

NOTES ON INTRASPECIFIC GEOGRAPHICAL VARIATION IN THE  
INDIAN ANTELOPE-RAT, *TATERA INDICA* (HARDWICKE)  
(MAMMALIA : RODENTIA)

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(With 2 Text-figures)

A good number of species and subspecies of *Tatera* Lataste, based mainly on colour characters and body measurements were described from the Asian region by Hardwicke (1807), Cuvier (1838), Waterhouse (1838), Wagner (quoted by Wroughton, 1906), Gray (1843), Wroughton (1906, 1977) and Cheesman (1921). Ellerman (1941) recognized only one species, namely, *Tatera indica* Hardwicke, from this region and treated all others, namely *dunni* Wroughton, *sherrini* Wroughton, *persica* Wroughton, *scansa* Wroughton, *bailwardi* Wroughton, *monticola* Wroughton, *ceylonica* Wroughton, *cuvieri* Waterhouse, *hardwickei* Gray, *taeniura* Wagner and *pitmani* Cheesman as its subspecies and synonymized *otarius* Cuvier with the nominate subspecies. Later, Ellerman (1947) and Ellerman and Morrison-Scott (1966) synonymized *sherrini*, *dunni*, *persica* and *monticola* with the nominate subspecies, and *scansa*, *bailwardi* and *pitmani* with *Tatera indica taeniura*, so that they recognised only four subspecies, namely, *indica*, *hardwickei*, *cuvieri* and *ceylonica* from the Indian subregion and *taeniura* from Syria, Iraq and a part of Iran.

While cataloguing the collection of rodents present in the Zoological Survey of India, Calcutta, we had an opportunity of examining a series of specimens of this species from Iraq, Iran, Pakistan, India and Sri Lanka and faced difficulty in their subspecification on the basis of the keys provided by Wroughton (1906, 1917), Ellerman (1963) and Agrawal (1967). Therefore, it was felt necessary to study this species afresh, based on the material present in the Zoological Survey of India, the Bombay Natural History Society and the data available in the extant literature. The results of our study are incorporated in this paper.

All measurements are in millimetres and have been taken after Ellerman (1963). The external and cranial measurements given by him have also been incorporated for our study. The body and cranial measurements of about 400 specimens belonging to different subspecies were statistically analysed. The measurements of type specimens,

Table 1. External and cranial measurements of type specimens of different subspecies of *Tatera indica* Hardwicke

Name of species	Type locality	Sex	External				Cranial						
			Head and Body	Tail	Hind-foot	Ear	Great-est length	Occip-itonasal	Zygo-matic width	Bulla	Pala-tal for.	Tooth row	Inter-orbital width
<i>Tatera indica taeniura</i>	Syria	—	230*	190	42								
' <i>Tatera indica pitmani</i> '	Fatah Gorge, R. Tigris, Iraq	♀	194	184	41	29	49	—	26	—	9.8	7.2	8
<i>Tatera indica indica</i>	Between Varanasi and Hardwar, U. P.	—	165	178	—	—	—	—	—	—	—	—	—
' <i>Tatera indica scansa</i> '	Kerman, Iran c 1738 m.	♂	180	193	39	26	45	—	25	12.5	—	6	—
' <i>Tatera indica bairwardi</i> '	Karun River, S. W. Iran, c 76 m	♂	166	182	41	28	44	—	23	11.5	—	6.5	—
' <i>Tatera indica monticola</i> '	Malamir, S.W. persia, c 100m	♀	164	177	39	28	46	—	25	12.5	—	6.5	—
' <i>Tatera indica persica</i> '	Seistan, Iran	—	190	200	41	24	45	—	25	—	—	6.1	—
' <i>Tatera indica dunni</i> '	Ambala, Punjab	♂	160	190†	37	24	44	43.5	22	—	8.5	6.5	7
' <i>Tatera indica sherrini</i> '	Jacobabad, Sind, Pakistan	♂	162	191	37	24	42	41.5	21	—	7	6	7
' <i>Tatera indica Hardwicke</i> '	Dharwar, Karnataka	—	175	202	50	22.5	—	—	—	—	—	—	—
<i>Tatera indica cuvieri</i>	Arcot, Madras	---	177	200	44	15‡	---	---	---	---	---	---	---
' <i>Tatera indica ceylonica</i> '	Ceylon	♂	160	150	14	20	44	43.9	22	11	—	6	---

\*Measured along the curve of a stuffed specimen.

†As per collector's record it is 203, but Wroughton (1917) corrected it to 190.

‡Measurement of ear probably not taken according to present method.

wherever available, have been taken into consideration and have been summarized in Table 1. Population-range diagrams (Text-figs. 1 & 2) for different external and cranial measurements have been prepared according to the methods of Dice and Leraas (1936) and Hubbs and Perlmutter (1942). The length of each ordinate represents the extremes of each set of measurements and a central cross-bar the mean ; a narrow shaded rectangle represents a distance equal to one standard deviation from the mean on each side of the mean, while the road rectangle represents a distance equal to twice the standard error of the mean on each side of the mean. The colours given in initial capital letters in the text have been recognized according to Ridgway's (1886) nomenclature.

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#### OBSERVATIONS

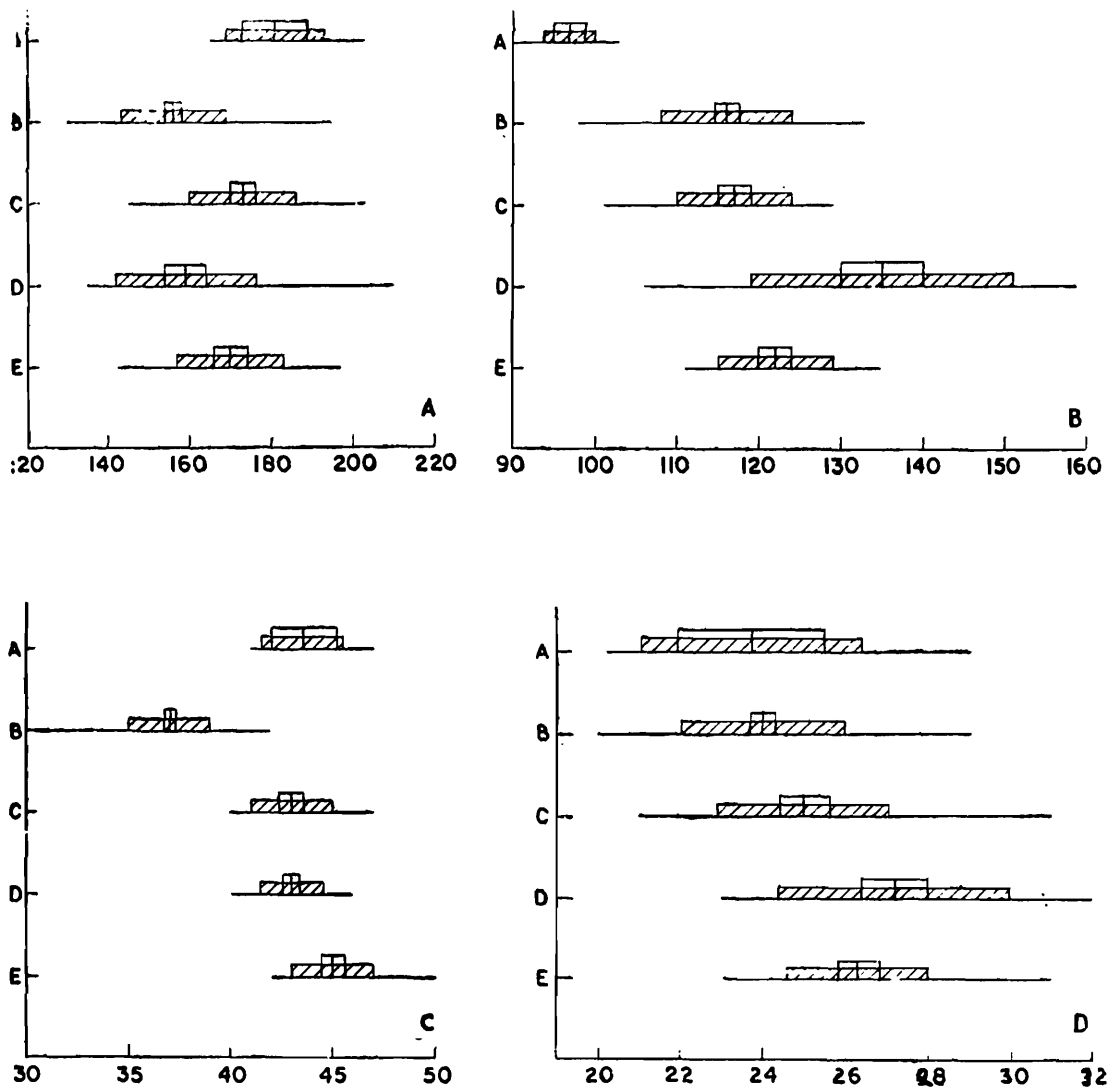
*Colour* : The dorsal colour in specimens of *Tatera indica taeniura* from Iraq ranges from Cinnamon to Raw umber mixed with Mummy brown or Wood brown.

The dorsal colour in *Tatera indica indica* ranges from sandy or sandy grey in specimens from Iran and Baluchistan to dark brown or Hazel in Madhya Pradesh, with all kinds of shades such as sandy grey in specimens from the Salt Range (Pakistan), Sandy mixed with Ochraceous in Punjab, brownish grey in Sind (Pakistan) and sandy to greyish brown in Gujarat and Uttar Pradesh. Therefore, the separation of *persica* (from Iran), *sherrini* (from Sind) and *dunni* (from Punjab) from *indica*, based on colour, by Wroughton (1917) is not convincing, and Ellerman (1947) was justified in synonymizing them with *T. indica indica*. Similarly, the colour in *cuvieri*, *hardwickei* and *ceylonica* varies widely *viz.*, Hazel, Tawny-Ochraceous, Ochraceous-rufous, grey, etc, irrespective of the locality. Therefore, the colour should not be considered as a character for their subspecific differentiation.

It was, further, observed that there is a tendency in the colour of the juveniles and subadults to be darker than that of adults, which varies from grey and Cinnamon to Olive.

*Nature of fur* : Dorsal fur is long and soft in winter and relatively short and harsh, even partially spiny, in summer, irrespective of the locality.

**Size :** Length of head and body : Wroughton (1906) distinguished *taeniura* and *indica* as larger than *cuvieri* and *ceylonica* (over 175 mm. vs less than 175 mm). An analysis of the head and body length from different populations reveals that there is no significant difference amongst them in respect of this character (Text-fig. 1a, table 2).



Text-fig. 1. Graphic comparison of different external measurements. (a) head and body (in mm) (b) tail as percentage of head and body (c) hindfoot (in mm) and (d) hindfoot as percentage of head and body, in five populations of *Tatera indica* (Hardwicke) A, *taeniura* ; B, *indica* ; C, *hardwickei*, D, *cuvieri* and E, *ceylonica*.

**Length of tail :** The length of tail in *taeniura* and *pitmani* differs from that of other subspecies\* in being shorter than the length of head and body (1 exception out of 11 examples).

Ellerman (1947, 1963) distinguished *cuvieri* from *ceylonica* and *hardwickei* in having a longer tail, over 130% of head and body length. Our study shows that, although, there is a tendency of the tail being relatively longer in *cuvieri* than in the other two (Text-fig. 1b, table 2) the range of measurements overlap even at 1 standard deviation, so that

\*The type specimen of *ceylonica* appears to be abnormal in which tail is shorter than the head and body length.

the relative length of the tail cannot be considered as a distinguishing character.

**Hindfoot :** The hindfoot in *Tatera indica indica* including *persica*, *sherrini*, *dunni*, *scansa*, *bailwardi* and *monticola* is short (Text-fig. 1 c, table 2), maximum length being 41 mm. (10 exceptions out of 225 examples), whereas in *taeniura*, *pitmani*, *cuvieri*, *ceylonica* and *hardwickei*, it is longer, ranging from 41-50 mm. (10 exceptions out of 160 examples).

Table 2. External measurements in different populations of *Tatera indica* (Hardwicke) Range, mean  $\pm$  2 standard error ; sample-size in parentheses.

	Head & body	Tail as % of HB	Hindfoot	Hindfoot as % of HB
<i>T. i. taeniura</i>	230	83	42	18
<i>T. i. pitmani</i>	165-203 181 $\pm$ 8 (10)	90-103 97 $\pm$ 2 (9)	41-47 43.5 $\pm$ 1.4 (8)	20.2-27.1 23.7 $\pm$ 1.8 (8)
<i>T. i. bailwardi</i>	161-187 173 $\pm$ 10 (5)	101-109 105 $\pm$ 3.2 (5)	40-42 41 $\pm$ 0.7 (5)	22.5-25.4 23.8 $\pm$ 0.3 (5)
<i>T. i. indica</i>	130-195 156 $\pm$ 2 (219)	98-133 116 $\pm$ 1.5 (219)	31-42 37 $\pm$ 0.3 (239)	20-29 24 $\pm$ 0.3 (239)
<i>T. i. cuvieri</i>	135-210 159 $\pm$ 5 (50)	106-159 135 $\pm$ 5 (42)	40-46 40 $\pm$ 0.4 (52)	23-32 27.2 $\pm$ 0.8 (52)
<i>T. i. hardwickei</i>	145-203 173 $\pm$ 3 (60)	101-129 117 $\pm$ 2 (57)	40-47 43 $\pm$ 0.6 (54)	21-31 25 $\pm$ 0.6 (54)
<i>T. i. ceylonica</i>	142-197 170 $\pm$ 4 (49)	111-140 122 $\pm$ 2 (45)	42-50 45 $\pm$ 0.6 (48)	23-31 26.3 $\pm$ 0.5 (48)

Ellerman (1947, 1963) separated *hardwickei* from *ceylonica* and *cuvieri* by its relatively shorter hindfoot (less than one-fourth of head & body length *vs* more than one-fourth). But an analysis of the measurements shows (Text-fig. 1d, table 2) that although the hindfoot tends to be slightly shorter in *hardwickei* than in the other two subspecies, but their ranges overlap much even at one standard deviation. Therefore, it is not possible to distinguish *hardwickei* from *ceylonica* and *cuvieri* on this character.

**Skull :** A detailed description of the structures of the skull of *Tatera indica* has been given by Ellerman (1963) and Agrawal (1967). It holds good for all its sub-species except in minor details, which are given below.

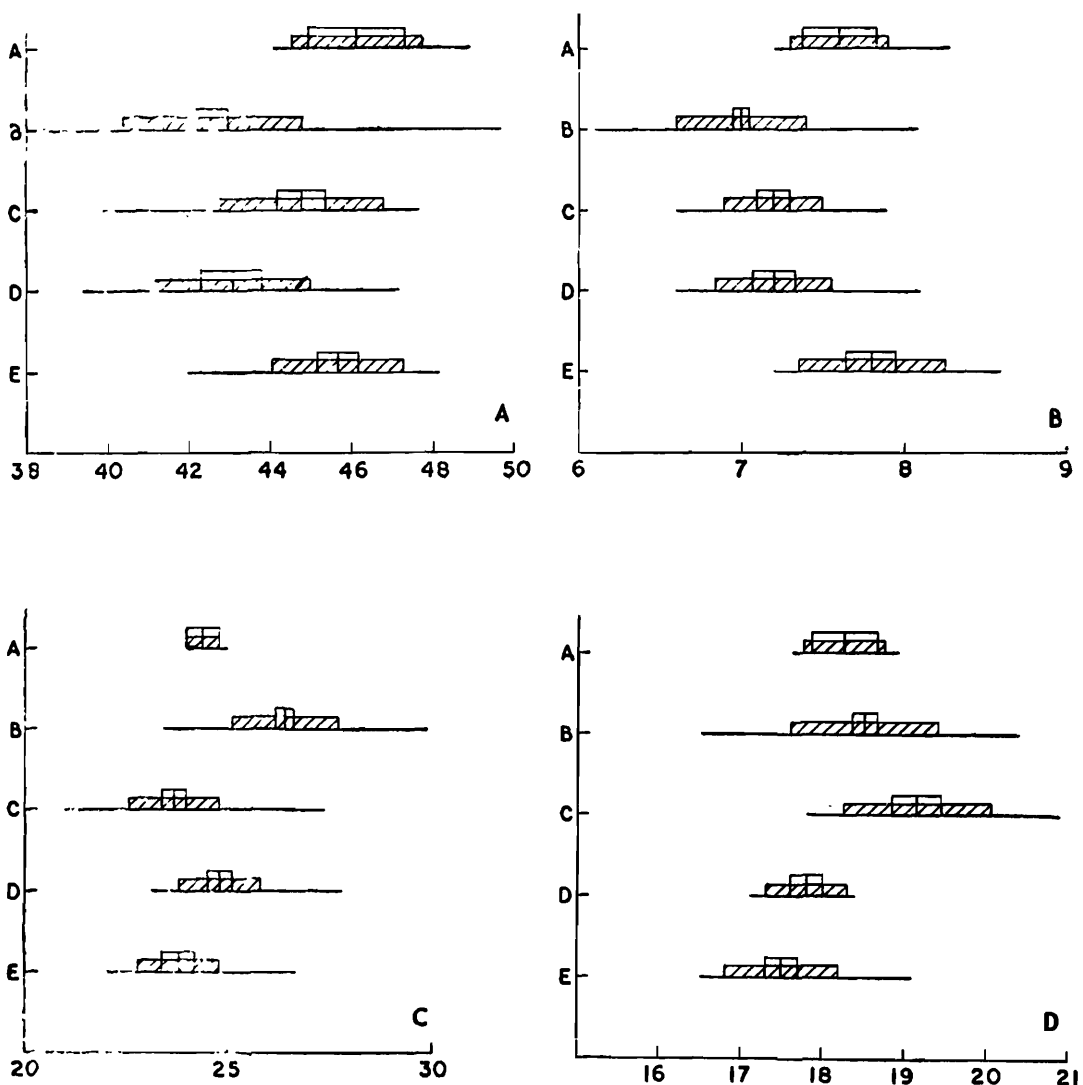
The supramaxillary root of the zygomatic arch is stouter in *cuvieri*, *hardwickei* and *ceylonica* than in *indica*.

The outer fold in the third upper molar is generally at right angles to the longitudinal axis in *indica* and faces obliquely backwards in *cuvieri*, *hardwickei* and *ceylonica*. Ghose *et al* (1976) have reported a

specimen from the range of *indica*, in which this fold is directed obliquely backwards. Therefore, this character is obscured by individual variation.

*Occipitonasal length* : An analysis of the length of occipitonasal shows that there is no marked difference amongst the different subspecies. Although there is a tendency in the skull of *ceylonica* of being slightly longer than that of *cuvieri* (Text-fig. 2a, table 3) as mentioned by Ellerman (1963), but it is not sufficient as to warrant a subspecific maintained on separation.

*Interorbital width* : Agrawal (1967) differentiated *ceylonica* from *hardwickei* and *cuvieri* on the basis of the least interorbital width (more



Text-fig. 2. Graphic comparison of different cranial measurements. (a) Occipitonasal length (in mm) (b) interorbital width (in mm) (c) bulla-length as percentage of occipitonasal length and (d) anterior palatal foramen as percentage of occipitonasal length, in five populations of *Tatera indica* (Hardwicke). A, *taeniura*; B, *indica*; C, *hardwickei*; D, *cuvieri* and E, *ceylonica*.

than 7.5 mm. vs less than 7.5 mm.). An analysis of this measurement in additional specimens shows that there is slight overlap between the southern populations namely *cuvieri*, *hardwickei* and *ceylonica* even at

one standard deviation (Text-fig. 2b, table 3). Further, the coefficient of difference between *cuvieri* and *ceylonica* comes to 0.75 and between *hardwickei* and *ceylonica* 0.80. According to Mayr (1969), a coefficient of difference of 1.28 or above should be taken into consideration for subspecific differentiation. Therefore, these subspecies cannot be this character.

**Tympanic bulla :** Ellerman (1963) considered bulla as one of the distinguishing characters between *indica* and South Indian and Ceylonese subspecies (over one-fourth of ONL *vs.* less than one-fourth). An analysis of this measurement in different subspecies indicates that the mean percentage of bulla in relation to occipitonasal length tends to be larger in *indica* (along with *persica*, *sherrini*, *dunni*, *scansa*, *bailwardi* and *monticola*) than in *pitmani*, *taeniura*, *cuvieri*, *hardwickei* and *ceylonica*. But within *indica*, it is larger in specimens from Iran and Baluchistan (Pakistan) and gradually decreases in those of central and eastern India, almost forming a cline (Agrawal, 1967), so much so that it, sometimes, reaches even less than one-fourth of the occipitonasal length. On the other hand, the bulla in *cuvieri*, *hardwickei* and *ceylonica* is not always less than one-fourth of the occipitonasal length but ranges from 23.1-27.8%, 21-27.4% and 22-26.7% respectively. However, bulla-length in *indica* differs from that of *hardwickei*, *ceylonica* and *taeniura* by more than one standard deviation, but overlaps that of *cuvieri* (Text-fig. 2c, table 3).

Table 3. Cranial measurements in different populations of *Tatera indica* (Hardwicke) Range, mean  $\pm$  2 standard error ; sample-size in parentheses.

Subspecies	Occipitonasal length	Interorbital width	Bulla as % of ONL	Palatal foramen as % of ONL
<i>T. i. pitmani</i>	44-49 46.2 $\pm$ 1.2(7)	7.2-8.3 7.6 $\pm$ 0.22 (7)	24.1-25 24.3 $\pm$ 0.4 (5)	17.6-18.9 18.2 $\pm$ 0.4 (6)
<i>T. i. bailwardi</i>	44-47 45.4 $\pm$ 1.2 (5)	— — +	25.5-26.6 26.2 $\pm$ 0.4 (5)	— —
<i>T. i. indica</i>	38.5-49.7 42.6 $\pm$ 0.4 (136)	6.1-8.1 7.0 $\pm$ 0.06 (136)	23.4-29.9 26.4 $\pm$ 0.2 (127)	16.5-20.4 18.5 $\pm$ 0.15 (136)
<i>T. i. cuvieri</i>	39.4-47.2 43.1 $\pm$ 0.7 (29)	6.6-8.1 7.2 $\pm$ 0.14 (28)	23.1-27.8 24.8 $\pm$ 0.4 (29)	17.1-18.4 17.8 $\pm$ 0.2 (29)
<i>T. i. hardwickei</i>	39.8-47.7 44.8 $\pm$ 0.6 (45)	6.6-7.9 7.2 $\pm$ 0.1 (43)	21-27.4 23.7 $\pm$ 0.34 (43)	17.8-20.9 19.1 $\pm$ 0.28 (40)
<i>T. i. ceylonica</i>	42-48.2 45.7 $\pm$ 0.5 (34)	7.2-8.6 7.8 $\pm$ 0.15 (34)	22-26.7 23.8 $\pm$ 0.36 (31)	16.5-19.1 17.5 $\pm$ 0.22 (33)

**Anterior palatal foramen :** Wroughton (1917) distinguished *hardwickei* from *ceylonica* and *cuvieri* in having a longer anterior palatal foramen, 10 mm. *vs.* 6-7 mm. Agrawal (1967) is also of the same view, but he differentiated the former from the latter two on its relative length *viz.*, over 18% of occipitonasal length *vs.* below 18%.

It is seen from the graphical analysis that the populations of *hardwickei*, *cuvieri* and *ceylonica* reveal some difference in respect of the length of palatal foramen in relation to occipitonasal length (Text-fig. 2d, table 3). But the coefficient of difference between the populations *cuvieri* and *hardwickei* comes to 0.97 and between *ceylonica* and *hardwickei* 1.03, which is far below 1.28. Therefore, it is not advisable to differentiate these subspecies on this character.

#### DISCUSSION

In the light of the above study it becomes obvious that *taeniura* along with *pitmani* can be distinguished from other subspecies of *Tatera indica* by their relative length of the tail which is shorter or subequal to the length of head and body as against longer than that in other subspecies. Since *pitmani* resembles *taeniura* in size and relative length of the tail, we would also treat the former as a synonym of the latter, as has been done by Ellerman and Morrison-Scott (1951). Cheesman (1920) identifies specimens of *Tatera indica* from southern Iraq as those of *bailwardi* but we treat them as those of *taeniura* (due to their tail being shorter than head and body length).

Separation of *persica*, *sherrini* and *dunni* on the basis of their body colour and of *monticola* on the length of head and body from *indica* does not hold good. As such, Ellerman and Morrison-Scott (1951) were justified in synonymizing them with the nominate subspecies. Further, they treated *bailwardi* (type-locality Karun River, Iran) and *scansa* (type-locality Kerman, Iran) as synonyms of *taeniura*. But both of them differ from *taeniura* and resemble *indica* in the tail being longer than the head and body and bulla being more than one-fourth of the occipitonasal length. Therefore, we would treat *bailwardi* and *scansa* as synonyms of the nominate subspecies, thereby restricting the range of *taeniura* to Syria and Iraq.

Ellerman (1947, 1963) separated *indica* from *cuvieri*, *hardwickei* and *ceylonica* by its shorter hindfoot (less than 41 mm *vs.* more than 41 mm) and relatively larger bulla (over one-fourth of ONL *vs.* less than one-fourth). From the analysis, it is clear that the absolute length of hindfoot is a valid character for differentiating them. As regards bulla, though there is a tendency of it being relatively larger in *indica*, but its measurement overlaps that of *cuvieri* (Text-fig. 2c) which, in turn, overlaps those of *hardwickei* and *ceylonica* even at one standard deviation. Therefore, the length of bulla cannot be treated as a character for their differentiation.



Ellerman (1947, 1963) separated *hardwickei* from *ceylonica* and *cuvieri* on the length of hindfoot and tail in relation to head and body, and Agrawal (1967) on the relative length of anterior palatal foramen. Similarly, they (locit) separated *cuvieri* from *ceylonica* on the basis of longer tail, shorter occipitonasal length and narrower frontals. But, from our analysis, it is clear that, although these differences are of probable significance (indicated by non-overlap of the standard error rectangle of comparable lines), these are insufficiently great to warrant subspecific distinction. As regards their coloration, there is a lot of variation and overlap. Therefore, we are inclined to treat *ceylonica* and *hardwickei* as synonyms of *cuvieri*.

A key to the identification of the Asian subspecies of *Tatera indica* Hardwicke, as well as their synonyms (within parentheses) is given below.

- |  |     |   |
|--|-----|---|
| 1. Tail shorter or equal to head and body length | ... | <i>T. indica taeniura</i> ( <i>pitmani</i> )  |
| — Tail longer than head and body length.         | ... | 2   |
| 2. Hindfoot less than 41 mm in length            | ... | <i>T. indica indica</i> ( <i>bailwardi</i> , <i>scansa</i> , <i>monticola persica</i> , <i>sherrine</i> , <i>dunni</i> ). |
| — Hindfoot 41 mm or more in length.              |     | <i>T. indica cuvieri</i> ( <i>hardwickei</i> , <i>ceylonica</i> ).  |

#### SUMMARY

The paper deals with the intraspecific geographical variation in the Indian Antelope-Rat *Tatera indica* Hardwicke.

The study of coloration, nature of fur, external and cranial measurements etc., of all the subspecies of *Tatera indica* show that though *hardwickei*, *ceylonica* and *cuvieri* are separated in many of the external and cranial characters by differences of probable significance, but these differences are insufficiently great to warrant subspecific distinction. Therefore, *hardwickei* and *ceylonica* have been synonymised with *cuvieri*. However, other two subspecies *indica* and *taeniura* stand valid. The former can be separated from others by its shorter hindfoot (less than 41 mm) and the latter by its shorter tail (shorter than head and body length).

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