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COMMUNICATION

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NOTES ON TAXONOMY AND CAPTIVE DEVELOPMENT OF THE *RATTUS ANDAMANENSIS* (BLYTH, 1860) (RODENTIA: MURIDAE) FROM SOUTHERN ANDAMANS, INDIA

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Abstract: Studies on mammalian fauna from the Andaman & Nicobar Islands have been done by various researchers but meager information is available on rodent fauna from these Islands. Morphometric and cranial details of fresh specimens of one of the rodent species, *Rattus andamanensis* (Blyth, 1860) of family Muridae, collected from its type locality in southern Andamans has been reported in the present paper. Morphological variations within the population are discussed. Observations on in-captivity-development of the young ones of the species in the laboratory are also recorded.

Keywords: Andaman & Nicobar Islands, development in captivity, Muridae, *Rattus andamanensis*, taxonomy.

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Author Details: DR. S.S. TALMALE is a taxonomist working on Indian small mammals and (Insecta) Odonata with 80 research papers and six books in his credit. MISS. T. BHARATHIMEENA is an entomologist working on insect fauna of the Andaman and Nicobar islands with five research papers, one book and three book chapters in her credit.

Author Contribution: Both authors contributed equally.

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INTRODUCTION

Blyth (1860) described *Rattus andamanensis* (*Mus (Leggada?) andamanensis*) as the indigenous rat of the Andamans, with diagnostic characters noted as “Size about half that of full-grown *Mus decumanus*, with tail fully as long as in that species; the colour of the upper-parts a shade or two darker, and of the lower-parts pure white. Form more slender, and the limbs proportionally less robust, than in *M. decumanus*. Fur much coarser and conspicuously spinous, with a few long black fine hairs intermixed; passing the hand along the fur in a backward direction, a very audible crackling sound is produced. The flat spines are similar in character to those of Prickly Dormouse from Malabar (*Platacanthomys lasiurus*), but are very much weaker; and the fur of the under-parts is soft.Length 8 or 9 in., and tail equal to the head and body; hind-foot with claws 1½ in.: ear conch (posteriorly) ¾ in. Length of dorsal spinous fur 5/8 in.; the spines being whitish on their basal half, and there is a soft dark ashy felt below the surface.” Further, Miller (1902) studied more specimens of the species from Mac Pherson Strait, South Andaman Island (Table 4). Ellerman & Morrison-Scott (1951) and Ellerman (1961) listed it as *Rattus rattus andamanensis*, and mentioned that the rat has been little known with only a few available specimens of co-type from Narcondam, Andaman Islands, and gave only cranial details as type skin was in a poor condition.

Corbet & Hill (1992) and Agrawal (2000) synonymized this taxon under the species *Rattus rattus* without any details. Musser & Carleton (1993), however, listed it as a subspecies of *Rattus tanezumi* (Temminck). Musser & Carleton (2005), on the basis of the law of priority, validated it as a separate species *Rattus andamanensis* and synonymized *burrulus* (Miller, 1902); *flebilis* (Miller, 1902); *holchu* Chaturvedi, 1966 (Andaman & Nicobar Islands, India); *sikkimensis* Hinton, 1919 (Sikkim, India); *hainanicus* G.M. Allen, 1925 (Hainan); *klumensis* (Kloss, 1916); *koratensis* Kloss, 1919; *kraensis* (Kloss, 1916); *remotus* (Robinson and Kloss, 1914) (Thailand) and *yaoshanensis* Shih, 1930 (China) under it, and also noted that on verification of multivariate analysis of morphometric traits shows Andaman Island populations and those on mainland Indochina are the same species. *Rattus andamanensis* is now widely distributed in Andaman & Nicobar Islands (islands of North Andaman, Interview, Middle Andaman, Long, Henry Lawrence, Havelock, South Andaman, Little Andaman, Car Nicobar & northernmost of the Nicobar Isles.), northeastern India (Sikkim, northern West Bengal, Arunachal

Pradesh, Nagaland, Manipur, Meghalaya), southern China, Vietnam, Laos, Cambodia, Thailand, central and northern Myanmar, Bhutan, and central and eastern Nepal (Aplin et al. 2016), possibly in Bangladesh (Srinivasulu & Srinivasulu 2012).

Studies on rodents from the Andaman & Nicobar Islands were done by Miller (1902), Thomas (1907), Chaturvedi (1966, 1980), Saha (1980), Musser & Newcomb (1983), Mandal & Ghosh (1984), Agrawal (2000), but no detailed account has been given about *Rattus andamanensis* from its type locality [Port Blair, South Andaman Island as mentioned by Miller (1902)]. Since meager information on the species from the Andaman & Nicobar Islands is available, an attempt has been made to collect fresh specimens from southern Andamans, to study and discuss morphological as well as cranial details and captive development in the present communication.

MATERIAL AND METHODS

Study Area

The islands of Andaman and Nicobar groups lie in the Bay of Bengal separated by a sea-space of 1190km from the Coromandal coast of India, 515km from the Tenasserim coast of Myanmar and 1255km from Kolkata. The Andaman group of islands is situated between 10.50000000–13.68333333 N and 92.18333333–93.11666667 E while those of Nicobar lie between 6.66666667–9.50000000 N and 92.50000000–94.16666667 E. There are more than 200 large and small islands in the Andaman group, which stretch out in a north-south direction. The Nicobars comprise about 22 smaller islands lying in a north to south-east direction. A 10 degree channel separates the Andamans from Nicobars by a sea-space of 296km. The land area of Andaman Islands is approximately 6,332km² and that of Nicobar Islands is 16.5km². The length of the Andamans is about 352km and width is a maximum of 52km. The Andamans form a compact chain of islands, whereas the Nicobars lie far separated from one another (Chaturvedi 1980).

Methods

The second author (TBM) undertook rodent surveys in the South Andamans during the year 2014–2015. Adults were collected with the help of Sherman traps using rice grains/bread/deep fried patties made of black gram as bait. The traps were set at two locations within the premises of the Central laboratory of the Central Island

Agricultural Research Institute of the Indian Council of Agricultural Research (ICAR–CIARI), Garacharma and poultry shed of Animal husbandry unit (11.82805556 N & 92.75777778 E). The bait was changed regularly every three to four days. There were accidental catches of pregnant females during the months of July, August and September 2014. The female rats which gave birth during trap catch were transferred into welded iron mesh chicken cages measuring 90cm x 50cm x 70cm (length, width, height). Food and water were provided in plastic cups fitted within the cage. Each female with its own pups was housed individually in separate cages. The cages were maintained in the Central Laboratory, ICAR- Central Island Agricultural Institute, Port Blair. Food mainly rice grains, bread pieces and fresh drinking water were given twice everyday at 09:00hr and 16:00hr. Observations were recorded between 09:00hr till 19:00hr everyday. The trapped pregnant females collected in the month of September 2014 gave birth to young ones after 10–12 days of catch. The first batch of three pups was born on 05 September 2014 and the second of two on 14 September 2014. Data on captive development of young ones and morphometrics are presented.

Nine rodent samples were collected, sacrificed and preserved in 10% formalin for further studies. The specimens were numbered R1 to R9. First author (SST) studied and identified the specimens. External and osteological measurements were taken as per Roonwal & Agrawal (1966) and Agrawal (2000). Identification of the specimens was done following (Blyth (1860), Miller

(1902) and Ellerman (1961). Measurements in detail are given in Table 3 & 4 for further discussion. The photographs of dorsal body hair and dentition were taken under Leica M205A Stereozoom Microscope and Skull photos by Nikon-D70 camera. The specimens under the present study (R2, R3, R4 & R6) were deposited in the National Zoological Collection of the Zoological Survey of India, Central Zone Regional Centre, Jabalpur, Madhya Pradesh (ZSI, CZRC/V - 6312, 6313, 6314 & 6315 respectively) and specimens (R1, R5, R7, R8 & R9) will be retained in the Central Island Agricultural Research Institute, Port Blair, Andaman & Nicobar Islands.

Observations

On the basis of description provided by Blyth (1860) and Miller (1902) the specimens under study were identified as *Rattus andamanensis* (Blyth).

Rattus andamanensis is commonly known as Indochinese Forest Rat on the basis of its wide distribution in the Indochinese region. The characteristic features of the freshly collected specimens observed on the basis of morphological as well as cranial study are: Head and body length in the range of 110–190 mm. Tail unicolor, rough in texture and longer than Head & Body length in the range of 140–200 mm (120.8% of HB). Forearm and hind foot white in colour. Hind foot averages 35.9mm in length and about 25.5% of HB. Dorsum brown with gray base hair, spiny, intermixing with fine long black hairs and ventral portion of the body pure white and soft. Gray base with white tip (dirty white) patch in thoracic region found in the specimens R1, R4, R6, R8,



Image 1. Female *Rattus andamanensis* with young ones (age of puppies two days)



Image 2. Young ones of *Rattus andamanensis* with developed body hairs, ear pinna (age of puppies 15 days)

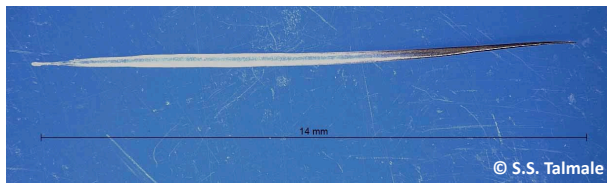


Image 3. Morphological structure and coloration of dorsal hair (spine) of *Rattus andamanensis*

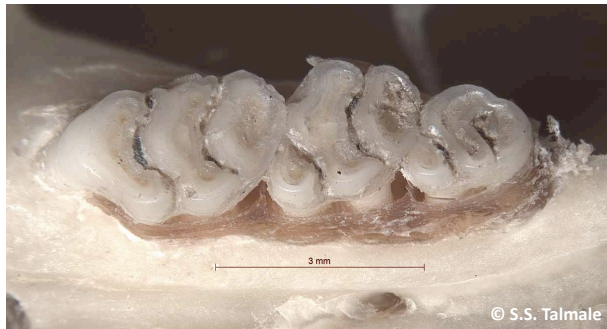


Image 4. Upper molar toothrow (left side) of *Rattus andamanensis*

& R9. Dorsal spines are flat whitish on their basal half (about 3/4th) and dark grayish-brown towards the tip and length from base to tip is about 14mm (Image 3). Six pairs of mammae (1 thoracic, 2 axial, 2 abdominal & 1 inguinal) found in the adult females under study. Occipito-nasal length is 40mm in the range of 33.3–46.1mm. Upper molar tooth-row is 7mm in the range of 6.7–7.3 and about 17.6% of onl (Image 4–6). Length of diastema averages 10.9 and 27.2% of the onl. Other detailed morphological and cranial measurements are given in Table 3 & 4. Dorsum soft and brown without any spines found in the sub-adults (R3, R5), however, dorsum of specimen (R7) had both soft and spiny fur.

Table 1. Postnatal development of *Rattus andamanensis*

Developmental stages	Period in days for development
Day of darkening of ear lobe and eye patch	2
Thickening of skin and development of whiskers	4
Skin turning grayish pink and hair started to develop all over the body	7
Pups started moving slightly	11
Shiny black coloured hairs all over body and very active movement and feeding	15
Very active locomotion	17
Eye slightly opened	19
Eye fully opened	20
Weaning period	29–35

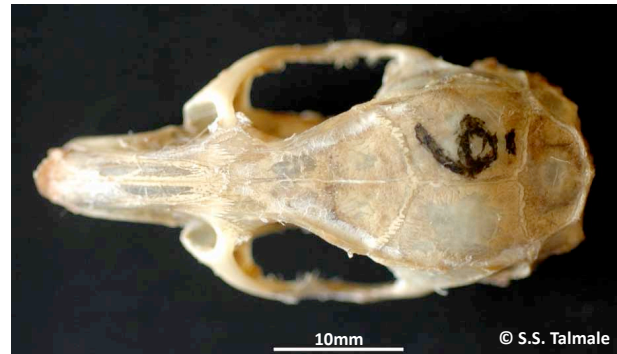


Image 5. Skull (dorsal view) of *R. andamanensis*



Image 6. Skull (ventral view) of *R. andamanensis*

Possibly the soft fur changes into the spiny on maturity.

During the study, nocturnal movement was often noticed and the rats became very active between 19:00hr till even after 01:00hr within lab premises. They were seen munching on bathing soap (lifebuoy-original) when food was unavailable. Females aggressively guarded the pups. Pups developed sharp teeth near weaning period and could not be held in hand for measurements on size, weight. They could deliver a sharp bite. Rat catch was frequent in the months of January 2015–April 2015 around 2–3 per day. In other parts of the year trap catch was one adult every 10 days. Rats were seen occupying holes; loosely covered cavities in the lab and sometimes the movement of rats was noticed in the space between the roof and ceiling.

The present study observed that the gestation period to develop the embryo into adult was 23 days. A litter consisted of maximum three pups at one time (Image 1). The new born pups were pinkish, hairless and blind; hair developed on the 7th day after birth (Image 2); The pups opened their eyes on the 19th–20th day. Pups attained weaning period by 29th day and preferred to take food, mostly bread pieces offered for the mother (Table 1 & 2).

Table 2. Day wise morphometry of juveniles of *Rattus andamanensis*
 Number of example studied (N=5) (3 and 2 numbers of pups from two different litters born on 05 September 2014 and 14 September 2014 from two different females respectively)

Body measurement in centimeter	Duration (days)					
	8	11	19	29	33	44
Head length	1.16±0.05	2.68±0.06	2.96±0.12	NR	NR	NR
Body length	3.26±0.23	4.36±0.12	4.64±0.13	NR	NR	NR
Tail length	2.64±0.07	4.58±0.06	4.84±0.06	NR	NR	NR
Total body length	7.06±0.22	11.68±0.13	12.22±0.14	NR	NR	NR
Fore arm	NR	1.82±0.15	2.44±0.16	NR	NR	NR
Hind foot	NR	2.4±0.11	2.82±0.09	NR	NR	NR
Total body weight (in grams)	6.04±0.07	8.37±0.13	10.28±0.08	13.5±0.06	15.6±0.07	183.05±0.56

NR - not recorded

Table 3. External and cranial measurements (mm) of *Rattus andamanensis* of the adult specimens studied during present study

	Male (R1)	Male (R2)	Female (R3)	Female (R4)	Male (R5)	Female (R6)	Female (R7)	Male (R8)	Female (R9)	Mean	Range	SD
HB	140	190	110	152	125	160	120	155	135	143	110–190	±24.3
TL	172	200	140	190	145	180	155	180	180	171	140–200	±20.4
TL as % of HB	122.8	105.2	127.2	125	116	112.5	129.1	116.1	133.3	120.8	105.2–133.3	±08.9
HF	36.5	38.6	32.5	37.7	35	35.2	33.6	39.1	35.6	35.9	32.5–39.1	±02.2
HF as % of HB	26	20.3	29.5	24.8	28	22	28	25.2	26.3	25.5	20.3–29.5	±02.9
E	22.8	24.2	21.3	22.2	24.5	22.5	22.3	22.4	22.6	22.7	21.3–24.5	±0.9
E as % of HB	16.2	12.7	19.3	14.6	19.6	14	18.5	14.4	16.7	16.2	12.7–19.6	±2.4
onl	40.1	46.1	33.3	41.5	36	43.3	36.1	40.4	43.3	40.0	33.3–46.1	±4.1
cbl	37.9	44.6	32.8	38.7	35.4	41.3	35.5	39.1	40.9	38.4	32.8–44.6	±3.5
nas	14.5	17.1	11.6	15.3	15.6	15.8	13.6	13.9	15.4	14.7	11.6–17.1	±1.5
pal	21.9	26.2	19.3	22	20.6	24.2	20.5	22.1	24.2	22.3	19.3–26.2	±2.1
mtr	6.9	7.2	6.7	7.0	6.7	7.1	7.2	7.3	7.0	7.0	6.7–7.3	±0.2
mtr as % of onl	17.2	15.6	20.1	16.8	18.6	16.3	19.9	18	16.1	17.6	15.6–20.1	±1.6
iw	6	6.8	5.5	6	5.6	6.4	5.7	5.9	6.4	6.0	5.5–6.8	±0.4
dia	109	13.1	9.3	10.7	10.1	12.3	8.5	11	12.5	10.9	8.5–13.1	±1.5
dia as % of onl	27.1	28.4	27.9	25.7	28.0	28.4	23.5	27.2	28.8	27.2	23.5–28.8	±1.6
bl	7.2	8.0	6.3	7.3	7.2	6.4	6.3	7.4	6.9	7.0	6.3–8.0	±0.5
bl as % of onl	17.9	17.3	18.9	17.5	20.0	14.7	17.4	18.3	15.9	17.5	14.7–20.0	±1.5
apf	6.8	9.0	6.2	6.4	6.8	7.9	6.3	7.4	7.4	7.1	6.2–9.0	±0.9
zw	16.8	21.2+	14.8+	18.4	15.7+	20.7	16.1	18.9	20	18.4	16.1–20.7	±1.7
ml	20.9	25.2	18.1	19	21.6	23.2	19.5	21.9	22.7	21.3	18.1–25.2	±2.2

+ Zygoma of the skull damaged, unable to take total measurement

Abbreviations: HB - Head & Body length; TL - Tail length; HF - Hindfoot; E - Ear; onl - Occipito-nasal; cbl - Condylbasal; nas - Nasal; pal - Palate; mtr - Maxillary toothrow; iw - Interorbital width; dia - Length of Diastema; bl - Bullae; apf - Anterior palatal foramina; zw - Zygomatic width; ml - Mandible; N - Sample Size; SD - Standard Deviation; NR - not recorded.

Table 4. Comparison of external and cranial measurements (mm) of *Rattus andamanensis* of the specimens studied during present study with specimens studied by Miller (1902), Chaturvedi (1966), and Saha (1980)

	Present study		Miller (1902)		Ellerman (1961)		Miller (1902)		Saha (1980)	Chaturvedi (1966)		
	<i>R. andamanensis</i> N=9		<i>R. andamanensis</i> N=8		<i>R. andamanensis</i> N=2		<i>R. flebilis</i> N=6		<i>R. burrullus</i> N=1	<i>Rattus flebilis</i> N=1	<i>Rattus rattus holchu</i> N=5	
No. of mammae	12						10			10	12	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range			Mean	Range
HB	143	110–190	177.2	160–188	—	—	202.8	193–210	174	228	144	115–173
TL	171	140–200	184	137–212	—	—	238.1	222–253	183	240	167.5	120–215
TI as % of HB	120.8	105.2–133.3	103.6	85.6–121.1	—	—	117.2	112.8–122.2	105.1	105.2		
HF	35.9	32.5–39.1	37.4	37–39	—	—	41.9	41–44	38	39.7	29.5	24–35
HF as % of HB	25.5	20.3–29.5	21.1	19.6–23.1	—	—	20.6	19.7–21.5	21.8			
E	22.7	21.3–24.5	—	—	—	—	21.0	—	19	21	21.5	17–26
E as % of HB	16.2	12.7–19.6	—	—	—	—	10.3		10.9			
onl	40.0	33.3–46.1	—	—	44.9	44.2–45.6		45–47.6	41.0	49.5	*20.0	37.0–43.0
cbl	38.4	32.8–44.6	—	—	—	—		40–41	37.4	47.6		
nas	14.7	11.6–17.1	—	—	15.9	15.5–16.4		18	15.0	18.8	13.3	11.3–15.3
pal	22.3	19.3–26.2	—	—	24.5	24.2–24.9		21.4–22.0	—	24.0	21.8	20.1–23.5
mtr	7.0	6.7–7.3	—	—	7.1	—		7.4–8.0	7.0	7.4		
mtr as % of onl	17.6	15.6–20.1	—	—	15.5	—			17.0			
iw	6.0	5.5–6.8	—	—	—	—		6.0–7.0	6.8			
dia	10.9	8.5–13.1	—	—	11.8	11.6–12.1		13	—	14.4	10.35	9.0–11.7
dia as % of onl	27.2	23.5–28.8	—	—	26.3	26.2–26.5		—	—			
bl	7.0	6.3–8.0	—	—	7.5	7.5–7.6		—	—		6.7	6.4–7.0
bl as % of onl	17.5	14.7–20.0	—	—	16.7	16.9–16.6		—	—			
apf	7.1	6.2–9.0	—	—	8.8	8.7–8.9		8.8	—	8.4	7.0	6.5–7.5
zw	18.4	16.1–20.7	—	—	—	—		19.8–22.0	19.8	24.8		
ml	21.3	18.1–25.2	—	—	—	—		26–27.6	—		6.25	5.7–6.8

*as mentioned in Chaturvedi (1966), possibly a typographic mistake

RESULTS AND DISCUSSION

Saha (1980) studied a specimen from Pahargaon, near Port Blair, South Andaman and identified as *Rattus flebilis* (Miller), later synonymized under *Rattus andamanensis*. The specimen was larger in size (onl 49.5mm) than the specimens under study (Table 4) and also five pairs of mammae as against six pairs in the present collection. *Rattus burrullus* (Miller, 1902) and *holchu* Chaturvedi, 1966, however, show morphological similarities with *Rattus andamanensis* in the hindfoot (below 40mm), occipito–nasal length (below 45 mm) and also 12 mammae in *holchu* (Table 4). On closer observation of the above mentioned morphological variations (reported in Table 4) within the population,

it is quite likely that two separate populations as spiny and soft furred and hind foot below and above 40mm possibly occur within the distributional range as mentioned by Miller (1902). Therefore, it is suggested that additional surveys and study of fresh specimens from Andaman & Nicobar Islands should be carried out and compared with freshly collected samples from the mainland for taxonomic review of the species.

Further, the present study reports observations that the gestation period and other postnatal developments of *Rattus andamanensis* observed under captivity (Table 1 & 2) are similar to other common rat species *Rattus rattus* (Feng & Himsworth 2014). Data collected and mentioned here are worthy for further developmental study of *R. andamanensis*.

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