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Morphological Variation in the Rats Inhabiting the Indian Desert

[With 4 Tables]

A comparison of external body parts and cranial characters in three populations of Cutch rock-rat, *Rattus c. cutchicus* (Wroughton, 1912) and Soft furred field-rat, *R. meltada pallidior* (Ryley, 1914) collected from their respective habitats in the Indian desert, has been made. In *R. c. cutchicus*, males are found to be larger in almost all the characters in Jalore and Jhunjhunu populations, whereas females tended to possess larger values in the Cutch sample. However, inter-population comparison indicated significant differences only for a few characters. In *R. meltada pallidior*, the male body parts are significantly larger in respect of head and body length and tail length ($P < 0.01$) in Churu-Jhunjhunu-Maulasar sample and tail length ($P < 0.01$) and hindfoot length ($P < 0.05$) in Gujerat population. Comparative study between populations indicated that only few cranial characters attained statistically significant differences.

I. INTRODUCTION

Three species of the genus *Rattus* are found in the fields in the Indian desert. The Cutch Rock-rat, *Rattus c. cutchicus* (Wroughton, 1912) inhabit the cracks and crevices in the rocky habitat (Prakash & Rana, 1972), *R. meltada pallidior* (Ryley, 1914), are found in the natural pastures and in cultivated fields. *Rattus gleadowi* (Murray, 1885), occur in the gravel patches in the sandy habitat (Prakash *et al.*, 1971). The present communication, incorporates analysis of data on the variations of body and cranial measurements of the first two species of field rodents. We have not been able to collect a large sample of *R. gleadowi* and hence this species has been left out for the present.

II. MATERIAL AND METHODS

Rattus cutchicus were snap trapped from rocks at Jalore (25°21'N—72°37'E) and Jhunjhunu (28°08'N—72°23'E) in the Rajasthan desert. A comparison of various body and cranial measurements has been made with those of the sample from Cutch (Bhuj — 23°15'N—69°48'E) as per the data presented by Ellerman (1961). *Rattus melitada pallidior* were collected from native pastures and irrigated crop fields at Churu (28°18'N—74°58'E), Jhunjhunu, Maulasar (27°24'N—74°35'E), Jadan (25°47'N—73°20'E), Jalore, Bisalpur (25°07'N—73°04'E) and a comparison has been done with the rodents collected from Palanpur (24°10'N—72°26'E), Gujarat State (Ellerman, 1961). All the methods and observations have already been explained in our earlier publications (Rana *et al.*, 1970, 1975).

III. RESULTS AND DISCUSSION

A. *Rattus cutchicus cutchicus* (Wroughton, 1914)

1. Differences between Sexes

Males in the Jalore and Jhunjhunu population are apparently larger in all the external body parts than their counterparts, except in respect of the ear, which is longer in Jhunjhunu females but the differences do not approach the level of significance (Table 1). Contrarily, females in Cutch population are bigger, though not significantly, in respect of head and body and tail lengths (Table 2). It is interesting to note that the sexual dimorphism percentage (SDP) is much more apparent in respect of almost all the body measurements in the Jhunjhunu population (—3 to —8) than those of Jalore (range —5 to —2) and Cutch populations (range —1 to +4) (Table 2).

Similarly, most of the skull measurements of male rats from Jalore and Jhunjhunu samples are larger than those of the females (Table 1) but the difference in auditory length and the length of diastema only reach a level of significance ($P < 0.05$) and that too in the Jalore population only. Whereas, females are larger in cranial characters than the males belonging to Cutch sample (Table 1) but none of the character exhibited significant differences.

It is pertinent here to mention that the sexual dimorphism within a population are of greater magnitude in the Jalore sample (SDP range —14 to +17) followed by Jhunjhunu sample (SDP range —5 to +12) and that of Cutch (—1 to +4) (Table 2).

2. Differences between the Three Populations

Although all the external body parts, except the ear, in the males of Jhunjhunu sample and that of females in the Cutch sample, are larger than their respective sexes in the other two populations yet no

Table 1
 Variations in the body and cranial characters (mm) in the three populations of *Rattus c. cutchicus*.
 Means and SE values are presented.

Characters	Jalore		Jhunjhunu		Cutch	
	Males, (n=6)	Females, (n=6)	Males, (n=4)	Females, (n=4)	Males, (n=5)	Females, (n=3)
Head and body length	112.25±2.50	108.16±2.37	119.50±3.22	110.25±5.55	111.80±3.91	114.00±5.00
Tail length	144.00±2.98	141.16±2.84	144.75±1.11	136.75±9.43	141.60±2.61	148.00
Hind foot length	25.00±0.36	24.25±0.63	25.25±4.33	24.50±0.50	24.20±0.38	24.00±0.57
Ear	17.88±0.29	16.33±1.84	15.50±0.28	15.62±0.95	18.66±1.09	18.50±0.57
Occipito-premaxillar length	29.50±1.31	28.16±0.91	31.50±0.41	31.87±0.60	—	—
Condylbasal length	31.16±0.73	28.91±0.69	32.50±0.35	31.37±1.01	32.23±0.47	32.53±0.62
Occipitonasal length	28.41±0.69	28.50±0.57	30.87±0.43	29.62±0.90	—	—
Zygomatic width	13.58±0.54	13.16±0.27	14.25±1.44	14.12±0.45	—	—
Inter-orbital width	5.33±0.11	5.41±0.31	5.12±0.15	5.00	—	—
Cranial width	12.50±0.40	13.41±0.43	14.12±0.28	13.50±0.20	—	—
Occipital breadth	11.75±0.21	10.91±0.37	10.50±0.34	11.00±0.20	—	—
Mean depth of occiput	5.50±0.18	5.16±0.22	4.50±0.20	4.87±0.26	—	—
Post molar length	12.41±0.20	11.66±0.37	12.37±0.40	12.12±0.40	—	—
Auditory length	8.00±0.12	7.16±0.27	7.75±0.32	8.00±0.20	—	—
Length of tympanic bulla	6.50±0.25	5.91±0.31	5.62±0.25	6.35±0.26	4.83±0.09	4.93±0.15
Breadth of tympanic bulla	3.42±0.41	3.66±0.18	4.00±0.35	3.87±0.15	—	—
Length of nasals	13.16±0.51	12.66±0.33	13.12±0.34	12.50±0.63	—	—
Combined width of nasals	3.83±0.11	4.16±0.12	4.12±0.15	4.25±0.25	—	—
Palatal length	13.08±0.29	12.41±0.35	13.25±0.25	13.12±0.45	15.66±0.23	15.93±0.30
Length of diastema	7.83±0.25	6.75±0.11	7.50±0.20	7.62±0.39	7.53±0.21	7.56±0.53
Length of anterior palatine foramina	7.25±0.35	7.33±0.40	7.37±0.26	7.12±0.33	7.36±0.19	7.40±0.05
Combined width of palatine foramina	4.41±0.36	4.16±0.12	4.75±0.45	4.62±0.25	—	—
Length of upper molars	5.83±0.17	5.83±0.17	5.50	5.50±0.20	5.20±0.15	5.46±0.13
Length of lower molars	5.41±0.21	5.33±0.11	5.12±0.49	5.12±0.49	—	—
Mandibular length	17.66±1.11	16.00±0.22	16.50±0.20	16.75±0.62	—	—

character appears to reach the statistical level of significant difference (Table 1).

On an average, most of the cranial measurements of rodents from Jhunjhunu population are larger than their respective sexes in the Jalore sample but the significant differences occurred with respect to condylobasal length ($P < 0.05$) in male rodents and occipitopremaxillar length ($P < 0.05$) and auditory length ($P < 0.05$) in females only (Table 1). The mean depth of occiput ($P < 0.01$), length of tympanic bulla ($P < 0.05$) and length of upper molars ($P < 0.05$) are significantly longer in the

Table 2

Comparison of sexual dimorphism percentage (*SDP*) in body and cranial characters for three populations of Cutch Rock-rats in the Indian Desert.

Characters	Jalore (N=12)	Jhunjhunu (N=8)	Cutch (N=8)
Head and body	-4.00	-8.00	+1.00
Tail	-2.00	-6.00	+4.00
Hind foot	-3.00	-3.00	-1.00
Ear	-5.00	0.0	-1.00
Occipitonasal length	-8.00	-4.00	0.0
Occipito-premaxillar length	-5.00	+1.00	—
Condylobasal length	0.0	-5.00	—
Zygomatic width	-4.00	-1.00	—
Inter-orbital width	+1.00	-3.00	—
Cranial width	+7.00	-5.00	—
Occipital breadth	-7.00	+4.00	—
Mean depth of occiput	-3.00	+8.00	—
Post molar length	-3.00	-3.00	—
Auditory length	-11.00	-3.00	—
Length of tympanic bulla	-10.00	+12.00	—
Breadth of tympanic bulla	+7.00	-4.00	+2.00
Length of nasals	-4.00	-5.00	—
Combined width of nasals	+8.00	+3.00	—
Palatal length	-6.00	-1.00	+1.00
Length of diastema	-14.00	+1.00	0.0
Length of anterior palatine foramina	+1.00	-4.00	0.0
Combined width of palatine foramina	-6.00	-3.00	—
Length of upper molars	0.0	0.0	+5.00
Length of lower molars	-2.00	0.0	—
Mandibular length	-10.00	+1.00	—

males of Jalore population. The length of tympanic bulla is significantly greater ($P < 0.05$) in both the sexes of Jhunjhunu sample as compared to Cutch population. The palatal length is significantly greater ($P < 0.05$) in both the sexes in the rats of Cutch population as compared to those of Jalore and Jhunjhunu samples. Whereas length of upper molars is significantly greater ($P < 0.05$) in the males of Jalore population as compared to respective sex in the Cutch population, occipitonasal length is significantly larger ($P < 0.05$) in the females of Cutch (Table 1).

B. *Rattus meltada pallidior* (Ryley, 1912)

1. Differences between Sexes

Almost all the external body parts are larger in the males than the females in the three populations but the level of significance is attained by head & body length and tail length in the Churu-Jhunjhunu-Maulasar (CJM) population ($P < 0.01$) and tail length ($P < 0.01$) and hind foot length ($P < 0.05$) in Gujarat population (Table 3). Negative values of sexual dimorphism percentage also confirm the above observations, i.e., the

Table 4

A comparison of sexual dimorphism percentage in body and cranial characters for three populations of *Rattus meltada pallidior* in Indian Desert.

Characters	Churu, Jhunjhunu Maulasar	Jadan, Jalore and Bisalpur	Gujarat
Head and body	-7.0	-11.0	-7.0
Tail	-7.0	-5.0	-16.0
Hind foot	-3.0	-3.0	-9.0
Ear	-1.0	-1.0	-13.0
Occipito-premaxillar length	-1.0	-2.0	—
Condylbasal length	0.0	-1.0	—
Occipitonasal length	-2.0	-2.0	-8.0
Zygomatic width	+2.0	-1.0	—
Inter-orbital width	+1.0	-5.0	—
Cranial width	+2.0	-2.0	—
Occipital breadth	-7.0	0.0	—
Mean depth of occiput	-2.0	-4.0	—
Post molar length	-2.0	-1.0	—
Auditory length	-8.0	-2.0	—
Length of tympanic bulla	+7.0	-10.0	-4.0
Breadth of tympanic bulla	-3.0	-7.0	—
Length of nasals	-2.0	-4.0	—
Combined width of nasals	+5.0	+5.0	—
Palatal length	0.0	-1.0	-8.0
Length of diastema	-3.0	-3.0	-5.0
Length of anterior palatine foramina	-7.0	-2.0	-4.0
Combined width of palatine foramina	-4.0	-3.0	—
Length of upper molars	+8.0	0.0	-8.0
Length of lower molars	-1.0	+4.0	—
Mandibular length	-2.0	-4.0	—

males are larger than the females in respective populations (Table 4). The variation in the size of various body parts is more marked in Jadan-Jalore-Bisalpur (JJB) (SDP -11 to -1) as compared to that in the Gujarat (SDP range -16 to -7) and CJM (-7 to -1) populations.

The skulls of male metads are larger than females in all the three localities, the difference is much more evident in the Gujarat and JJB samples. The observations are supported by the SDP values also (Table 4).

Table 3
Variation in the mean values (mm \pm SE) of body and cranial characters of the three populations of *Rattus meltdada pallidior* in the Indian Desert.

Characters	Churu-Jhunjhunu-Maulasar		Jadan-Jalore-Bisalpur		Gujarat	
	Males, (n=7)	Females, (n=8)	Males, (n=11)	Females, (n=15)	Males, (n=6)	Females, (n=4)
Head and body length	126.14 \pm 0.51	118.25 \pm 2.12	132.18 \pm 0.30	118.25 \pm 2.16	132.00 \pm 3.73	123.25 \pm 3.81
Tail	120.50 \pm 0.42	112.16 \pm 2.60	112.28 \pm 0.23	107.46 \pm 2.60	132.50 \pm 2.48	113.25 \pm 2.86
Hind foot	23.50 \pm 0.47	23.00 \pm 0.18	23.59 \pm 0.24	23.03 \pm 0.36	25.83 \pm 0.55	23.75 \pm 0.35
Ear	18.35 \pm 0.72	18.31 \pm 0.56	19.09 \pm 0.40	18.23 \pm 0.46	21.08 \pm 0.69	18.66 \pm 0.79
	(n=7)	(n=6)	(n=10)	(n=15)	(n=3)	(n=5)
Occipito-premaxillar length	31.50 \pm 1.16	31.33 \pm 0.38	31.05 \pm 0.54	30.46 \pm 0.48	—	—
Condylbasal length	31.14 \pm 0.95	31.25 \pm 0.77	30.70 \pm 0.33	30.64 \pm 0.44	—	—
Occipitonasal length	32.00 \pm 1.04	31.58 \pm 0.80	31.60 \pm 0.39	31.13 \pm 0.36	34.30 \pm 0.89	31.82 \pm 0.70
Zygomatoc width	14.57 \pm 0.53	15.00 \pm 0.38	14.55 \pm 0.35	14.5 \pm 0.21	—	—
Inter-orbital width	4.92 \pm 0.34	5.00 \pm 0.17	5.45 \pm 0.20	5.18 \pm 0.09	—	—
Cranial width	12.78 \pm 0.47	13.08 \pm 0.58	13.10 \pm 0.35	12.92 \pm 0.31	—	—
Occipital breadth	11.42 \pm 0.58	10.66 \pm 0.27	11.00 \pm 0.12	11.00 \pm 0.19	—	—
Mean depth of occiput	5.35 \pm 0.19	5.25 \pm 0.16	5.45 \pm 0.21	5.28 \pm 0.15	—	—
Post molar length	13.14 \pm 0.36	12.91 \pm 0.45	13.00 \pm 0.30	12.90 \pm 0.24	—	—
Auditory length	8.50 \pm 0.30	7.83 \pm 0.33	8.20 \pm 0.24	8.06 \pm 0.16	—	—
Length of tympanic bulla	6.14 \pm 0.82	6.58 \pm 0.30	7.00 \pm 0.22	6.30 \pm 0.12	6.10 \pm 0.49	5.26 \pm 0.30
Breadth of tympanic bulla	4.28 \pm 0.11	4.16 \pm 0.12	4.25 \pm 0.11	3.96 \pm 0.13	—	—
Length of nasals	12.92 \pm 0.47	12.75 \pm 0.30	13.00 \pm 0.33	12.53 \pm 0.23	—	—
Combined width of nasals	4.35 \pm 0.15	4.50 \pm 0.08	4.20 \pm 0.24	4.43 \pm 0.24	—	—
Palatal length	14.14 \pm 0.39	14.25 \pm 0.47	13.85 \pm 0.19	13.73 \pm 0.24	17.86 \pm 0.52	16.48 \pm 0.98
Length of diastema	8.28 \pm 0.29	8.08 \pm 0.30	8.20 \pm 0.17	7.96 \pm 0.19	8.56 \pm 0.32	8.14 \pm 0.42
Length of anterior palatine foramina	8.07 \pm 0.25	7.58 \pm 0.21	7.60 \pm 0.17	7.50 \pm 0.18	7.86 \pm 0.28	7.62 \pm 0.42
Combined width of palatine foramina	4.92 \pm 0.18	4.75 \pm 0.11	4.65 \pm 0.25	4.53 \pm 0.22	—	—
Length of upper molars	5.92 \pm 0.15	6.41 \pm 0.38	5.95 \pm 0.13	6.00 \pm 0.10	5.83 \pm 0.17	5.40 \pm 0.16
Length of lower molars	5.35 \pm 0.23	5.33 \pm 0.11	5.15 \pm 0.07	5.40 \pm 0.11	—	—
Mandibular length	18.00 \pm 0.47	17.60 \pm 0.59	17.85 \pm 0.35	17.26 \pm 0.39	—	—

These range from -8 to -4 in Gujarat sample; -10 to +5 in *JJB* sample; and from -8 to +8 in the *CJM* population.

2. Differences between the Three Populations

All the external body parts are larger in the females of Gujarat sample than their respective sexes in other two populations but difference in none of the characters approach the level of statistical significance (Table 3). In case of male metads, however, the head and body length is largest in the *JJB* sample. Further, this difference is statistically significant between the males of *CJM* and Gujarat samples in respect of tail length ($P < 0.01$), hind foot length ($P < 0.01$) and ear length ($P < 0.05$).

Most of the cranial measurements in the males and females of *CJB* population are larger than their respective sexes in the *JJB* population. However, significant differences between males of *CJM* and Gujarat samples occurred with respect to palatal length ($P < 0.01$). Whereas, occipitonasal length ($P < 0.05$) and palatal length ($P < 0.01$) are significantly larger in the males of Gujarat population than in the males of *JJB* sample, palatal length in the females of Gujarat is significantly larger ($P < 0.01$) than the females in the other two populations. Length of upper molars is significantly greater in the females of *CJM* ($P < 0.05$) and *JJB* population ($P < 0.01$) than their respective sexes in Gujarat population. This significant difference might be due to their having significantly large palate (Table 3).

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ZMIENNOŚĆ MORFOLOGICZNA PRZEDSTAWICIELI RODZAJU *RATTUS*
Z PUSTYNI INDYJSKIEJ

Streszczenie

Badano porównania wymiarów ciała i czaszki u trzech populacji *Rattus c. cutchicus* (Wroughton, 1912) i *Rattus meltada pallidior* (Ryley, 1914) łowionych na pustyni indyjskiej (Pustynia Thar). U *R. c. cutchicus* samce z populacji łowionej w okolicach Jalore i Jhunjhunu są większe niż samice, w przeciwieństwie do populacji Cutch, gdzie zależności były odwrotne (Tabela 2). Tym niemniej porównania pomiędzy poszczególnymi populacjami wskazują, że zróżnicowanie jest istotne tylko w odniesieniu do niewielu wskaźników (Tabela 1). U *R. meltada pallidior* samce z populacji Churu, Jhunjhunu i Maulasar mają istotnie większą długość ciała i ogona a z okolic Gujarat znamienne większą długość ogona i stopy w porównaniu do samic (Tabela 4). Porównawcze badania cech czaszkowych wskazują, że różnice między populacjami odnoszą się tylko do niewielu wskaźników (Tabela 3).