, with less grey and more brown.

External measurements of the holotype, in mm.—1 ad. ♂: Head and body 139, tail 172, hindfoot 39.

Cranial measurements, in mm.—4 ♂ ♀: Post-molar length 15.0–17.1, palate 18.3–19.8, palatal foramina 6.7–7.4, tooth-row 6.0–6.4.

Genus 40. **Mus** Linnaeus

Subgenus (a) **Mus** Linnaeus

104. **Mus musculus** Linnaeus

(vi) **Mus musculus pygmaeus**

Biswas and Khajuria

The Pygmy House Mouse

Text-fig. 52

1955. *Mus musculus pygmaeus* Biswas and Khajuria, *Proc. zool. Soc., Calcutta*, 8, p. 28.

1957. *Mus musculus pygmaeus* Biswas and Khajuria, *Proc. zool. Soc., Calcutta*, Mookerjee memor. Vol., pp. 243-244.

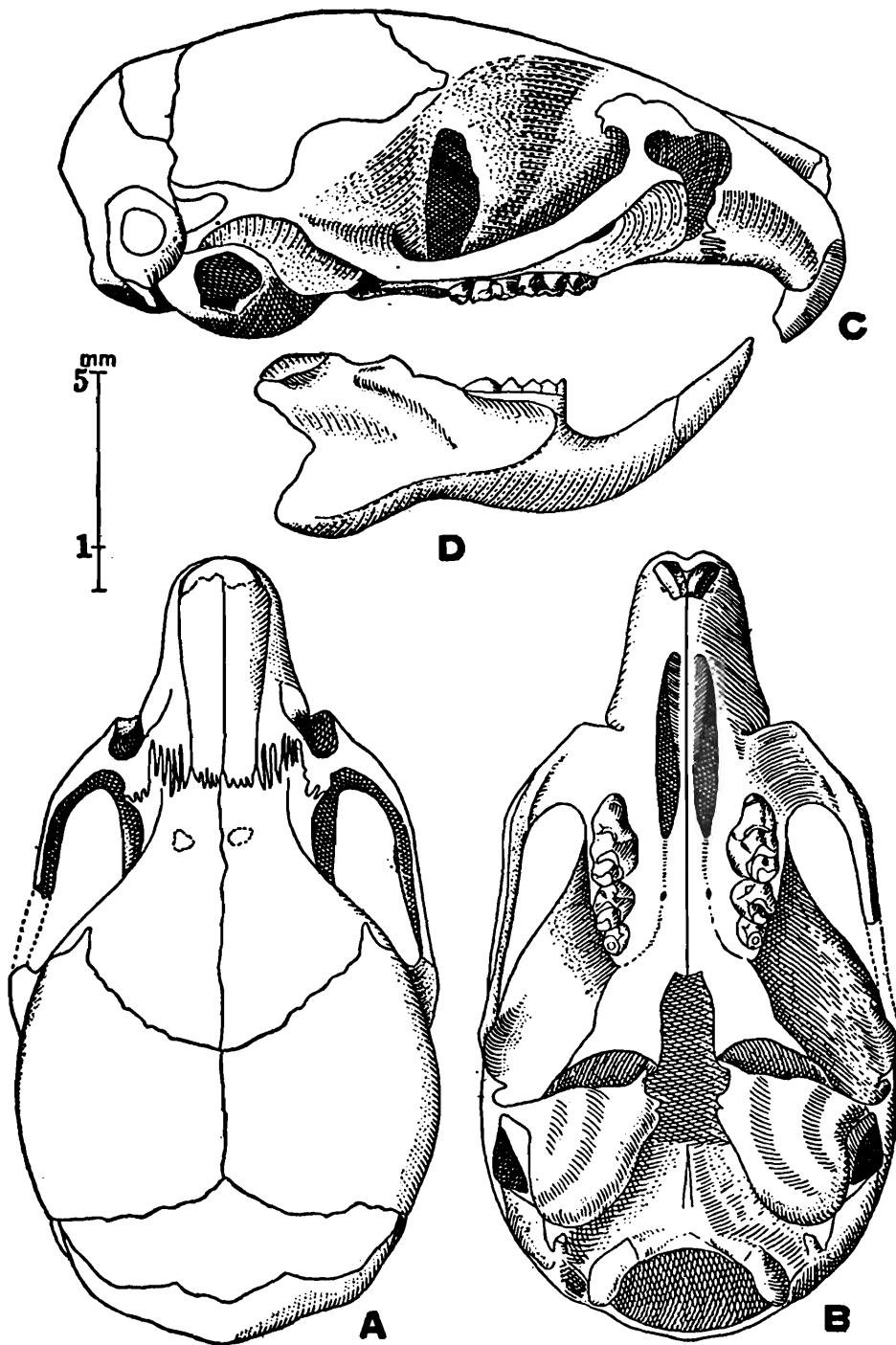
Type-locality.—Pangboche (c. 4,300 metres), Imja Valley, Khumbu, Nepal.

Distribution.—Imja Valley, Khumbu, NEPAL (known only from the type-locality).

Description.—This form differs from all other known subspecies of *Mus musculus* by having a darker coloration on the upperside, white on the underside, longer fur, much smaller size, and broader cranium and nasals (Text-fig. 52). It comes close to *M. m. homourus* Hodgson.

External measurements of the holotype, in mm.—1 ad. ♂: Head and body 55, tail 64, hindfoot 15.5, ear 12.0.

Cranial measurements of the holotype, in mm.—1 ad. ♂: Occipitonasal length 17.9, palatal foramina 3.6, diastema 4.1, bullae 3.5, toothrow 3.0.



TEXT-FIG. 52. *Mus musculus pygmaeus* Biswas and Khajuria. A, B, C, dorsal, ventral and lateral views of the skull of the holotype. D, lower jaw of the same. (After Biswas and Khajuria, 1957, p. 243.)

106. **Mus cervicolor** Hodgson(vii) **Mus cervicolor imphalensis** (Roonwal)

The Manipur Jungle Mouse

Text-fig. 53

1948. *Leggada nagarum imphalensis* Roonwal, *Proc. nation. Inst. Sci. India*, Calcutta, **14**, p. 386.
 1950. *Leggada nagarum imphalensis* Roonwal, *Rec. Indian Mus.*, Delhi, **47** [1949], pp. 53-57, pls. 1 and 9.
 1960. *Mus cervicolor imphalensis* Ellerman, *Fauna India*, Mammalia (2nd ed.), **3** (Rodentia), p. 765.

Type-locality.—16 miles north of Imphal on Dimapur Road, Manipur, India, c. 3,500 ft. (1,070 metres).

Distribution.—INDIA: Central Manipur: 16-17 miles north of Imphal on Dimapur Road, c. 1,067 metres. Western BURMA: Kalewa in Kabaw Valley, Sagaing district, c. 110 metres.

Description.—This race differs from the adjacent *nagarum* in having the head and body longer, tail much shorter, colour of dorsum colder and darker, with more grey, skull somewhat larger, nasals much longer, zygomatic plate straight, and upper incisors slightly pro-odont (Text-fig. 53). The form appears to be close to *Mus cervicolor nitidulus* Blyth (as understood by Ellerman, 1947, p. 384).

'Dorsum grizzled dark mummy brown, paler and more tawny at the sides. Venter silvery grey.' Tail hairs about dark brown with pale rufous tips.

External measurements, in mm.—6 ♂ ♀: Head and body 85-91, tail 56-64, hindfoot 15-17, ear 12-13.

Cranial measurements, in mm.—5 ♂ ♀: Occipitonasal length 20.6-22.3, palatal foramina 4.8-5.6, nasals 8.4-9.1, diastema 6.2 (of holotype only), bullae 3.8 (of holotype only), tooth-row 3.5-3.8.

Subgenus (b) **Coelomys** Thomas111a. **Mus guhai** Nath

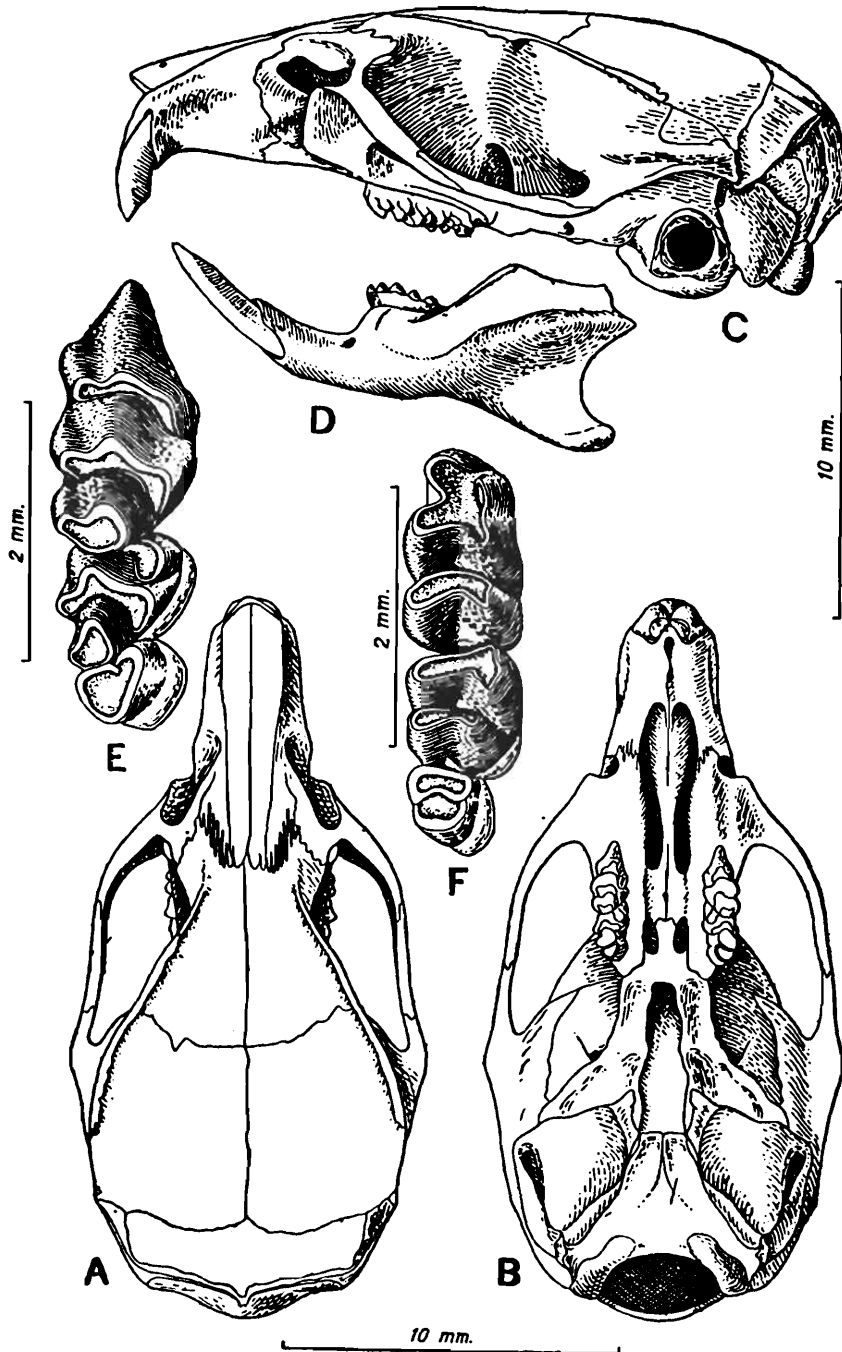
The Khasi Hills Mouse

Text-fig. 54

1952. *Mus guhai* Nath, *J. zool. Soc. India*, Calcutta, **4**, p. 85.

Type-locality.—Nongpoh, Khasi Hills, Assam.

Distribution.—INDIA: Khasi Hills, Assam (known only from the type-locality).

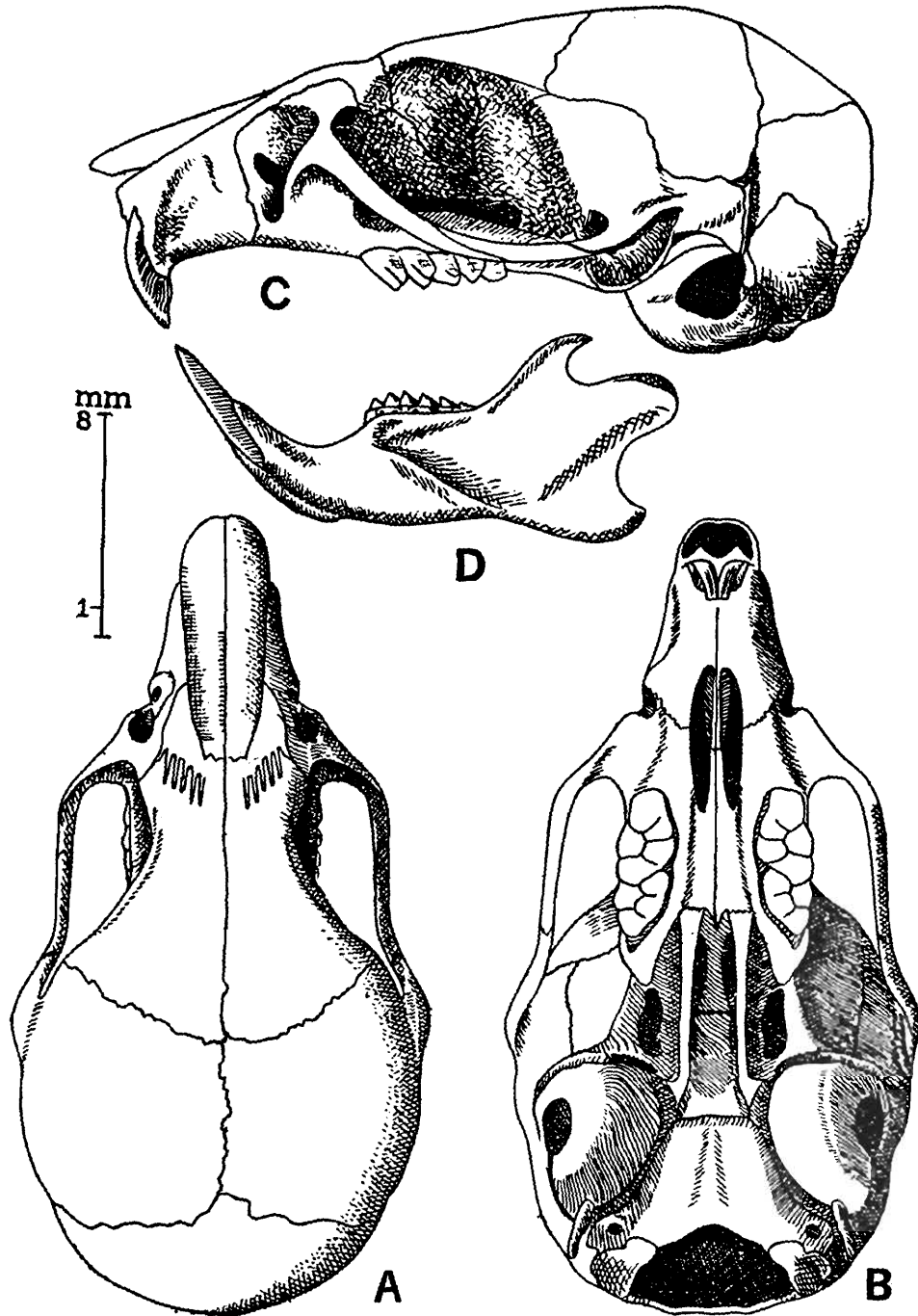


TEXT-FIG. 53. *Mus cervicolor imphalensis* (Roonwal). A, B, C, dorsal, ventral and left side-view of the skull of the holotype. D, outer side-view of left mandible. E, upper molar crowns of right side, in surface view. F, lower molar crowns of right side, in surface view. (After Roonwal, 1950, Pl. IX.)

Description.—This species is readily recognizable by its short head and body length, and soft fur without any spines, which is rather commonly found in *Mus pahari* Thomas and

Mus mayori (Thomas) with which it appears to be closely related.

Skull larger than *M. pahari* but smaller than *M. mayori*; palatal foramina longer and reaches far back to the level of m^1 ; rostrum shorter; m^3 almost vestigial; palatal length shorter (Text-fig. 54).



TEXT-FIG. 54. *Mus guhai* Nath. A, B, C, dorsal, ventral and lateral views of the skull of the holotype. D, outer side of left mandible. (After Nath, 1952, p. 87.)

Dorsum dark mummy brown. Venter greyish white, not sharply defined laterally. Ears dark brown; hindfeet pinkish brown. Tail uniformly dark brown throughout.

Measurements.—External and cranial measurements are given in Tables 114 and 115 respectively.

TABLE 114.—*Range of external measurements of Mus guhai*
Nath, in mm.

	Head and body	Tail	Hindfoot	Ear
Holotype 1 ♂	79	87.5	24.5	16
Paratypes 5 ♂	72.5–77	76–82	23.5–24	13–15

TABLE 115.—*Range of cranial measurements of Mus guhai*
Nath, in mm.

	Occipitonasal length	Palatal length	Length of pala- tal foramina	Length of nasals	Length of dia- stema	Bullae	Length of tooth- row
Holotype 1 ♂	28.5	11.5	5.4	8.0	7.0	5.2	4.6
Paratypes 5 ♂	25.2–27.7	11.7–11.8	5.1–5.3	—	6.9–7.0	4.9–5.2	4.3–4.6

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THE FAUNA OF INDIA
Monographs

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1. INTRODUCTION

The *Fauna of India* series of monographs is a continuation of the well-known *Fauna of British India* series which was being published under the authority of the Secretary of State for India in England. It was sanctioned in the year 1883, and the first volume of the series, on *Mammalia* (Part 1), by W. T. Blanford, appeared in 1888. Since India's Independence, in 1947, the Government of India have assumed the responsibility of publishing the series under its new title, *The Fauna of India*, and three volumes—one on *Butterflies* (Vol. 2, revised edition, by G. Talbot, 1947), a second one on *Coleoptera*, Families Lucanidae and Passalidae (by G. J. Arrow, no date = 1950), and a third on *Polychaeta* (by P. Fauvel, 1953)—have already appeared since; some more are in the press, while others are either about to go to the press or are in the course of preparation.

While Lt.-Col. R. B. S. Sewell, of Cambridge, England, continues to act as the editor of those volumes for which arrangements had been already made with him, the Director, Zoological Survey of India, is the editor of all other volumes. In either case, the volumes will be printed in India and published under the patronage of the Government of India.

The Director, Zoological Survey of India, is anxious that a continuous flow of publications of the series is established, but this would depend largely on the availability of suitable authors not only in India but also in other parts of the world. It is hoped that several specialists would be interested in the authorship. As details concerning the preparation of the series may not be known to them, some general information is given below; further enquiries may be made from the undersigned.

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The general object of the series is to produce authoritative taxonomic monographs of a high scientific standard on the different groups of Indian animals, so as to make them available not only to the students, naturalists, and research workers in zoology, but also to workers in the allied fields of the applied sciences such as medicine, public health, veterinary science, forestry, agriculture, etc., and to the general public.

3. SCOPE AND LAYOUT

Though primarily devoted to the fauna of the Republic of India (including Sikkim and Bhutan), the *Fauna of India* will continue to cover, as far as possible, the neighbouring countries like Nepal, Burma, Ceylon and Pakistan, whose fauna is closely allied to that of India. The marine fauna of the Indian Ocean is also included.

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6. VOLUMES PUBLISHED AND IN PREPARATION

A list of the volumes published so far, and in preparation, is appended.

Zoological Survey of India,
34, Chittaranjan Avenue,
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15th July, 1959

M. L. ROONWAL,
Director,
Zoological Survey of India

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By FAUVEL, P. 1953. 4 (unnumbered)+xii+508+iv pp.,
1 map (in pocket). Price Rs.30 or 46 sh.

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By HARDING, W. A., and MOORE, J. P. 1927 (March 23).
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1908 (December 7). Testacellidae and Zonitidae. xxxii
+312 pp. Price 14 sh.

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phidae and Janellidae. xii+520+2 (unnumbered) pp.
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Order (A) **COLEOPTERA**

Suborder (a) *Adephaga*

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Vol. 2—By ANDREWS, H. E. 1935 (October 23). Carabidae: Harpalinae I. xvi+324+10 (unnumbered)+6 pp., 5 pls. (4 col.), 1 figd. map. Price 22 sh. 6 d.

Suborder (b) *Polyphaga*

Series (1) *Clavicornia*

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Series (2) *Lamellicornia*

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By ARROW, G. J. 1931 (December 15). Coprinae. 2 (unnumbered)+xii+428+24 (unnumbered) pp., 13 pls. (1 col.), 1 figd. map. Price 30 sh.

By ARROW, G. J. No date [= 1950, April 28]. Lucanidae and Passalidae. xii+274+46 (unnumbered)+6 pp., 23 pls. (1 col.). Price 50 sh.

Series (3) *Phytophaga*

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*By JACOBY, M. 1908 (March 14). Chrysomelidae. xx+534+4 (unnumbered) pp., 2 pls. (both col.). Price 28 sh.

- By MAULIK, S. 1919 (July). Chrysomelidae: Hispinae and Cossidinae. xii+440+2 (unnumbered) pp. Price 21 sh.
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- By MARSHALL, G. A. K. 1916 (November 28). Curculionidae. xvi+368+2 (unnumbered) pp. Price 21 sh.

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Series (6) *Diversicornia*

- By KAPUR, A. P. Coccinellidae. [Under preparation.]

Order (B) DERMAPTERA

- By BURR, M. 1910 (February 3). xviii+218+20 (unnumbered) pp., 10 pls. (1 col.). Price 14 sh.

Order (C) DIPTERA

- Vol. 1†—By BRUNETTI, E. 1912 (November). Nematocera (excluding Chironomidae and Culicidae). xxviii+2 (unnumbered)+582+26 (unnumbered) pp., 12 pls. Price 28 sh.

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