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THE TAXONOMIC STATUS OF *RATTUS TONDANUS* SODY AND NOTES ON THE HOLOTYPE OF *R. BECCARII* (JENTINK) AND *R. THYSANURUS* SODY (RODENTIA: MURIDAE)

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In the fall of 1969, I worked at the Rijksmuseum van Natuurlijke Historie in Leiden and studied the murid rodents in the large collection of the late H. J. V. Sody. There I examined holotypes of the taxa he named and described in his report on "Six New Indo-Malayan Rats" that was published in 1932. The identities and allocations of four of these taxa—*R. maxi*, *R. taerae*, *R. rattus santalum*, and *R. r. samati*—will be discussed in future reports dealing with the murid fauna of the Indo-Malayan and Indo-Australian regions that are now in preparation. The other two taxa, *R. tondanus* and *R. thysanurus*, are discussed in this paper.

ABBREVIATIONS AND METHODS

Specimens reported in the following pages are in collections of the American Museum of Natural History (A.M.N.H.), New York; the British Museum (Natural History) (B.M.), London; the Museum Zoologicum Bogoriense (M.Z.B.), Bogor, Indonesia; the Rijksmuseum van Natuurlijke Historie (R.M.N.H.) (the personal collection of H. J. V. Sody now belongs to the Rijksmuseum van Natuurlijke Historie and is gradually being registered and incorporated into the main collection of the museum. Most of Sody's specimens, however, are still unregistered and these are designated here as "Sody No.," a notation Sody used in his publications to refer to specimens in his collection), Leiden; and the United States National Museum, Smithsonian Institution (U.S.N.M.), Washington, D. C.

Measurements of the lengths of head and body, tail, and ear are those made by collectors and were taken from labels attached to study skins. I

measured length of the hind foot (including the claws) of all specimens from dry study skins.

Cranial measurements were taken with dial calipers graduated to tenths of millimeters. The limits of most of these measurements are defined elsewhere (Musser, 1970). I measured the greatest length and greatest breadth of each first upper molar with the dial calipers placed under a dissecting microscope.

Latitudes and longitudes for localities mentioned in the text beyond were taken from a gazetteer of Celebes (no. 5) issued by the Hydrographic Office of the United States Navy Department (H. O. Pub. no. 885, second edition, July, 1944).

THE TAXONOMIC STATUS OF *RATTUS TONDANUS*

H. J. V. Sody named and described *Rattus tondanus* on the basis of one specimen obtained from Tondano (1°18'N, 124°53'E), northeastern Celebes. Sody thought his new species closely resembled *R. marmosurus*, a species occurring in northeastern Celebes that was named and described by Oldfield Thomas in 1921. Sody diagnosed *R. tondanus* as (1932: 158): "A member of the *xanthurus* group. The resemblance of the skin of this rat with that of *R. marmosurus* is astonishingly large. Externally there are no other noticeable differences than a somewhat longer tail and longer hindfoot, whilst the fur on the hindback is a little softer in the new species (it is much easier to make a permanent 'division' in these hairs in *tondanus* than in *marmosurus*). This nearly perfect resemblance is remarkable because in *marmosurus* the nature of the fur, especially on the hindback and the root of the tail, is very specific. In the skull, however, large differences appear to exist, though the teeth are of the same small size. The skull of *tondanus* is relatively much shorter or broader and the nasals end very broad anteriorly, the incisors are less episthodont, the lachrymal notches are very prominent, the palatal foraminae do not reach as far backwards, etc."

Sody went on to describe the fur as "Just like in *R. marmosurus*: very long and soft (even softer than in *marmosurus*), the ordinary hairs (on the back more than 25 mm in length) intermixed with long, but not excessively elongated, piles (up to 35 mm). Fur trespassing on the base of the tail."

Color of the holotype was "Also like in *R. marmosurus*: general colour above near cinnamon-brown, beneath dirty white, insharply defined. The individual common hairs on the back are grey with brown tips, the piles grey at their bases, then dark ringed up to shortly below the end, the extreme tips usually light coloured (also on the middle of the back, which forms a slight difference with *marmosurus*, in which species the entire ends

of these piles are black). Hands and feet brown with white digits. Tail black for its basal 30%, rest white. Whiskers black."

During the years after publication of Sody's description of *R. tondanus*, authors placed the taxon in the *xanthurus*-group of species in *Rattus* (Tate, 1936; Ellerman, 1941, 1949; Hooijer, 1950; and Laurie & Hill, 1954). Hooijer was the only one of these persons who had actually examined the holotype of *R. tondanus* before their respective reports were published. George H. H. Tate, however, eventually examined the holotype in 1937, one year after his paper on the Muridae of the Indo-Australian region was published. In his notes that are in the files of the Department of Mammalogy at the American Museum of Natural History, Tate indicated that *R. tondanus* was "apparently allied to *marmosurus*."

Tate correctly evaluated the affinities of *R. tondanus*. The holotype is an example of *R. marmosurus*, a conclusion I reached after studying the holotype of *R. tondanus* at the Rijksmuseum van Natuurlijke Historie, the holotype of *R. marmosurus* at the British Museum (Natural History), and 19 other examples of *R. marmosurus* from the following localities in north-eastern Celebes:

Mt. Kalabat, 1°27'N, 125°01'E: U.S.N.M. Nos. 217788-217794.
 Langowan, 1°09'N, 124°49'E: R.M.N.H. Nos. 18314, 18315, and 18319.
 Mt. Masarang, 1°19'N, 124°51'E: B.M. Nos. 97.1.2.21 and 97.1.2.22 (holotype).
 Roeroekan, 1°21'N, 124°52'E: A.M.N.H. Nos. 101254, 101255, and 101257.
 Mt. Sapoetan, 1°08'N, 124°45'E: Sody Nos. P 2 and P 3.
 Temboan, 1°05'N, 124°40'E: U.S.N.M. Nos. 217688 and 217691.
 Tomohon, 1°19'N, 124°49'E: M.Z.B. No. 5812.

The holotype of *R. tondanus* (R.M.N.H. No. 21234; Sody designated the specimen as Sody No. P 89 in the published description) is an adult male and consists of a skin and skull; both are preserved in excellent condition. Sody apparently compared the holotype with two adults in his collection from Mt. Sapoetan (Sody Nos. P 2 and P 3) that he had correctly identified as *R. marmosurus*. External and cranial measurements of these three specimens, the holotype of *R. marmosurus*, and other adults from localities in northeastern Celebes are listed in Table 1. I compared the holotype of *R. tondanus* closely with the two specimens from Mt. Sapoetan; these and the holotype are of comparable ages and conditions of pelage.

I could not verify the external differences that Sody used to distinguish the holotype of *R. tondanus* from specimens of *R. marmosurus*, primarily differences in texture of pelage and lengths of tail and hind foot. Both color and texture of pelage of *R. tondanus* are indistinguishable from that of the two specimens of *R. marmosurus* in Sody's collection. Furthermore, the

TABLE I
External and Cranial Measurements (in Millimeters) of Adults
of *Rattus tondanus* and *R. marmosurus* from Northeastern Celebes.

<i>R. marmosurus</i>												
	♂ R.M.N.H. No. 21234 (Holotype)	♂ B.M. No. 97.1.2.22 (Holotype)	♀ B.M. No. 97.1.2.21	♀ Sody No. P 3	♀ Sody No. P 2	♂ U.S.N.M. No. 217791	♀ U.S.N.M. No. 217793	♂ U.S.N.M. No. 217794	♀ U.S.N.M. No. 217788	♂ U.S.N.M. No. 217789	♂ U.S.N.M. No. 217691	♂ U.S.N.M. No. 217688
Sex												
Length of Head and Body	193	231	—	206	214	190	195	185	175	185	200	185
Length of Tail	257	257	—	234	245	225	220	240	260	—	275	270
Length of Hind Foot	41	40	—	38	38	35	37	37	40	37	37	38
Length of Ear	21	21	—	20	20	19	21	20	19	18	21	19
Greatest Length of Skull	44.0	44.7	42.5	43.5	46.9	44.1	42.9	43.2	43.4	43.9	—	42.7
Zygomatic Breadth	20.5	21.6	19.9	—	20.7	20.4	—	20.5	19.9	19.9	—	19.4
Interorbital Breadth	6.7	6.1	5.9	6.1	6.3	6.2	6.4	6.2	6.0	6.0	6.3	6.0
Length of Nasals	16.2	16.8	15.3	16.8	18.1	15.9	16.0	15.3	15.7	16.7	17.5	15.7
Length of Rostrum	13.0	13.4	13.1	13.2	14.4	13.4	13.5	12.4	13.2	13.1	15.3	13.6
Breadth of Rostrum	8.8	7.9	7.6	7.6	7.8	8.2	7.7	7.6	7.4	7.6	8.1	7.6
Breadth of Braincase	17.1	17.2	16.8	—	17.0	16.6	16.1	17.6	15.8	17.0	17.5	16.5
Height of Braincase	13.2	13.0	12.1	—	13.1	12.5	11.9	—	12.0	—	12.5	12.2
Length of Diastema	12.2	13.1	11.8	12.4	12.4	12.3	11.8	11.4	11.8	11.8	12.6	11.6
Palatal Length	22.0	23.4	21.6	—	22.9	22.7	22.3	—	21.5	—	23.2	21.3
Length of Incisive Foramina	8.1	9.0	8.5	8.2	8.9	9.1	7.8	8.2	8.6	8.2	8.7	9.0
Breadth of Incisive Foramina	3.3	3.5	3.4	2.7	3.1	3.6	3.0	—	3.2	—	3.2	3.4
Length of Palatal Bridge	7.9	7.5	7.3	—	7.5	6.9	7.3	7.3	6.6	7.2	7.9	6.4
Breadth of Mesopterygoid Fossa	3.3	3.3	3.1	—	3.7	3.4	3.2	—	3.0	—	3.6	2.9
Length of Bulla	7.8	7.4	7.5	7.5	7.5	7.1	7.7	—	7.8	—	7.9	6.8
Breadth of Bulla	5.9	6.4	6.4	5.8	5.8	6.9	6.1	—	6.1	—	6.1	5.7
Height of Bulla	5.7	6.1	5.7	5.2	6.0	5.5	5.8	—	6.0	—	6.1	5.8
Alveolar Length of M1-s	7.3	8.0	7.1	7.0	7.5	7.3	7.3	7.2	7.0	7.0	7.3	6.7
Length of M1	3.4	3.3	3.2	3.1	3.3	3.2	3.4	—	3.1	—	3.1	3.1
Breadth of M1	2.4	2.3	2.2	2.1	2.3	2.1	2.5	—	2.3	—	2.4	2.2

external measurements of *R. tondanus* fall within the range of variation of other adult *R. marmosurus* from northeastern Celebes (Table 1).

There are no significant taxonomic differences between the configurations and measurements of the skull of *R. tondanus* and those of *R. marmosurus*. Values for most cranial measurements of *R. tondanus* listed in Table 1 fall within the range of variation of specimens of *R. marmosurus* from northeastern Celebes. The only dimensions exceeding that range are interorbital breadth and breadth of rostrum but they are only slightly larger than any of the other specimens listed in Table 1. Most of the cranial features considered by Sody to distinguish *R. tondanus* from *R. marmosurus* are individually variable and are matched by specimens of *R. marmosurus*. The wide rostrum and flaring nasals are the only conspicuous feature of *R. tondanus* that separates it from most examples of *R. marmosurus*, but this configuration is found in some specimens of the latter (U.S.N.M. No. 217793, for example). In my opinion, *Rattus tondanus* Sody, 1932, is clearly a subjective synonym of *R. marmosurus* Thomas, 1921.

Five of the 20 specimens of *R. marmosurus* that I examined for this report are in the collection of the Rijksmuseum van Natuurlijke Historie; two of them are in Sody's collection and the other three are old specimens that were given to the museum by S. C. I. W. van Musschenbroek and identified as *R. xanthurus* by F. A. Jentink. These last three are valuable specimens and because of their scientific value and their historical interest, my identification requires an explanation.

In his "Catalogue Systématique des Mammifères," published in 1888, Jentink listed 11 specimens that he had identified as "*Mus xanthura* Gray" as follows:

- "a. Individu adulte monté. Célèbes, Ménado-Langowan. Des collections de M. van Musschenbroek, Septembre 1875. (Cr. a du Cat. Ost.).
- "b. c. Individus adultes et semi-adultes montés. Ménado-Kakas. De M. van Musschenbroek, Septembre 1875.
- "d-k. Individus adultes et semi-adultes montés. Ménado-Langowan. De M. van Musschenbroek, Septembre 1875."

When I worked in the museum at Leiden, I could find only nine of the specimens listed by Jentink, specimens "a" through "i". Each is mounted in a life-like pose and attached to a wooden base. The skins are dirty and in poor condition. The color of their pelage has been altered from the original hues; all are a dull, grayish straw-brown—a color common to old mounted specimens of rats. At the time I examined the series most of the skulls were still in the skins, but through the cooperation of Dr. A. M. Husson, the skulls of six specimens were extracted and cleaned so I could

verify my identifications that were first based on external features.

Three species are represented in the series: *R. xanthurus*, *R. dominator*, and *R. marmosurus*. The correct identities of the nine specimens are listed in Table 2.

TABLE 2

Identities of 9 of the 11 Specimens of "*Mus xanthura*"
Listed in F. A. Jentink's "Catalogue Systématique des Mammifères"

Jentink's Designation	R.M.N.H. No.	Age	Locality in Northeastern Celebes	Species of <i>Rattus</i>
"a"	18310	Adult	Langowan	} <i>R. xanthurus</i> Gray, 1867
"b"	18312	Adult	Kakas	
"c"	18313	Juvenile	Kakas	
"f"	18316	Adult	Langowan	
"h"	18318	Juvenile	Langowan	
"g"	18317	Juvenile	Langowan	} <i>R. dominator</i> Thomas, 1921
"d"	18314	Adult	Langowan	} <i>R. marmosurus</i> Thomas, 1921
"e"	18315	Adult	Langowan	
"i"	18319	Juvenile	Langowan	

Rattus xanthurus was named and described by J. E. Gray in 1867 and when Jentink's Catalogue was published in 1888 the range of morphological and age variation in the species was still unknown. Jentink apparently thought the differences he observed between the specimens were those of age and he did not recognize that he actually had examples of three species before him. Two of these, *R. dominator* and *R. marmosurus*, would not be named until more than 40 years later (Thomas, 1921). It is also significant that both *R. xanthurus* and *R. marmosurus* are represented in the series because specimens of both were obtained from Langowan. Records of sympatry between the two species are important because some mammalogists have considered *R. marmosurus* to be a subspecies of *R. xanthurus* (Ellerman, 1949; Laurie & Hill, 1954). Evidence gathered to date on geographic distribution and morphology of the two forms, however, indicates that *R. marmosurus* is a morphologically distinctive and valid species as was pointed out by Oldfield Thomas (1921), its original describer, and other authors (Tate, 1936; Sody, 1941; Misonne, 1969; and Musser, in press).

NOTES ON *RATTUS BECCARII* AND *R. THYSANURUS*

Rattus beccarii was first described by F. A. Jentink in 1879 under the name "*Mus leucopus*" (p. 8). His description was short:

"Upper parts grayish brown; sides of nose, cheeks, chin, throat, belly

and inside of legs, white. Tail longer than head and body, thinly covered with short hairs, longer near the tip, forming a little tuft. Whiskers, much longer than the head, brown at the base, for the rest white. The fur of the back is composed of three kinds of hair: 1°. woolly hairs, very thin, undulating, white; 2°. bristles, brown, longer than the rest of the fur, and: 3°. spinous hairs, very flat, white, channeled, brown near the tip. The fur of the under surface with two kinds of hair: 1°. woolly as the back, but shorter, and 2°. spinous hairs, entirely white."

"The ears are nearly naked, rounded at the tip. The upper cutting-teeth are orange, the lower ones much lighter coloured."

The description was based upon two specimens, but Jentink provided the following measurements of only one of them: "Head and body" (150 mm); "Tail with tuft" (168.5 mm); "Ear" (14.5 mm); "Hind foot" (25 mm); "Length upper molar series" (5 mm); "Distance between incisor and first upper molar" (9 mm); and "Distance between incisor and first lower molar" (4.5 mm).

One year later Jentink (1880: 11) renamed the mouse *Mus beccarii*, for the name *leucopus* had already been used by J. E. Gray in 1867 for a rat from Queensland. The name *beccarii* is now associated with the genus *Rattus* (Tate, 1936; Ellerman, 1941, 1949; and Laurie & Hill, 1954).

Jentink never designated a holotype for *Mus beccarii*. In 1888 he listed the two specimens in the "Catalogue Systématique des Mammifères" as:

"a, b. Individus adultes montés, types de l'espèce. Célèbes, Ménado-Langowan. Des collections de M. van Musschenbroek, Septembre 1875. (Cr. a du Cat. Ost.)."

I examined both specimens at the Rijksmuseum van Natuurlijke Historie to determine if they represented the same species, selected a lectotype, and compared them with the holotype of *Rattus thysanurus*.

The two syntypes of *M. beccarii* are examples of the same species. Specimen "a" has now been registered as R.M.N.H. No. 18305 and specimen "b" as R.M.N.H. No. 18306. Both are mounted in a life-like pose and were originally attached to wooden bases. The skins are in good condition, although the tip of each tail is missing and the pelage of each is faded and dirty. The skulls have been extracted from the skins and cleaned. Both are incomplete. Most of the braincase of specimen "a" is missing. The skull of specimen "b" is more complete, only part of the occipital region is gone. Specimen "a" is an adult; all the teeth are well worn. Specimen "b" is also an adult but judged by wear of teeth it is younger than specimen "a".

Specimen "a" should be considered the lectotype of *Mus beccarii*. Its skin is in better condition than that of specimen "b," and more importantly,

values for lengths of the toothrow and diastema of specimen "a" are closer to the values published in Jentink's original description than are those of specimen "b."

The holotype of *Rattus thysanurus* is also at Leiden. It was originally designated as Sody No. P 59 and it is now registered as R.M.N.H. No. 21232. The specimen is an adult female and was obtained from Toemaratas, Sapoetan Mountains in northeastern Celebes.

Sody's description of the holotype of *R. thysanurus* recalls Jentink's description of *R. beccarii*. For example, Sody described the fur of his specimen as (1932: 157): "Above 3 kinds of hairs occur: woolly hairs, rather many spines and a number of long bristles. Belly with 2 kinds of hairs: woolly ones and rather many spines! Tail clad with short hairs, becoming longer towards the end where (for about 4 cm) a very distinct pencil is formed, quite like (or perhaps even more pronounced than) in *Chiropodomys gliroides*."

Sody then described the color as "On the back, the woolly hairs being grey, the spines whitish with dark (blackish or brownish) tips, the bristles black with white tips, the whole of the surface seems grey, with a brownish hue over the middle of the back. The eyes are bordered by a narrow blackish ring. The ventral side, including the innerside of the forelegs and partly the innerside of the hindlegs, is creamy white, all separate hairs being white to their bases. Line of demarcation between ventral and dorsal colours not very sharply defined. Hands and feet white with a small, slightly darker area over the middle. Tail unicoloreus, rather light grey. Whiskers black (the long ones) or partly white (the short ones)."

Sody was aware of similarities between his description of *R. thysanurus* and Jentink's description of *R. beccarii* for he stated (p. 158) that "I was struck by a special resemblance in some points with the descriptions of Jentink's *Mus beccarii*. Besides having about the same measurements of the teeth and the same white colour of the under surface, there is in both species the same spininess of the ventral fur, a character, which, as far as I know, is rather uncommon in rats!" Nevertheless, Sody thought that *R. thysanurus* was a valid species that could be distinguished from *R. beccarii* by its longer tail and its gray upper parts (instead of grayish brown as described for *R. beccarii*).

Recent authors who have published on the murid fauna of the Indo-Australian region have considered *R. thysanurus* to be a synonym of *R. beccarii* (Tate, 1936; Ellerman, 1941, 1949; and Laurie & Hill, 1954). These workers based their decisions on Sody's and Jentink's two descriptions for as far as I know none of them actually studied the type specimens

of either *R. thysanurus* or *R. beccarii* before their respective reports were published.

After studying the type specimens of *R. thysanurus* and *R. beccarii* I can confirm that the specimens represent the same taxon. The holotype of *R. thysanurus* consists of a skin and a skull that was prepared from a specimen originally preserved in fluid. It is approximately the same age as the lectotype of *R. beccarii* and closely similar to it in external features, cranial and dental configurations, and cranial measurements (Table 3). Pelage of the upper parts of *R. thysanurus* is not as spiny as either specimen "a" or "b," the color is slightly paler, and the tail is longer as reported by Sody. These differences, however, are not of taxonomic significance. The degree

TABLE 3
External and Cranial Measurements (in Millimeters)
of Type-specimens of *Rattus thysanurus* and *R. beccarii*

	<i>R. thysanurus</i>	<i>R. beccarii</i>	
	R.M.N.H. No. 21235 (Sody No. P 59)	R.M.N.H. No. 18305 (Specimen "a")	R.M.N.H. No. 18306 (Specimen "b")
Sex	♀	?	?
Length of Tail	186	162 *	160 *
Length of head and Body	123	—	—
Length of Hind Foot	25	28	27
Length of Ear	20	—	—
Greatest Length of Skull	33.3	—	—
Zygomatic Breadth	16.3	—	—
Interorbital Breadth	5.3	5.4	5.2
Length of Nasals	12.4	12.3	11.4
Length of Rostrum	9.9	9.4	9.2
Breadth of Rostrum	5.8	—	5.5
Length of Diastema	9.0	9.1	8.6
Palatilar Length	13.6	14.0	13.2
Palatal Length	15.7	15.7	15.2
Length of Palatal Bridge	5.0	5.4	5.0
Breadth of Zygomatic Plate	2.5	2.4	2.2
Length of Incisive Foramina	5.8	5.6	5.6
Breadth of Incisive Foramina	2.4	2.3	2.2
Alveolar Length of M ¹⁻³	4.8	5.0	4.8
Length of M ¹	2.3	2.4	2.4
Breadth of M ¹	1.5	1.6	1.5

* Lengths of tails were measured with string as described elsewhere (Mussey, 1971); tips of tails are missing.

of spyness is individually variable in the specimens of *R. beccarii* I have examined. Because the holotype of *R. thysanurus* was originally prepared from a specimen preserved in fluid and because the two type specimens of *R. beccarii* are now faded and dirty, differences in color cannot be evaluated accurately. Even so, differences in color between the three type specimens are slight.

The tail of the holotype of *R. thysanurus* is longer than either of the type specimens of *R. beccarii*, but this is also a character that is individually variable. I have examined six other specimens of *R. beccarii*, one from Roeroekan (A.M.N.H. No. 101261) in northeastern Celebes and five from Gimpoe (U.S.N.M. Nos. 219682-219686) in middle Celebes. All are adults. Length of tail in the specimen from Roeroekan is 155 mm and in the series from Gimpoe the tail length varies from 185 mm to 200 mm.

Rattus thysanurus Sody, 1932, should continue to be regarded as a synonym of *R. beccarii* (Jentink, 1879).

Rattus beccarii is still known only from a few specimens: the type specimens of *R. beccarii* and *R. thysanurus*, the example from Roeroekan, and the five individuals from Gimpoe. Matschie (1900: 282) discusses a specimen from the Minahassa region in northeastern Celebes, but I have not examined that individual.

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