

## A CONTRIBUTION TO THE TAXONOMY OF INDIAN FIVESTRIPED SQUIRREL (*FUNAMBULUS PENNANTI* WROUGHTON), WITH DESCRIPTION OF TWO NEW SUBSPECIES

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### INTRODUCTION

The Fivestriped Squirrel, *Funambulus pennanti* Wroughton, is found over almost all of India in forested country, comparatively open area or in human habitations. Its range of distribution is approximately from Dharwar in Karnataka ( $c15^{\circ}27'$  N lat.), Maharashtra and about Godavari River in Andhra Pradesh in the South, and from Bengal as far as west to Iran through plains of northern India and Himalayan foot hills, including Nepal. Chaturvedi (1966) has reported it from Andaman Island (probably introduced). From Karnataka through Maharashtra, Madhya Pradesh, Orissa to southern parts of Bihar and southern West Bengal it occurs with the Threestriped Squirrel, *Funambulus palmarum* Wroughton, but under variable ecological conditions in different places.

Originally, Wroughton (1905, 1916) described three subspecies of *Funambulus pennanti*, namely, *pennanti* (type locality : Mandvi Taluka, Surat, Gujarat), *argentescens* (type locality : Rawalpindi, Pakistan) and *lutescens* (type locality : Dessa, Banas Kantha (= Palanpur), Gujarat). Ellerman and Morrison-Scott (1951) and Ellerman (1961), however did not give validity to any of Wroughton's subspecies. Ellerman (1961, p. 210) says : "Wroughton divided this species into three races based on supposed colour characters. These are completely inconsistent and what he seems to have described three colour variation which it appears may take place anywhere." Moore and Tate (1965) in their valuable contribution have revived all the three of Wroughton's subspecies. They (Moore and Tate, *op. cit.*) gave the distribution of *F. p. argentescens* from the western border of Nepal through northern part of Uttar Pradesh, Himachal Pradesh in India, Punjab, North West Frontier Provinces, Sind, Baluchistan in Pakistan and westwards, that of *F. p. lutescens* at Dessa, Palanpur (presently Banas Kantha), Gujarat, and rest of India up to Dharwar, Karnataka, is occupied by *F. p. pennanti*. However, Agrawal and Chakraborty (1979) could not recognise any difference in the three subspecies and found Ellerman's (*op. cit.*) observation to be correct. From the present study based on the materials of this species in the collection of the Zoological Survey of India and large number of specimens borrowed from the Bombay Natural History Society, we, however, do

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not agree with Ellerman and Morrison-Scott's (1951), Ellerman's (1961) also of Agrawal and Chakraborty's (1979) views. On the contrary, like Moore and Tate (1965) we are in the opinion of recognising all these subspecies of Wroughton, but observations are slightly different from them.

A critical study on the geographic variations in the colour of the dark and light stripes forming the saddle, head, sides of the body, flank, forelimb and hindfoot, tail and position of the saddle, besides general colouration and size was made on 250 examples of this species from different areas of India. From the study it was revealed that in *Funambulus pennanti*, the average character rather than absolute measurements or particular colour, as it generally happens in many other rodents and small mammals, is important in the recognition of its infra specific categories. It is found that, in spite of having individual variation among the members of various populations of the Fivestriped Squirrels, colour pattern is not as inconstant as has been commented by Ellerman (*op. cit.*), and the white stripes alone do not have much importance in its subspecific identification.

In consideration of the average colour pattern, we agree with Ellerman (*op. cit.*, p. 210) that the specimens of *F. pennanti* from Salt Range, Pakistan 'cannot be distinguished from the normal *lutescens*' for they actually belong to this subspecies of Wroughton rather than to *argentescens*, as considered by the above author. On the contrary, we disagree with Ellerman that the specimens from Danta (near the type locality of *F. p. lutescens*) in Gujarat, Sind in Pakistan and Gwalior in Madhya Pradesh belong to the same population, or the material from Khadesh in Maharashtra are similar to those of *lutescens* on average characters. However, after working carefully through this difficult species which is distributed over a wide area with variable physiography, climate, rainfall and forest zones, it is considered in this work that the undermentioned subspecies of this Indian squirrel should be recognised. These subspecies, in addition to their morphological differences on average characters, also possess variable ecological co-relations (vide Table 1).

In dealing with the subspecies, morphometry of the skulls have not been accounted in this study, for they hardly represent any appreciable differences for subspecific recognition.

The materials referred in the work, unless otherwise mentioned, are all study skins and adult specimens. The body measurements refer to those taken by the collector in the field and given here in millimeters. Measurements available in Ellerman (1961) were also utilised, when required for comparison, estimation, *etc.*

The colour names mentioned with initial capital letters are recognised after Ridgway's (1886) nomenclature.

Abbreviations commonly used are : m = meter; c = *circa* (= approximately); ex = example; lat. = latitude; long. = longitude.

The abbreviations like ZSI and BNHS denote the Zoological Survey of India and the Bombay Natural History Society; others as N., S., indicate geographical directions like north, south *etc.*

The main ecological works have been done by one of us (PSG).

## OBSERVATIONS

*Funambulus pennanti pennanti* Wroughton, 1905

1905. *Funambulus pennanti pennanti* Wroughton. *J. Bombay nat. Hist. Soc.*, 16(3) : 411. (Mandvi Taluka, Surat, Gujarat).

*Material examined* : INDIA : 24♂, 16♀, 2 unsexed : MAHARASHTRA : Jalgaon District (East Kahndesh) : 2♀; Pachora; March 1911 (BNHS). 1♂, 3♀; Ghodasgaon; April 1911 (1ex : ZSI, 3ex BNHS). 5♂; Vawal Taluk; February and April 1919 (BNHS). 6♂, 1♀; Moharala, Vawal Taluk; December 1918 and February 1919 (BNHS). 1♂; Maloa, Vawal Taluk; February 1919 (BNHS). 1♂, 1 unsexed; Bhusawal; May 1919 (BNHS). 2♀; Chalisgaon; February 1919 (BNHS). 1♀; Bhaunti; no date (BNHS). 2♂, 2♀; Edlabad; March 1974 (ZSI). GUJARAT : Surendranagar District : 1♂; Satapur, Dhrangadhra; September 1912 (ZSI). Rajkot District : 1♀; Rajkot; December 1912 (ZSI). Junagadh District : 1♂; Junagadh; September 1912 (ZSI). 1♀; Talala, Junagadh; October 1912 (ZSI). Surat District : 2♂; Sirwan; November 1962 (ZSI). MADHYA PRADESH : East Nimar District : 2♂; Chandgarh (c 398 m alt.); December 1911 (BNHS). 1♂; Ganon; December 1911 (BNHS). Hoshangabed District : 1♀; Dhaim; February 1912 (BNHS). 1 unsexed; Bori Forest; no date (BNHS). 2♂, 1♀; Sakot (c 367 m alt.); January 1912 (2 ex : BNHS; 1 ex : ZSI).

External measurements :	24♂	21♀
Head and body :	135–156 (142.4)	134–150 (142.6)
Tail :	130–158 (147.1)	74–169 (147.3) (19 ex.)
Hind Foot :	33–49 (36.9)	34–40 (37.3)
Ear :	15–17 (16.2)	15–18 (16.2)
Proportion of ear to head and body size :	8.3–13.5%	10–12.5%

The dark stripes in this subspecies are speckled with black and Buff or Orange-Buff hairs; in fully adult specimens proportions of black and Buff are more or less same. Head Cream Buff and in some specimens Buff-Yellow to Orange-Buff, minutely speckled with black; lighter in the back, but generally not very lighter than the nape and anterior portion of saddle, particularly in the northern material of this subspecies. The light stripes vary from creamish white to Primrose Yellow in colour. The central light stripes, with the exception of few western Indian examples, generally darker than the outer pairs. The dorsal sides of the manus and pes are lighter, ranging from dirty white, Primrose Yellow, Straw Yellow to Cream Buff; sometimes speckled with black, especially those from northeastern area of the range. The colouration in the ventral side Straw Yellow to Cream colour. The sides of the body, the flank, the fore and hind limbs are Straw Yellow speckled with certain amount of black, in few occasions with rusty wash. The saddle generally commences from the anterior angle of ears or slightly posterior between the ears. The outer light stripes are quite prominent. The tail is not bushy, but somewhat slender.

*Range* : Western India, from about 15°27' N lat. in Dharwar in Karnataka and then through Maharashtra to Gujarat (excluding Bhuj, Kutch and Banas Kantha (= Palanpur) in the west; the eastern limit of its range being approximately up to Hoshangabad District in Madhya Pradesh.

*Remarks* : *Funambulus pennanti pennanti* Wroughton has its affinity with *F. p. argentescens* Wroughton regarding colour.

This subspecies though occurs in the the same geographical area with *Funambulus palmarum* (Linn), but in different ecological environs, unlike the next subspecies mentioned hereunder. C. A. Crump (*in* Wroughton and Ryley, 1913, pp. 53–54) says that in Hoshangabad *F. palmarum* lives up on the hills amongst bamboo bushes and *F. pennanti* in the valleys. At Panchgani-Mahabaleshwar Plateau it has been observed that *F. palmarum* occurs at a higher elevations in cooler, moister and thicker semi-evergreen type of forests. Where as *F. pennanti* is commonly found at the base of the hills forming the plateau in deciduous type of forests (Tiwari *et al*, 1971). Moore and Tate (1965, p. 70) have cited similar habitat difference of these two species at Palni Hills. Tiwari *et al.* (*op. cit.*) have also observed that *F. pennanti* is less arboreal than *F. palmarum* at Panchgani-Mahabaleshwar Plateau.

Moulting has been observed in one specimen from Jalgaon District (East Khandesh) in Maharashtra, collected in early February.

#### *Funambulus pennanti chhattisgarhi*, new subspecies

*Material examined* : *Holotype* : INDIA : 1♀ : ZSI Reg. No. 19513; skin and skull; Katagarh, Dhenkanal District, Orissa; 25th May 1972; Coll. P. K. Das. Deposited in the National Zoological Collection, Zoological Survey of India, Calcutta.

*Paratypes* : INDIA : 29♂, 33♀; MAHARASHTRA : Chandrapura District : 4♂, 1♀; Chandrapura (= Chanda); June 1912 (4 ex : BNHS; 1 ex : ZSI). 2♂, 3♀; Chichapalli; June 1912 (3 ex : BNHS; 2 ex : ZSI). Nagpur District : 1 subad ♂, 1♀; Khindsi, c 4 km N. of Ramtek; June 1969 (ZSI). 1♀; Mansar; June 1969 (ZSI). 1♀; Wahi Tola, Mansar Mines; June 1969 (ZSI). MADHYA PRADESH : Balaghat District : 1♂, (in spirit); Santia vill. (near Khatia), c 8 km NE of Kisli, Kanha National Park; February 1966 (ZSI). 1♀; Ouda (c 157 m alt.); May 1912 (BNHS). 1♀; Baihar; September 1957 (ZSI). ORISSA : Puri District : 1♂, 1♀; Baligai; October 1908 (ZSI). Cuttack District : 1♀; Nandan Kanan; November 1971 (ZSI). Mayurbhanj District : 1♀; Baripada; no date (ZSI). Dhenkanal District : 1♂, 1♀; Tikarpara; January 1972 (ZSI). Bolangir District : 1♀; Lerk Paley, c 5 km S. of Bolangir; March 1946 (ZSI). Kalahandi District : 1♂; Madanpur, Rampur; May 1972 (ZSI). Sambalpur District : 1♂; Rairakhol; July 1973 (ZSI). Ganjam District : 1♂, 1♀; Tarasingi; December 1971 (ZSI). Boudh Khondmals (= Phulbani) District : 1♀; Katagarh; 1972 (ZSI). WEST BENGAL : Purulia District : 1♂; Purulia; December 1948 (ZSI). 2♂; Raghunathpur; 1 ex. without any date and the other December 1948 (ZSI). 1♂, 1♀;

Inampur, Manbhum (= Purulia); one taken in 1886 (without any other particulars) and the other in November 1948 (ZSI). 1♀; Manbhum (Purulia); November 1948 (ZSI). BIHAR : Singhbhum District : 1♀; Luia (c 305 m alt.), Chaibasa; July 1914 (BNHS). Hazaribagh District : 4♂, 2♀; Nimiaghat (c 305 m alt.); April to June 1914 (5 ex : BNHS; 1 ex : ZSI). 1♂; Barkagaon (c 647 m alt.); April 1914 (BNHS). 2♂, 1♀; Lohra (c 305 m alt.); April 1914 (BNHS). 4♀; Jagodih (c 183 m alt.); April 1914 (BNHS). Palamau District : 5♂, 6♀; Daltongunj; March 1914 (6 ex. : BNHS; 5 ex. : ZSI). 1♀; Palamau (c 183 m alt.); March 1914 (BNHS).

*External measurements of the holotype* : Head and body 145; tail 140; hindfoot 35; ear 14.

External measurements of paratypes :	28♂	25♀
Head and body :	122–175 (141)	118–159 (144.3)
Tail :	102–157 (137)	83–171 (136.2)
Hind Foot :	32–41 (36.2)	34–40 (36.4)
Ear :	15–18 (16.1)	15–18 (16.2)
Proportion of ear to head and body size :	8.4–12.5%	7.3–12.9%

*Diagnosis* : General colouration on the dorsal side is brighter than all other subspecies of *Funambulus pennanti*; seasonally (particularly from rainy seasons to winters) becomes very dark. The head is not remarkably lighter than the back and of the same colour as those of the inner and outer pairs of dark stripes. The stripes are quite glossy and speckled with bright Orange-Buff and black. The light stripes are generally Buff-Yellow in many individual and extends over the basal region of the tail. The outermost light stripes is occasionally very faint and scarcely distinguishable. The manus and the pes are dorsally lighter and Straw Yellow to Buff or intermediate between those two colours. The side of the body, the flank, the fore and the hind limbs are speckled with Buff and black with rusty wash; the Buff colour, however, predominated. The tail slender, not bushy; underside in many individuals has a Buff or Buff-yellow lines running down its middle region. The saddle is brightly coloured (due to the brightness of the dark bands) than any other subspecies of the species; sometimes the dark stripes of the saddle, especially the posterior half, becomes almost black. The inner pair of dark stripe and central stripe generally commences between the ear. Colouration of the ventral side Primrose-Yellow.

*Range* : Central and eastern India, from southern Bihar and southeastern West Bengal through Orissa and easternmost district of Madhya Pradesh and Maharashtra to as far south about the Godavari River.

*Remarks* : The subspecies, unlike *Funambulus pennanti pennanti*, occurs together with *Funambulus palmarum* (Linn.) in the same place. Crump (*in* Wroughton, 1915, p. 108) said that at Hazaribagh and Rajmahal Hills both the species occur together at the same place and on the same

ground. In January 1966 we have noticed *F. palmarum* and *F. pennanti* on two side by side trees at Motinala, Mandala District, Madhya Pradesh. We have also trapped specimens of both the species from the same ground at Khindsi, near Ramtek, Nagpur District, Maharashtra. Collection of both the species from the same ground has also been made by ZSI party in Kalahandi; Boudh Khondamals and Ganjam Districts in Orissa. In some specimens from Daltongunj in Bihar, the Buff-Yellow of the central light stripes is less pronounced and approximates to the next subspecies mentioned hereunder. Perhaps an intergrading zone! This needs further study on additional material.

Moulting of hairs on the head has been observed in two specimens collected from Daltongunj, Bihar, in March.

*Funambulus pennanti gangutrianus*, new subspecies

*Material examined* : Holotype : 1♂; ZSI Reg. No. 16398; skin and skull; Banaras Cant., Uttar Pradesh; 25 October 1956; Coll. H. Khajuria. Deposited in the National Zoological Collection, Zoological Survey of India.

*Paratypes* : INDIA : 51♂, 25♀; 6 unsexed : WEST BENGAL : Calcutta 5♂, 1♀; Calcutta; December to January 1868–1869 and March 1960 (1♂ without any date) (ZSI). Howrah District : 1 unsexed; Botanical Garden, Shibpur; no date (ZSI). 2♂, 1 unsexed; Belur; November 1908 (ZSI). 1♂, Balley; June 1963 (ZSI). Hoogly District : 1♀; Chandernagar; July 1950 (ZSI). BIHAR : Darbhanga District : 3♂, 6♀; Bhagownie (c 46 m alt.); April to May and August to September 1921 and 1922 (8 ex. BNHS; 1 ex. ZSI). 2♂, 2♀; Bhunar (c 46 m alt.); March and May 1914 (BNHS). Gaya District : 2♂, 1♀; Singar (c 427 m alt.); March and May 1914 (BNHS). Giridhi District : 1 unsexed; Pareshnath; April 1909 (ZSI). MADHYA PRADESH : Rewa District : 5♂ (1 juv.); Rewa; March 1947 (ZSI). Gwalior District : 2♂; Chorepura (c 336 m alt.); August 1914 (ZSI and BNHS). 1♂; Agar Malwa; December 1922 (ZSI). 1♂, 1♀; Morari; June 1922 (ZSI). 5♂; Chatigaon (c 274 m alt.); July 1914 (BNHS). 1♀; Guna; October 1922 (ZSI). 1♂; Rothia; November 1922 (ZSI). UTTER PRADESH : Gorakhpur District : 2♂; Gorakhpur; January and February 1955 (ZSI). Mirzapur District : 1♂; Mirzapur; December 1946 (ZSI). Varanasi District : 5♂, 3♀; Varanasi (= Banaras) Cantonment; March to December 1945, 1946, 1948, 1956 (ZSI). 3♂; 2 unsexed; Varanasi; January, February and September 1945 (ZSI). Lucknow District : 2♂, 1♀; Lucknow; January 1908 (ZSI). Agra District : 1♂; Agra Cantonment; January 1908 (ZSI). Bareilly District : 2♂, 1♀; Bareilly; March 1907 (ZSI). Bahraich District : 3♂ (1 subad.), 3♀; Bahraich; October 1956 (ZSI). Bijnor District : 3♀; Bijnor; January 1907 (ZSI). Pilbhit District : 1♀; Pilbhit; March 1919 (ZSI). Nainital District : 1♂; Ramnagar, Kumaon; December 1913 (ZSI). PUNJAB : Hoshiarpur District : 1♂; Hoshiarpur; 1955 (no other particulars) (ZSI).

NEPAL : 2♂; locality unknown; September 1958 (ZSI). 1 unsexed; no other particulars (ZSI).

*External measurements of the holotype* : Head and body 150; tail 130, hind foot 38; ear 38.

External measurements of paratypes :	31♂	20♀
Head and body :	126–182 (148.8)	133–165 (145.9)
Tail :	75–166 (132.3)	78–164 (135.6)
Hindfoot :	35–40 (38.1)	34–41 (37.9)
Ear :	15–19 (16.6)	13–18 (17.0)
Proportion of ear to head and body size :	8.2–14.3%	9.1–12.5%

*Diagnosis* : This subspecies is not brightly coloured as in *Funambulus pennanti chhattisgarhi*. Comparatively brightness in some specimen between July and September are however noticed than those collected in other seasons. Coat coarse. The dark stripes are speckled with black and Buff to Orange-Buff; black predominated in some individuals, while in others the Buff or Orange-Buff. The head is lighter than the back; Buff to Buff-Yellow, minutely speckled with black. The light stripes are Primrose Yellow, the central light stripes very rarely darker than the other observed in two specimens of which one is from Hosiarpur in Punjab and Medinipur in West Bengal. In two specimens from Darbhanga in Bihar and Gwalior in Madhya Pradesh a tendency of darkness have also been observed. The hands and feet are lighter; Primrose Yellow or between Primerose Yellow and Straw Yellow. The sides of the body, the flank, the fore and hind limbs are Primrose Yellow to Straw Yellow washed with very little amount of black. The saddle commences between the ears, but prominent posterior to the forelimbs. The colouration of the ventral side is Primrose Yellow or sometimes between Primrose Yellow and Straw Yellow or lighter. The tail usually appears bushy; midventral line occasionally Buff-Yellow or Straw Yellow. The outer light stripe is quite prominent.

*Range* : From Bengal through Bihar (excluding southern Bihar and southwestern West Bengal), Uttar Pradesh, northern part of Madhya Pradesh, Nepal to southeastern Himachal Pradesh and as far west around Hosiarpur in Punjab in India.

*Remarks* : Unlike in *F. p. pennanti* and *F. p. chhattisgarhi*, this subspecies does not occur with *Funambulus palmarum* (Linnaeus).

Out of six examples examined from Gwalior, the head of two specimens from Chatigaon (Ghatigaon) gives Straw Yellow colour as in the next subspecies *lutescens*. It appears that the area is an intergrading zone between *F. p. gangutrianus* and *F. p. lutescens*, and needs confirmation on study based on further material.

Moulting has been observed in a specimen behind the fore limbs collected in May from Darbhanga in Bihar.

*Funambulus pennanti lutescens* Wroughton

1916. *Funambulus pennanti lutescens* Wroughton. *J. Bombay nat. Hist. Soc.*, **24** : 430. (Deesa, Banas Kantha (= Palanpur), Gujarat).

*Material examined* : INDIA : 24♂, 14♀, and 2 unsexed : GUJARAT : Banas Kantha District : 1♂; Lunwa; April 1913 (ZSI). 2♂, 1♀; Deesa (type locality); March 1948 (ZSI). 1♀; near Balaram River, Palanpur; March 1948 (ZSI). RAJASTHAN : Ganganagar District : 1♀; Asarjana (c 15 km W of Nohar); October 1960 (ZSI). 1♀; Diplana (c 20 km E of Nohar); October 1960 (ZSI). Bikaner District : 1♀; Kotri (c 6 km N of Kolayat); September 1960 (ZSI). 1 unsexed; Bikaner; October 1962 (ZSI). Jaipur District : 1♂, 1♀; Dudu; January 1959 (ZSI). 8♂ (1 juv., 3 ex. in alcohol), 3♀ (in alcohol); Sambhar; April and May 1957 (ZSI). 1♀; Kishangarh; November 1956 (ZSI). Ajmer District : 1♂ (in alcohol); Rajoshi Reserve Forest (c 11 km SE of Ajmer); November 1956 (ZSI). Udaipur District : 1♂; Forest near Udaipur Lake (near Udaipur); October 1941 (ZSI). 1 unsexed without any locality; October 1941 (ZSI). 2♂; (c 3 km E of Maoli Junction Riy. Stn.); February 1948 (ZSI). 1♂; Kankroli (c 32 km N of Maoli Junction Riy. Stn.); February 1948 (ZSI). 1♂; Jagmandi (c 22 km E of Phuled Riy. Stn.); March 1948 (ZSI). Sirohi District : 1♂; Mt. Abu; March 1948 (ZSI). Jodhpur District : 1♂, 1♀ (in alcohol); Beriganga (c 16 and 19 km N of Jodhpur); December 1956 (ZSI). 1 juv. ♂, 1 unsexed (both in alcohol); Kailana Lake (c 8 km W of Jodhpur); December 1956 and January 1958 (ZSI). 1♀ (in alcohol); Mandore (c 12 km N of Jodhpur); June 1960 (ZSI). Jaisalmer District : 1 juv. ♂, 2♀; Nokh; August 1960 (ZSI). HIMACHAL PRADESH : Kangra District : 1♂, 1♀; Dhamtal; November 1922 (ZSI). PUNJAB : Gurdaspur District : 1♂; Madhupur, southeastern bank of Ravi River; February 1929 (ZSI).

PAKISTAN : 1♂, 2♀ : PUNJAB : Rawalpindi Division : 1♂; Kallar Kahar, Salt Range; April 1923 (ZSI). 1♀; Sodhi, Salt Range; May 1923 (ZSI). 1♀; Chakri, Salt Range; March 1923 (ZSI).

External measurements :	22♂	16♀
Head and body :	125–152 (140.6)	129–152 (141.0)
Tail :	87–126 (139.8)	91–167 (138.2) (17 exs)
Hindfoot :	33–41 (37.5)	32–42 (36.1)
Ear :	12–18 (15.2)	14–19 (15.8)
Proportion of ear to head and body size :	7.8–12.2%	9.2–13.1%

This subspecies, on the average, is larger in head and body length than *Funambulus pennanti pennanti*, the dark stripes are speckled black and Ochraceous Buff. The later colour, however, pre-dominates. The head is lighter than the back and is Straw Yellow to sandy in colour, minutely speckled with black. The light stripes are Cream Buff to Buff; occasionally white.



The central light stripe never gets darker than the other light stripes. The manus and pes are lighter dorsally, Cream Buff to Straw Yellow in colour. The sides of the body, the flank, anterior and posterior limbs are Primrose Yellow, sometimes Straw Yellow, speckled with black. The tail is generally prominent but sometimes not traceable very well for it becomes almost concolourous with the colouration of the sides of the body.

*Range* : It occurs from Deesa, Banas Kantha (= Palanpur), Gujarat, northwards through the Great Desert and others parts of Rajasthan, extending as far north on Salt Range in Punjab, in Pakistan and Kangra Valley in Himachal Pradesh in India.

*Remarks* : As in *Funambulus pennanti gangutrianus* and *F. p. argentescens*, this subspecies also does not occur together with *Funambulus palmarum*.

***Funambulus pennanti argentescens* Wroughton**

1905. *Funambulus pennanti argentescens* Wroughton. *J. Bombay nat. Hist. Sco.*, 16(3) : 413. (Rawalpindi; northern Punjab, Pakistan).

*Material examined* : INDIA : 1♂; GUJARAT : Kachchh District : 1♂; Bhuj; August 1911 (ZSI).

PAKISTAN : 6♂, 5♀ : SIND : Hyderabad Division : 1♂; Mirpur Sikra; October 1922 (ZSI). 1♀; Gharo; October 1922 (ZSI). 1♀; Gholam; October 1922 (ZSI). 1♂; Hyderabad; 1855 (no other particulars) (ZSI). Khairpur Division : 1♂; Jacobabad; February 1915 (ZSI). BALUCHISTAN : Kalat Division : 1♂; Tarbat; November 1917 (ZSI). 1♀; Punjgur; January 1918 (ZSI). 1♀; Mand, Makhirali; March 1918 (ZSI). Quetta Division : 1♀; Pishin; February 1872 (ZSI). PUNJAB : Rawalpindi Division : 1♂; Rawalpindi; no date (ZSI). 1♂; Chak-Lala; July 1921 (ZSI).

External measurements :	17♂	12♀
Head and body :	112–140 (135.8)	117–146 (135.0)
Tail :	115–164 (136.6)	125–170 (145.5)
Hindfoot :	33–38 (35.3)	33–39 (36.4)
Ear :	15–19 (16.2)	13–19 (16.4)
Proportion of ear to head and body size :	10.8–14.7%	9.5–14.3%

This is smallest in head and body size among all the subspecies known. The dark stripes are speckled black and Cream Buff; black predominates. The head is lighter than the back; Cream-colour to smoky, minutely speckled with black. The light stripes are white. The central light stripes never darker than the outer light stripes. The manus and pes are lighter dorsally; whitish to

Cream-colour. The ventral side is white in colour. The sides of the body, the flank, the fore and hind limbs are Primerose Yellow speckled with a certain amount of black. The tail is not bushy, more or less slender. The saddle generally commences from the inner angle of the ear. The outer pair of light stripes are quite prominent.

*Range* : Kutch in Gujarat in India through arid and semiarid country of Pakistan as far west to Iran.

**Tentative Key to the Identification of the Subspecies of *Funambulus pennanti*  
Based on Average Body Measurements**

1. Average head and body length under 136 mm. .... *F. p. argentescens*  
— Average head and body length above 136 mm. .... 2
2. Head and body length averages above 145 mm. .... *F. p. gangutrianus*  
— Head and body length averages below 145 mm. .... 3
3. Tail larger than head and body. .... *F. p. pennanti*  
— Tail average shorter than head and body. .... 4
4. Average ear length below 16 mm. .... *F. p. lutescens*  
— Average ear length above 16 mm. .... *F. p. chhattisgarhi*

A comparison of external characters and ecological co-relations of the five subspecies are summarized in Table 1, and comparison of average external measurements of the above subspecies are given in Table 2. Also their approximate distribution have been shown in Text-figure 1.

**SUMMARY**

Taxonomy of one of the most common rodent, *Funambulus pennanti* Wroughton, which occurs over a wide area from southern to northern India, under variable ecological conditions, has been studied afresh in the light of the material present in the Zoological Survey of India and Bombay Natural History Society. The colour variation which is obvious in such a widely distributed species, the three subspecies, namely, *Funambulus pennanti pennanti* Wroughton, 1905, *Funambulus pennanti argentescens* Wroughton, 1905, and *Funambulus pennanti lutescens* Wroughton, 1916, have been recognised to be valid on average colour characters and measurements. Moreover, description of two new subspecies of the Five striped Squirrel has been provided.

**Table 1.** Comparison of the subspecies of *Funambulus pennanti*.

	<i>F. p. pennanti</i>	<i>F. p. chhattisgarhi</i>	<i>F. p. gangutrianus</i>	<i>F. p. lutescens</i>	<i>F. p. argentescens</i>
1	2	3	4	5	6
<b>CHARACTERS</b>					
Size of head and body	134–156 (142.5)	118–175 (142.6)	126–182 (147.3)	125–152 (140.8)	112–146 (135.4)
Proportion of ear to head and body size	8.3–13.5 (10.9)	7.3–12.9 (10.1)	8.2–14.3 (11.2)	7.8–13.1 (10.4)	9.5–14.7 (12.1)
Dark stripes	Speckled black and Buff to Orange-Buff. Proportion of black and other colour almost same	Glossy; speckled with bright Orange-Buff and black	Speckled black and Orange-Buff. Generally Orange-Buff predominates to some extent, sometimes the black	Speckled black and Ochraceous Buff. Latter colour predominates	Speckled black and Cream Buff. Black predominates
Light stripe	Creamish white to Primrose Yellow	Creamish white	Primrose Yellow	Cream Buff to Buff, sometimes white	White
Central light stripe	Often deeper than other light stripes	Generally deeper than other light stripes, and Buff Yellow in colour	Very rarely deeper than the outer light stripes	Never deeper than other light stripes	Never deeper than other light stripes
Outer light stripe	Quite prominent	Generally prominent; in rare cases hardly distinguishable	Prominent	Generally prominent, but sometimes untraceable	Quite prominent
Shaddle	Generally commences from the anterior angle of the ears or between the ears	Commences between the ears; brightly coloured than any other subspecies	Generally commences posterior to forelimbs	Commences between the ear; usually prominent up to base of tail	Commences from the inner angle of the ears usually prominent up to the base of tail
Head	Lighter than back, ranges from Cream Buff to Orange Buff, minutely speckled with black. In many individuals not lighter than the nape and anterior portion of shaddle	Not lighter than back; concolourous with the dark stripes of the shaddle	Lighter than back; Buff to Buff-yellow, minutely speckled with black	Lighter than back and Straw Yellow to sandy in colour, minutely speckled with black	Lighter than back, Cream colour to smoky, minutely speckled with black

1	2	3	4	5	6
Upper side of manus and pes	Light whitish to Cream colour and even Primrose Yellow to Straw Yellow	Light, Straw Yellow to Buff or intermediate	Light, Primrose Yellow to Straw Yellow	Light, Cream Buff to Straw Yellow	Light, whitish to Cream colour
Sides of body, flank, fore and hind limbs	Straw Yellow speckled with certain amount of black or speckled black and Straw Yellow, with faint rusty wash	Speckled Buff and black, with a rusty wash; Buff colour predominates	Primrose Yellow to Straw Yellow speckled with very little amount of black	Primrose Yellow, sometimes Straw Yellow and speckled with black	Primrose Yellow speckled with certain amount of black
Tail	Generally slender; down the middle region of north-eastern examples Straw Yellow in most cases	Slender, under side has a Buff or Buff Yellow line down the middle region	Bushy, down the middle region of underside generally Buff yellow	Generally not very Bushy	More or less slender
Ventral side	Whitish to Cream colour, even Primrose Yellow to Straw Yellow	Primrose Yellow	Primrose Yellow to Straw Yellow	Cream Buff, sometimes white	White
ENVIRONMENTAL CORRELATION Soil type	Primarily black and deep black soil (Regur soil)	Primarily red and yellow soil or red loam	Primarily alluvial, mixed red and black or salt impregnated grey and brown soil	Primarily sandy or desert type	Primarily alluvial
Rainfall	60-400 cm	200-300 cm	100-300 cm	20-60 cm	15-70 cm
Vegetation type	Tropical : Mainly dry deciduous and thorny; moist deciduous and evergreen or semievergreen in places	Tropical : Mainly moist deciduous and evergreen; partly occurs in dry deciduous vegetation	Tropical : Mostly dry deciduous, and moist evergreen and deciduous	Tropical : Thorny, including desert type	Tropical : Thorny
Occurrence with <i>Funambulus palmarum</i>	Occurs in the same geographical region, but not found in the same place with <i>F. palmarum</i>	Occurs in the same geographical region and in the same place with <i>F. palmarum</i>	Does not occur with <i>F. palmarum</i>	Does not occur with <i>F. palmarum</i>	Does not occur with <i>F. palmarum</i>

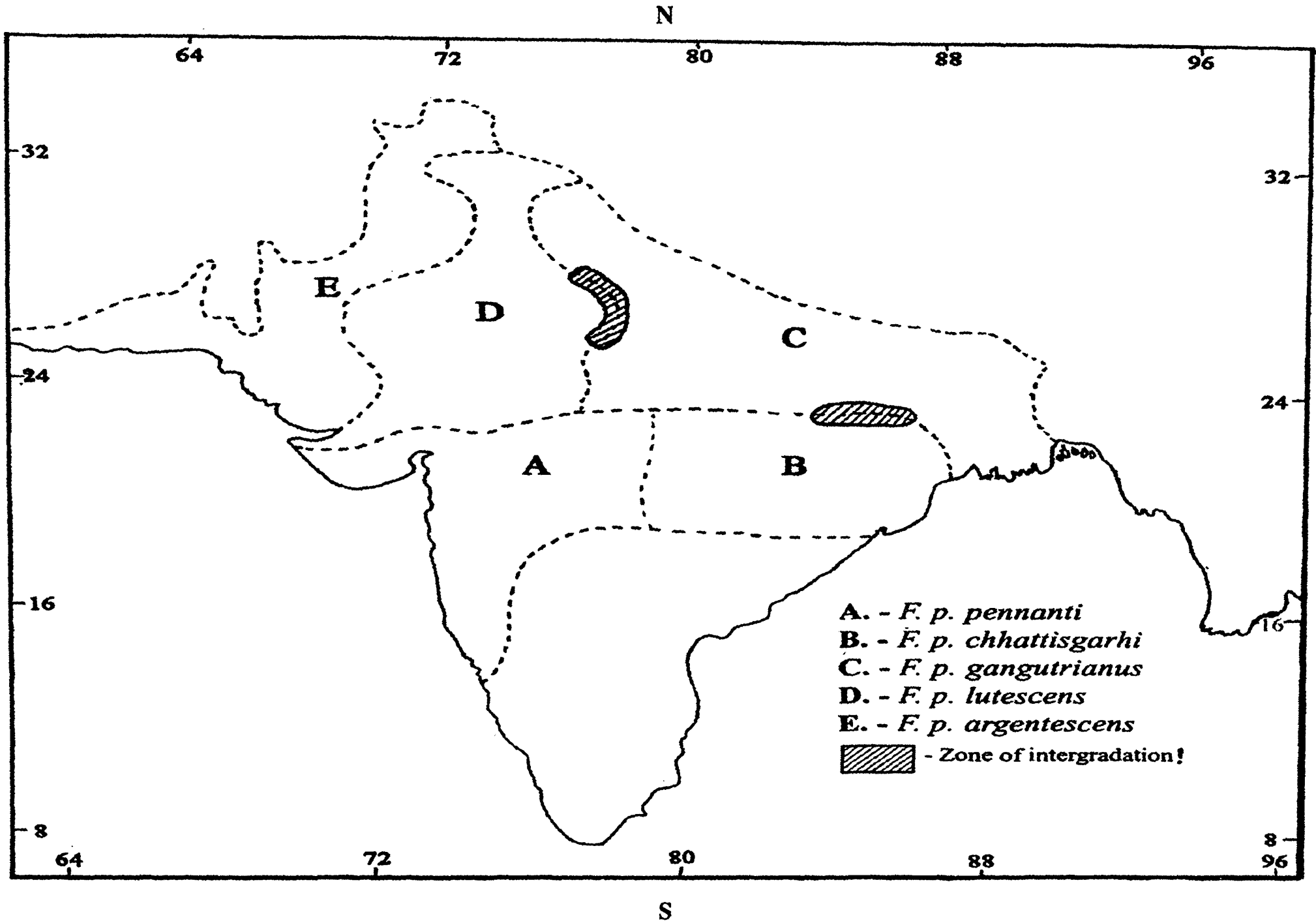


Fig. 1. Showing distribution of five subspecies of *Funambulus pennanti*. A-*F. p. pennanti*; B-*F. p. chhattisgarhi*; C-*F. p. gangutrianus*; D-*F. p. lutescens*; E-*F. p. argentescens*.

**Table 2.** Comparative average external measurements of five subspecies of *Funambulus pennanti*.

Subspecies	No. of examples and sex	Head and body	Tail	Hindfoot	Ear
<i>F. p. pennanti</i>	24 ♂:	142.4	147.1	36.9	16.2
	21 ♀:	142.6	147.3	37.3	16.2
<i>F. p. chhattisgarhi</i>	28 ♂:	141.0	137.0	36.2	16.1
	25 ♀:	144.3	136.2	36.4	16.2
<i>F. p. gangutrianus</i>	31 ♂:	148.8	132.3	38.1	16.6
	20 ♀:	145.9	135.6	37.9	17.0
<i>F. p. lutescens</i>	22 ♂:	140.6	139.8	37.5	15.2
	16 ♀:	141.0	138.2	36.1	15.8
<i>F. p. argentescens</i>	17 ♂:	135.8	136.6	35.3	16.2
	12 ♀:	135.0	145.5	36.4	16.4

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