

AMERICAN MUSEUM NOVITATES

Number 217

Published by
THE AMERICAN MUSEUM OF NATURAL HISTORY
New York City

June 16, 1926

59.9,32R(51)

RATS (GENUS *RATTUS*) FROM THE ASIATIC EXPEDITIONS¹

BY GLOVER M. ALLEN

Through the work of the Asiatic Expeditions of The American Museum of Natural History under the leadership of Dr. Roy Chapman Andrews, a magnificent series of over 1500 well-prepared skins of true rats (*Rattus*) has now been assembled from China, chiefly from the provinces of Yunnan, Fukien, Hainan, Szechwan, and Chili. A study of this collection in connection with previously published reports, especially those by Thomas and by Bonhote, affords a fairly comprehensive view of the distribution and variation of this group in China, though the relation of some of the species to Indian and Burmese representatives is still to be better worked out. In its general distribution the genus is one of warmer climates, with more species in the southern than in the northern half of China. Many of these, however, though perfectly distinct and possessing well-marked characters, are so similar in superficial appearance, size and color, that a careful comparison is often needed to establish their identity. As an aid to the general student, therefore, some of the chief characteristics of the several forms here mentioned are briefly given in connection with each, while those pertaining to the species are grouped in a key. Most of the species known from China are included in the collection. Of those listed by Bonhote (1906, Proc. Zoöl. Soc. London, 1905, p. 394), the species *ling* and *losea* were not identified, nor were specimens of the later-described *excelsior* (Thomas) taken.

KEY TO SPECIES OF *Rattus* LISTED

- A.—Belly white, sharply marked off from color of sides; its hairs white to the roots.
 - a.—Size large, hind foot 50–55 mm.
 - b.—Color browner, ochraceous and black above. *edwardsi*.
 - b'.—Color gray, grizzled.
 - c.—Chocolate brown, under fur sparse. *mackenziei*.
 - c'.—Grizzled gray and whitish, fur normal. *latouchei*.
 - a'.—Size smaller, hind foot 27–35 mm.
 - b.—Pelage very hispid, color bright ochraceous above. . . . *huang*.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 66.

*b*¹.—Pelage slightly or not spinous in summer, color duller.

c.—Larger, hind foot 35 mm.

A dark area about the eye, tail tip white.

andersoni.

No dark eye-spot, tail dark all around. *rattus*.

*c*¹.—Smaller, hind foot 27–31 mm., belly with a slight yellowish tint. *confucianus*.

B.—Belly hairs slaty-based, at least medially.

a.—Lower surfaces washed with ochraceous, back of hands dark brown.

flavipectus.

*a*¹.—Lower surfaces tipped with whitish; feet white.

b.—Tail shorter than head and body. *norvegicus*.

*b*¹.—Tail usually longer than head and body.

c.—Larger, hind foot about 35 mm.; nasals ending posteriorly in a median point on a level with premaxillaries; outer anterior tubercle of *m*¹ reduced.

griseipectus.

*c*¹.—Smaller, hind foot 30–32 mm., nasals truncate posteriorly and shorter than premaxillaries; three anterior tubercles of *m*¹ well marked.

humiliatus.

***Rattus rattus rattus* (Linnæus)**

Mus rattus LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 61.

This is the common Black Rat introduced from Europe, with larger ears than the Brown Rat, and the tail proportionately longer, exceeding half the total length. It is apparently rare away from the coast, and its status even there is not altogether clear. The collections include but a single specimen from Kuliang, Fukien Province.

***Rattus rattus sladeni* (Anderson)**

Mussladieni ANDERSON, 1878, 'Anat. and Zool. Researches Western Yunnan,' p. 305.

Kloss, who has reexamined Anderson's original specimens in alcohol from the Kakhyen Hills, western Yunnan, regards them as representatives of a valid race of *Rattus rattus*. The color is bright tawny above, mixed with black; below, pure white to the bases of the hairs, with a faint buffy tinge; hands and feet white; tail dark all around, averaging about 114% of head and body or 53% of total length, not so long as in some of the Indian races. Mammæ 3–3=12.

A series of thirty-three skins from various localities in western Yunnan is referred to this subspecies. Seventeen are from the Burma border, Namting River, at 1700 feet altitude; others are from the Salween and Mekong Rivers, at very slightly higher altitudes; while three from Tali Lake, at 6500 feet, and one from Pei-tai, forty miles

south of Chungtien, at 8000 feet, represent the highest elevations where the species was found. The last locality is also the most northern. While to some extent this is doubtless a house rat, it is nevertheless a natural wild species, and the series of skins is fairly uniform in color. Eight show a median gray stripe or blaze on the chest, and about a quarter of them have the central area of the backs of the feet darkened. To judge from the description, the race *khyensis* of Burma must be very similar to this.

Apparently no wild form of this species has been recorded from eastern China. Bonhote, in his review of Chinese rats in 1906, does not include it. It is therefore interesting to find three specimens from Fukien Province, collected by Rev. H. R. Caldwell for The American Museum of Natural History. Two of these are from Yuki, the other from Yenping farther inland. The collector's note records that the first two were taken in sword grass by the river bank. Although unaccompanied by skulls or measurements, these seem to be indistinguishable from the Yunnan specimens and are provisionally referred to the race *sladeni*.

***Rattus rattus hainanicus*, new subspecies**

TYPE.—Adult female, skin and skull, No. 59223, American Museum of Natural History, from Nam Fong, island of Hainan, China. February 15, 1923. Clifford Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Tail longer than in *R. r. sladeni*, averaging more than 120 per cent of head-and-body length; the dorsal coloring duller, more olive in general appearance, not so bright ochraceous as in the latter.

Dorsal surfaces nearly "yellow ocher" of Ridgway (1912), much duller than the "ochraceous buff" of *sladeni*, considerably darkened in the median area by long black hairs which are most conspicuous and somewhat hispid over the rump. The sides of the body and cheeks are grayer on account of the lack of black hairs and the showing through of the gray bases of the pelage in these parts. The backs of the feet are clothed with short, polished white hairs; the tail is dark all around, although two out of the series of ten show a tendency to a white tip, one of 20 mm., the other of about 3 mm., just below the end. The entire under parts of body and limbs are buffy white clear to the bases of the hairs, though in one specimen of the series a small gray spot is present at the center of the chest. Mammary 3-3 = 12.

SKULL.—In comparison with material at hand, the skulls of the Hainan form of *Rattus rattus* show a very strong development of the supraorbital ridges which are broad and overhanging, with a prominent angle at the back of the orbit, whence they continue straight posteriorly to the parietal notch and thence less prominently to the outer corners of the interparietal. The incisive foramina are wider, more bowed outward than in Yunnan skulls referred to *sladeni*.

MEASUREMENTS.—The type was measured by the collector as follows: head and body, 180 mm.; tail, 222 (123% of head and body); hind foot, 31; ear, 24. In the dried specimen, the hind foot, with claw measured 33 mm.

The skull measures: greatest length, 44 mm.; basal length, 39; palatal length, 23.8; diastema, 11.8; zygomatic width, 20.7; width across postorbital angles, 11; mastoid width, 16.2; nasals, 16.2; upper cheek teeth, 7.8; lower cheek teeth, 7.8; length of bulla, 7.3.

In his careful study of the Indian House Rats, Hinton has lately shown that those from Sind, in western India, are "very different" from those in other parts of that country, and may provisionally be referred to the subspecies *alexandrinus*. To the eastward, *Rattus rattus* breaks up into various geographic subspecies, differing slightly in size, proportions, number of mammae, and color tone. The original, "wild" form is apparently white-bellied to the roots of the hairs with, in some cases, a gray pectoral spot. The gray-bellied forms seem to be urban, and more or less commensal with man. The relative scarcity of the "wild" type in southern China is shown by the fact that the Asiatic Expeditions secured only twenty-one in Yunnan and but three in Fukien while Bonhote did not include it in his review of Chinese rats. On Hainan it seems to be equally uncommon, only ten specimens in all having been taken at Nam Fong and Nodoa. In these, the long tails, duller coloring and heavily ridged skulls seem to separate them readily from the shorter-tailed and brighter-colored specimens of the two provinces mentioned. All are quite uniform in general appearance, while the tendency to the development of a white tail-tip is unusual in the species.

***Rattus humiliatus* (A. Milne-Edwards)**

Mus humiliatus A. MILNE-EDWARDS, 1868-74, 'Recherches Hist. Nat. des Mammifères,' p. 137, Pl. XLI, fig. 1.

A small rat, tail about 52 per cent of total length, hind foot about 31 mm., greatest length of skull (adult) about 38 mm. The color, although in general recalling that of the Norway Rat, is slightly more tawny and the black hairs of the back are so evenly distributed that they fail to make a darker dorsal area. The feet are white and the tail is usually slightly paler on the lower than on the upper side. The whitish of the belly is not sharply bounded laterally, and the hairs are mostly pale slate-color at base, though often pure white in the axillary region or at the sides. The nasals are squarely truncate posteriorly and exceeded in length by the prolongations of the premaxillæ, while the three anterior tubercles of the upper first molar are nearly equal in size.

This species is apparently rare in collections. The type is supposed to have come from Peking or its vicinity but subsequent collecting there seems not to have revealed its presence. Bonhote states that it is absent from the collections made by Rickett, Styan, and La Touche, though he

records a single one from Nanking. He adds, further, that a specimen received from the Paris Museum as belonging to this species, and collected by Père David in western Fukien, proves to be *R. norvegicus*, so that the same mistake may have been made with supposed Peking examples. The collections of the Asiatic Expeditions include a small series taken in Fukien at Futsing and Yenping, and a very large number from the island of Hainan. I am unable to see any important difference in these two groups, though it is quite probable that they might be different from Peking specimens if any were available. The apparent scarcity of the species in North China make it seem questionable if Père David's original specimens were not after all from Fukien. In Hainan Mr. Clifford Pope found this the dominant species of the genus, abundant in the high grass and bushes bordering rice-fields, but less plentiful in the jungles.

***Rattus humiliatus celsus*, new subspecies**

TYPE.—Adult female, skin and skull, No. 43393, American Museum of Natural History, from Taku Ferry, west bank of the Yangtze River, Yunnan, China, 6000 feet altitude. November 20, 1916. R. C. Andrews and Edmund Heller, collectors.

DESCRIPTION.—Similar to *R. humiliatus* of southeastern China in size and general proportions, but longer-haired and lacking the bright buffy or cinnamon tone, which in this highland race is much paler; belly with a buffy tint instead of white.

General color above nearly "light ochraceous buff" of Ridgway, 1912, sparsely lined with black. The individual hairs are slaty-based with tips of "light ochraceous buff" or paler, about "pale ochraceous buff," the latter predominating at the sides of the body, and grading into the buffy whitish of the belly. Long black hairs line the entire upper part of the dorsal surface from nose to tail, darkening the lower back. Feet white. Lower side of limbs and body whitish with a buffy wash, the bases of the hairs grayish or pale slaty except on throat, fore limbs, axillæ and inguinal region, where usually the dark bases are lacking. Tail thinly haired. The minute setæ dark brown above, but distinctly paler below. Mammæ 3-3=12.

SKULL.—In comparison with specimens from Fukien and Hainan, the skull differs in having slightly longer nasals which average about 15 against 13 mm. in adults. The supraorbital ridges in both series continue strongly backward to the point where the parietal suture makes an angle, beyond which the ridge is faintly but clearly traceable to the outer corner of the interparietal. The extreme width of the latter bone equals the distance from its outer angle to the antero-lateral corner of the parietal on the ridge. First upper molar with the three tubercles of its anterior row well defined and subequal; palate with a distinct median point at its posterior edge.

MEASUREMENTS.—The following dimensions of the type are from the collector's label; head and body, 160 mm.; tail, 198; hind foot, 33; ear, 22. Probably the tail measurement as given is too long. It averages about 51 per cent of total length. The skull measures: greatest length, 40.5; basal length, 35.3; palatal length, 22;

diastema, 10.4; zygomatic width, 19.5; mastoid width, 15.2; nasals, 16; upper cheek teeth, 7.6; lower cheek teeth, 7.5.

A series of nineteen skins from Yunnan is at once separable from the coast form by the longer pelage and grayer tone, with belly less white, and by the longer nasals. The series comprises eleven from Taku Ferry, west bank of the Yangtze, 6000 feet; one from Yunnan-yi, 6500 feet; one from forty miles south of Chungtien, 8000 feet; three from Hapa, 20 miles north of Taku, 10,000 feet; and three from Peitai Mountain, 10,000 feet. These localities indicate a considerable range for *humiliatus* as a species, from near sea-level to 10,000 feet.

In its more or less drab coloration the series from Yunnan closely resembles *Rattus griseipectus* superficially, but specimens may readily be distinguished from the latter by their shorter and relatively broader hind foot, the white hairs of which are coarser and less burnished; by the relatively shorter tail, and ear; and by the skull with its nasals truncate posteriorly and shorter than the premaxillaries, as well as by the characters of the first upper molar, with its three tubercles of the anterior row all clearly marked off and subequal.

***Rattus flavipectus* (A. Milne-Edwards)**

Mus flavipectus A. MILNE-EDWARDS, 1871, Nouv. Arch. Mus. d'Hist. Nat., Paris, VII, p. 93.

A species resembling the Norway Rat in general appearance, but with tail usually slightly more than half the total length, the fore feet with dark central areas instead of white, and the fur of the belly slaty at base tipped with buffy. The nasals are slightly shorter than the premaxillaries, and the supraorbital beading extends to the posterior edge of the parietal, flaring out laterally along the outer curve of the braincase.

This brown rat, in its distribution in China, seems to be mainly southern, though it reaches high country in Szechwan and Yunnan. It is recorded by Bonhote from Fukien and Kiangsi Provinces as well as from Formosa. The type was from Moupin, western Szechwan. Additional localities are furnished by the material from the Asiatic Expeditions. Rev. H. R. Caldwell collected a series in the mountains of Fukien near Yenping, and there are others from Futsing and Kuliang in the same province. In eastern Szechwan a few, including partly grown young, were taken late in the year at Wanhsien. The Duke of Bedford's expeditions apparently brought back none from this province, nor does it appear in the lists of species from Yunnan collected by Ward and Forrest. The collections of the Asiatic Expeditions, however,

include specimens from Yunnan-yi (6500 feet), one from Lichiang, 8200 feet (young), and three quite typical examples from Hsiao Tien, Mekong River (6500 feet), all in Yunnan. In addition, a single one was taken on the island of Hainan by Mr. Clifford Pope of the Third Asiatic Expedition and is an addition to the species known from the island. Although living as a wild species, this is frequently a house rat, coming into the native temples or dwellings.

***Rattus flavipectus yunnanensis* (Anderson)**

Mus yunnanensis ANDERSON, 1878, 'Anat. and Zool. Researches Western Yunnan,' p. 306.

This is a brighter-colored race with the belly nearly white and the yellowish wash usually restricted to the throat and middle area of the chest, where it may be intensified to a rusty tint.

In the lower country of southwestern Yunnan the representative of *R. flavipectus* is noticeably brighter in color and whiter-bellied, with the buffy wash usually more restricted. Anderson's name, based on specimens from "Ponsee, Hotha and Teng-yue-chow," is apparently applicable to it, and it should stand as a subspecies.

A series of fifteen adults was secured from the following places near the southwestern boundary: Mucheng, Salween drainage, 7000 feet; Changlung, Salween River, 2000 feet; and Namting River, Burma border, 1700 feet. Its relationship to the Indian representatives of the group remains to be shown, while structurally it seems very close to *R. r. sladeni*. Three skins from farther north, Hsiao Tien, seem to represent the typical subspecies.

As pointed out by Bonhote, the dark color of the backs of the fore feet is a very constant character. The buffy wash over the entire lower surface is fairly constant in *flavipectus*, but in *yunnanensis* it is rarely so extensive.

***Rattus griseipectus* (A. Milne-Edwards)**

Mus griseipectus A. MILNE-EDWARDS, 1871, Nouv. Arch. Mus. d'Hist. Nat., Paris, VII, p. 93.

A rat with much the general appearance of the common Roof Rat (*Rattus r. alexandrinus*) but grayer and with the tail about 50 to 52 per cent of total length. Among Chinese species it may be recognized by the abundance of longer black hairs in the mid-dorsal area, producing a darker, longer pelage than in *R. humiliatus* (which it may often much resemble when immature), by its long slender hind foot (35 mm.), with shining white hairs, its gray belly, and large papery ears. The skull,

compared with that of *R. humiliatus*, is larger, the braincase wider; the nasals end posteriorly in a median point on a level with the posterior ends of the premaxillaries, and the outer tubercle of the anterior row on the first molariform tooth is much reduced and usually not marked off by a vertical furrow on the front face.

This rat seems to be widely distributed across southern China. The type locality is Szechwan and it has also been recorded from Fukien. In the collections of the Asiatic Expeditions are specimens from these provinces as well as from several localities in western Yunnan from 1700 to 10,000 feet, from Hunan (Yochow), and from the island of Hainan. The last is the southernmost record of the species, which had not been previously recorded for the island. Three of the five skins from Hainan have a median spot on the belly where the hairs are pure white to their bases, instead of gray-based. They do not seem to differ in any important way, however, from the small series from Szechwan and Yunnan, which in general aspect are very uniform.

***Rattus norvegicus socer* (Miller)**

Epimys norvegicus socer MILLER, 1914, Proc. Biol. Soc. Washington, XXVII p. 90.

The indigenous race of the Brown Rat differs from that of Europe in its slightly smaller size, smaller hind foot (35–39 mm. instead of 40 or more), somewhat brighter color and slightly more hairy tail, which, as in the typical race, is shorter than head and body (46 per cent of total length). The skull, in addition to being less heavily formed, has usually a less wide interparietal, so that the width across the cranial ridges at the interparietal equals rather than exceeds the width at the postorbital angles.

This species is, as with us, a house rat. Seventeen specimens preserved from inland localities seem all referable to this race rather than to the introduced form from Europe, which doubtless occurs in the sea-ports. The localities are: Chili, Eastern Tombs; Shensi, near Feng-siangfu; Szechwan, Wanhsien; and Yunnan, Lichiang, 8200 feet. Two immatures without skulls, from Fukien, Yenping, seem to be the same.

***Rattus confucianus confucianus* (A. Milne-Edwards)**

Mus confucianus A. MILNE-EDWARDS, 1871, Nouv. Arch. Mus. d'Hist. Nat., Paris, VII, p. 93.

A slenderly formed rat, with tail about 56 per cent of the total length; above, a mixed ochraceous and black, the latter predominating

on the mid-dorsal area; below, clear white to the roots of the hairs, with a very faint yellowish wash. Feet white with dark metatarsal area. Summer coat spinous above.

As a species, this is common and of wide distribution over nearly the whole of China in suitable country, preferring hilly and rocky ground with at least a slight cover of vegetation. A very large series secured by the Asiatic Expeditions affords a valuable basis for comparison of specimens from distant parts of the range. Originally described from "Setchuan," the typical form is the darkest of the races, with the mid-dorsal area noticeably clouded by the long black hairs. The metapodials are also as a rule conspicuously darker; the tail is longer than head and body, averaging 56 per cent of the total length, either dark above and white below or with a white tip sometimes involving as much as a third of the length. In a series of 76 from Wan-hsien, Szechwan, 31 (40 per cent) have the tail white-tipped. Frequently the terminal white area is broken by little islands of dark in the mid-dorsal line, even including the tip. In nearly all, the buffy of the cheeks is continuous across to the muzzle, though rarely the white of the upper lip is produced upward to include a spot at the base of the whiskers. About a quarter of the series (19 in 76) have a spot in the center of the chest between the forelegs, varying from a very small tuft of hair with gray bases to a broader area, in one case 8 by 10 mm., with slaty bases and clear russet tips. In summer pelage many of the dorsal hairs are flattened and spine-like, but these are usually shed in late fall or early winter, so that January and February specimens have full soft fur.

In the highlands of central China this race covers an extensive area, including Szechwan Province, and extending southward into the mountains of Yunnan. A series from Lichiang, Yunnan, at 10,000 feet, taken in late October and early November, are all in soft winter coat. They seem indistinguishable from typical *confucianus* and Thomas has referred a series from the same region to that race. About half of those examined have a conspicuous white spot at the base of the whiskers as an extension of the usual narrow white edging of the upper lip.

To the eastward, the range doubtless extends across to the coast, for a series of skins from Fukien is practically similar to the Szechwan specimens, though perhaps a shade less dark above and the dark metatarsal area averaging less in extent and depth. Thus, in a series of 45, the feet are white or practically so in 25, while in most of the others the dark area is less well marked than in those from Szechwan. The difference, however, is extremely slight. To the north the length of tail

decreases, the colors pale somewhat, and at least one or two local races are recognizable. To the south, the colors become brighter as in Hainan or richer as on the Burma border.

***Rattus confucianus sacer* (Thomas)**

Mus confucianus sacer THOMAS, 1908, Proc. Zool. Soc. London, p. 6.

A paler, buffy-gray race, with tail long-haired and white-tipped, and the backs of the feet white.

This is typical in the Shantung peninsula, northern China; the type locality, Chefoo. Although the present collections contain none from Shantung, a large series from Yochow, Honan Province, is probably not very unlike this race, and the same is doubtless true of the series from Tai-pei-shan, Tsing-ling Mountains, Shensi Province, and from Fengsiangfu, Shensi. Indeed, Thomas considers Tsing-ling specimens intermediates between this and the typical race. Their feet average white, sometimes with the dark metatarsal area indicated by a buffy or grayish wash. The tail is usually white-tipped in (76 out of 84), and about a third have the white spot at the base of the whiskers. The winter pelage is apparently without spiny hairs. The subspecies is perhaps transitional to the following.

***Rattus confucianus chihliensis* Thomas**

Rattus confucianus chihliensis THOMAS, 1917, Ann. Mag. Nat. Hist., (8) XX, p. 199.

Differs from the typical form in having the tail shorter, about 49 per cent of total length, its tip penicillate and usually white above for as much as the terminal half.

The type locality is the Imperial Tombs, 65 miles east of Peking, Chili Province, whence a series of twenty-five was secured by the Asiatic Expeditions. In general color these are not very different from those taken to represent *sacer* in Honan and Shensi. Immatures are slightly grayer than adults. The dark metatarsal area is present in about half the series, and, while the summer skins are more or less spinous above, the few taken in winter are uniformly soft-furred. This seems to be the northernmost race of the species.

***Rattus confucianus luticolor* (Thomas)**

Mus confucianus luticolor THOMAS, 1908, Abstr. Proc. Zool. Soc. London, December 22, p. 45.

A paler and slightly smaller race than *sacer*. The type specimen is from Yen-anfu, Shensi Province.

A small series of the sulphur-bellied rat from He-shuin, Shansi Province, is intermediate between the races *chihliensis* and *sacer* or *luticolor*, and is perhaps to be regarded as representing *luticolor*, which is typical along the southern edge of the Ordos Desert. Its differential characters are its smaller size and paler color as compared with *sacer*. The He-shuin series is decidedly more ochraceous than *chihliensis*, due to the fewer and more scattered black hairs mid-dorsally. The tail is relatively shorter than in typical *confucianus* or *sacer*, averaging 51 per cent (47–53) of the total length, but not so short as in *chihliensis* where it is about 49 per cent. The pelage in these December skins is devoid of spines.

***Rattus confucianus* (? near *bukit*) (Bonhote)**

Mus bukit BONHOTE, 1903, Ann. Mag. Nat. Hist., (7) XI, p. 125.

Specimens representing *confucianus* from the lower subtropical parts of western Yunnan on the Burma border tend to be more richly colored than the typical subspecies. Thus, several from Mucheng, 6000 feet, on the Salween River, are a deep ochraceous, almost ferruginous on the back, cheeks, and sides, even the backs of the hind feet being buffy in some cases. Others from Homushu Pass, 8000 feet, a little to the northward, are intermediate: some are quite as richly colored as those from Mucheng, while other individuals are practically like typical *confucianus*. These brighter specimens are doubtless to be regarded as variants approaching a richer-colored subtropical form which may be either *Rattus mentosus* Thomas of upper Chindwin, Burma, or possibly *Rattus bukit* Bonhote, described from peninsular Siam, but occurring also in northern Siam (near Chiangmai). The relationship of these two to *Rattus confucianus* must be very close, perhaps not more than subspecific, as nearly as can be judged from descriptions alone.

***Rattus confucianus lotipes*, new subspecies**

TYPE.—Adult female, skin and skull, No. 59303, American Museum of Natural History, from near Nodda, island of Hainan, China. February 9, 1923. Clifford Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Characterized by the combination of brighter ochraceous coloring especially of the sides; the paler back; white feet lacking the dark metapodial area; the sharply bicolor tail (dark above, white throughout below); slightly sulphury belly; and by the spinous nature of the coat in winter as well as in summer.

The general coloring above is the usual mixed ochraceous and black, but the latter does not darken the pelage of the back to the extent that it does in typical

confucianus, while the former predominates laterally so that the sides of the head and neck, a spot behind the ears, and a narrow line at the sides of the body are nearly clear ochraceous. Some adult specimens are prevailingly ochraceous. In a series of over thirty specimens the tail is almost without exception dusky to the tip above, while its ventral half is clear white throughout lacking the dark pigment in the scales usually present in *confucianus* at least toward the base. The backs of the hands and feet are white, quite lacking all trace of the dark area on the metapodials. In some cases, however, there may be a slight buffy tinge to the basal part of the hind foot. The ventral surface of the body from chin to tail, including the lower surfaces of the limbs nearly to the ankles, is sharply marked off, sulphury white, notably yellower than in the neighboring races to the north. The upper lips are narrowly white, but in no case does this extend upward to form a white spot at the base of the whiskers as often in the typical subspecies, but always the ochraceous tint of the cheeks is continuous from the muzzle back along the sides of the head. The tail is less thickly haired than in the northern races.

SKULL.—Compared with typical *confucianus* the skull of the Hainan race presents no special peculiarities, except that in adults it appears slightly heavier, or may reach a slightly greater average size.

MEASUREMENTS.—The proportions of the body are practically as in the typical form, with the tail forming 56 per cent (average of 33 specimens) of the total length. The type was measured by the collector as follows: head and body, 135 mm.; tail, 180; hind foot, 30; ear, 21. The skull measures: greatest length, 39.5; basal length, 33.8; palatal length, 20; diastema, 10.3; zygomatic width, 16.5; mastoid width 14.5; interorbital width, 6.0; depth through audital bulla, 13; upper cheek teeth, 6.5; lower cheek teeth, 6.5.

The Hainan representative of this widely distributed rat is notably different from the typical form of Szechwan and equally so from the same race in Fukien, as well as from the other races to the north. In response to its warmer habitat, its colors are brighter, more ochraceous, and the whitish belly is more suffused with a sulphury wash. The feet are quite without the darkened central area, and the tail lacks the white tip and the darkening of the basal scales below so commonly found in the northern races. Unlike these, too, the pelage is spinous in winter (January, February, March specimens) as well as in summer. While the small dark chest-spot, occasionally seen as an individual variation, is usually absent, it is developed in one specimen so as to form a nearly complete collar, barely broken in the mid-line.

This species has not previously been recorded from Hainan, and its discovery is due to the intensive work carried out by Mr. Clifford Pope in 1922 and 1923. While the localities whence they came are given as Nodoa and Nam Fong, these are said by him to be inclusive terms, for many specimens were from the mountains some eight miles to the west.

***Rattus andersoni* (Thomas)**

Epimys andersoni THOMAS, 1911, Abstr. Proc. Zoöl. Soc. London, February 14, p. 4.

A rat resembling *R. confucianus* in general appearance but much larger, with proportionally longer, white-tipped tail, and a purer-white belly; a dark area about the eye.

The single specimen on which this species was based was taken at Omisan, Szechwan, by Malcolm Anderson, but Thomas has since recorded specimens from the Mekong valley and the Mekong-Yangtze divide at from 6000 to 9000 feet. The series secured by Dr. Roy Chapman Andrews extends the known distribution to the Lichiang range at localities between 9000 and 10,000 feet altitude. These specimens have a shorter tooth row than recorded for the type (7.5 average, against 8.2 mm.) and are on the average smaller in other dimensions of the body but may for the present be considered identical.

Of interest as extending the known range of the species to what may be nearly its northernmost limit is a single individual secured at the base of Tai-pei-shan, Tsing-ling Mountains, Shensi Province. The skull shows it to be somewhat immature but it is not distinguishable from the Yunnan series. This wide-ranging rat affords, thus, another example of the uniformity of the fauna of the central Chinese highlands.

It is interesting that none of the Asiatic Expeditions secured *R. excelsior*, described from Szechwan. It is apparently a smaller but closely allied species, chiefly differing in size. The rat I described in 1912 as *Epimys zappeyi* from Wa-shan, in central Szechwan, is a form of it, differing so far as the single example shows, in its brighter color and restricted white area below, with the wrists dark all around. Unless future collections show that these points are purely individual, it may be regarded as another local race of that isolated mountain area, and should stand as *Rattus excelsior zappeyi*.

***Rattus huang* (Bonhote)**

Mus huang BONHOTE, 1905, Abstr. Proc. Zoöl. Soc. London, No. 23, p. 19.

A brighter-colored rat than *R. confucianus*, which it resembles in size and color pattern. The white of the belly is purer, without buffy wash, the ear is slightly shorter, the pelage more hispid, and the skull with the flaring temporal ridges more strongly marked and continued conspicuously to the corner of the interparietal.

This is a common species in Fukien Province, and a large series was taken also on the island of Hainan. The two lots seem to be quite

indistinguishable. Rev. H. R. Caldwell, who collected most of the Fukien specimens, notes on the label of a January 29 skin, "nests in trees." In two cases embryos are noted: two on July 28, three on August 2, indicating small litters. This is apparently a species of southern China.

***Rattus huang vulpicolor*, new subspecies**

TYPE.—Adult male, skin and skull, No. 43297, American Museum of Natural History, from the Namting River, at the Burma border, altitude 1700 feet. February 23, 1917. R. C. Andrews and E. Heller, collectors.

DESCRIPTION.—Similar to *R. huang* of Fukien, but with a proportionally longer tail, slightly smaller skull, and much more vivid fulvous coloring above.

General color above, from forehead to base of tail a bright fox-color, nearly "ochraceous orange" (Ridgway, 1912), lined in the mid-dorsal area with black, but becoming nearly clear on the cheeks, sides of body and upper sides of fore and hind limbs. The individual hairs are slaty at base, with bright fulvous tips, intermixed with black-tipped bristles the bases of which are slaty. The muzzle is duller, brownish. Below, from chin to vent, including the lower sides of the fore-limbs to the wrists, a narrow edge of the upper lip, and the inner side of the hind legs nearly to the ankle, pure white to the roots of the hairs, with, however, a faint buffy tint over the chest and upper abdomen, a region where the hairs are very slightly hispid. The base of the tail all around is fulvous and the ankles are dusky fulvous. The backs of the feet have a narrow dusky median area mixed with buffy, and passing into clear buff toward the sides of the feet, which with the toes are clothed above with short white hair. The tail is sharply bicolor as in *R. huang*, dusky above to the tip, clear white below to the extreme end.

SKULL.—Compared with that of *R. huang* the skull of this race is slightly smaller and more delicate, but otherwise resembles that of the typical form. The prominent supraorbital bead is continued directly backward to the interparietal border instead of stopping short of it as in *R. confucianus*. The auditory bullæ are small as in the latter and in typical *huang*. The incisive foramina reach just to the level of the molar tooth rows. The nasals very slightly exceed the premaxillaries in backward extent above, and end about on a line joining the anterior margins of the orbits. The interparietal ends anteriorly in a blunt median point, rather more prominent than in *R. confucianus*.

MEASUREMENTS.—The type was measured in the flesh as follows: head and body, 140 mm.; tail, 203; hind foot, 31; ear, 20. It is slightly the largest of the six specimens. The ratio of tail to total length is 59 per cent in the type and a second example, 58 per cent in three others, and 57 per cent in the youngest specimen, whereas in a series of *R. huang* from Fukien, the tail is from 54 to 57 per cent of total length, averaging 56 per cent.

The skull of the type measures: greatest length, 36 mm.; basal length, 30.1; palatal length, 17.5; diastema, 8.5; zygomatic width, 16.3; mastoid width, 13.8; interorbital width, 6.4; width between outer corners of anterior cheek-teeth, 6.8; upper tooth row, 6; lower tooth row, 6.

This is obviously the representative of *R. huang* in western Yunnan, where, however, it must be uncommon, for careful collecting by such

skilful naturalists as Andrews and Heller resulted in the capture of but seven individuals, four of which are from the Namting River, Burma border, at the low altitude of 1700 feet, the others from Yang-pi River, Teng-yueh road, 5000 feet, and Mekong River, 8000 and 9000 feet, respectively. The last two are young adults, and are less spiny than those from the lower level, though all are winter specimens (December to February); indeed, the Yang-pi individual is practically without spiny hairs. As indicated by the known localities in Fukien, Hainan, and, now, western Yunnan, the range of *R. huang* as a species is evidently much more southern than that of *R. confucianus* to which it is allied. Bonhote, in describing it, regarded his *R. rapit* of Borneo as its nearest ally, but apparently no representative of the species has yet been discovered in the intermediate region of the Malay Peninsula, nor can I, from a careful comparison of descriptions, feel sure that any of the many forms of the genus known in eastern India is to be regarded as representing it. The discovery of this rat in western Yunnan is thus a considerable extension of the previously known range of the species. The new race is a very beautiful, delicately formed rat, much exceeding the typical eastern race in the bright coloring of its pelage.

***Rattus mackenziei* (Thomas)**

Epimys mackenziei THOMAS, 1916, Journ. Bombay Nat. Hist. Soc., XXIV, p. 411.

A large rat (hind foot 51–55 mm.), chocolate brown above, grizzled with gray ticking, under fur sparse; below pure white to the roots of the hairs; feet mostly white with dark ankles and central metatarsal area; tail nearly uniform dark, sparsely haired, with or without a white tip or white under side.

Three specimens of this rat extend its known range from Burma (Chin Hills) into China. Two were taken at Mucheng, Salween drainage, 7000 feet altitude, and one at Ho-mu-shu Pass, 8000 feet. In general appearance they recall *R. latouchei* but are browner, with almost no soft under fur on the back. The amount of white on the tail, as usually with albinistic markings, seems to vary greatly. Thomas describes the type as having the terminal two-fifths white. In the race *fax* from Tenasserim, only the extreme tip is white, while in the three from Yunnan, only one has a short white tip (20 mm.). In a second the tail is whitish throughout below, though the scales at its base are pigmented, while in the third the tail is almost uniformly dark as to both hairs and skin. In one there is a median white stripe on the forehead.

Rattus edwardsi (Thomas)

Mus edwardsi THOMAS, 1882, Proc. Zoöl. Soc. London, p. 587, Pl. XLIV.

A very large, gray-brown rat, with buffier sides, pure white belly and white-tipped tail. The feet are dark-centered with silvery-white sides and toes; foot about 55 mm.

This species does not seem to have been secured in China outside of Fukien Province, unless Satunin's *Mus gigas* from Szechwan is the same. In the small series at hand, adults in summer pelage are somewhat spiny, while others taken in November and December, though with many stiff, bristly hairs in the dorsal pelage, are less spiny. An adult trapped July 28 contained two embryos. The mammæ are 2-2=8.

Rattus latouchei (Thomas)

Mus latouchei THOMAS, 1897, Ann. Mag. Nat. Hist., (6) XX, p. 113.

A gigantic species of the size and general appearance of *R. edwardsi* but the dorsal coloration a mixed gray-brown and white, giving a uniform pepper-and-salt effect. The line marking off the pure white of the belly is less sharply defined.

A single skin from "northwestern Fukien" is practically a topotype of this little-known rat.