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TAIL CARRIAGE IN THE HANUMAN LANGUR, *PRESBYTIS ENTELLUS ENTELLUS* (PRIMATES, CERCOPITHECIDAE) IN THE INDIAN DESERT

By

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(With 5 Text-figures, 1 Plate and 3 Tables)

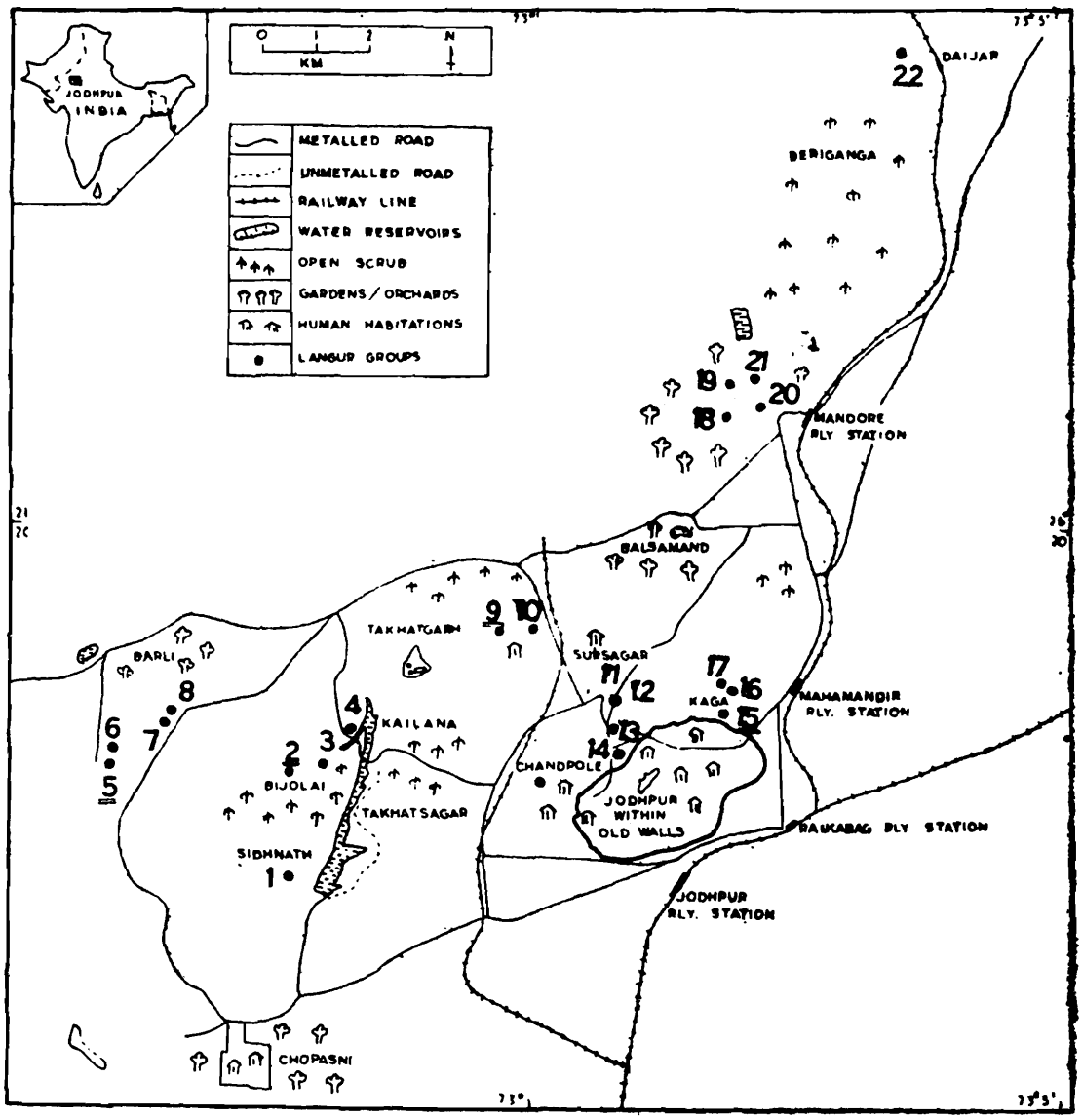
INTRODUCTION

Little attention has been given to the mode of tail carriage in Primates except in the Indian rhesus macaque, *Macaca mulatta* (Zimmerman), where the most dominant or alpha male carries the tail erect, while in other individuals it is pendant (Ojha, 1974). *Presbytis entellus* (Dufresne) (Cercopithecidae, Colobinae) is the common langur of India and Sri Lanka, and has 15 subspecies (Pocock, 1928*a*, *b*, 1939; summary in Roonwal and Mohnot, 1977). It has a long, powerful, rope-like tail which is about 50 percent longer than the head-and-body. Little is known of its tail carriage, but Roonwal (1976, and in press) has recently studied the occurrence of geographical, subspecific and clinal variations.

We present here the results of field study on the North Indian subspecies, *P. entellus entellus* (Dufresne), in an isolated population on the eastern fringe of the Great Indian Desert around Jodhpur (preliminary account in Roonwal and Makwana, 1976). The tail is normally (while standing or walking) looped forward. The problems studied were the nature and shape of the loop, the loop index, the position of the tail tip, the left-right stance of the tail, and sexual and other differences in tail carriage.

Material and Methods

This study was carried out in the semi-desert, rocky country around Jodhpur (latitude 26 18' N, longitude 73 04' E) in western Rajasthan (Fig. 1), which, within an area of about 50 kms, harbours a wild, isolated population of about 900 langurs divided into some 32 groups (Mohnot, 1974). For over a hundred kilometres or more around there are no langurs or any other primates. Observations were made during a 2-year period on 68 separate individuals in 22 different groups (18 bisexual-unimale, 4 all-male; names and locations as in Text-Fig. 1) for about



Text-fig. 1. Map of Jodhpur and vicinity, to show the location of groups of *Prebytis entellus entellus* which were studied for tail carriage. Groups were bisexual-unimale except where otherwise stated; all-male groups are double-underlined. *Group names* 1. Sidhnath. 2. Bijolai C (all-♂). 3. Bijolai A. 4. Bijolai B. 5. Bhadreswar A (all-♂). 6. Bhadreswar. 7. Kadamkandi A. 8. Kadamkandi B. 9. Chopar B (all-♂). 10. Chopar A. 11. Sursagar A. 12 Sursagar B. 13. Vidyasal A. 14. Vidyasal B. 15. Kaga B (all-♂) 16. Kaga A1. 17. Kaga A2. 18. Guest House. 19. Guest House A. 20. Nagadari. 21. Nagadari A. 22. Daijar.

104 observation-hours, on 4,899 individual 'episodes' (see below). Continuous observations on single animals lasted from brief periods to half an hour or more. (A pair of field binoculars were helpful in observing distant animals). Daily observations lasted several hours at a stretch to enable us to follow individuals and groups for long periods under various situations. The dominance status of males within all-male groups was determined by food offer tests.

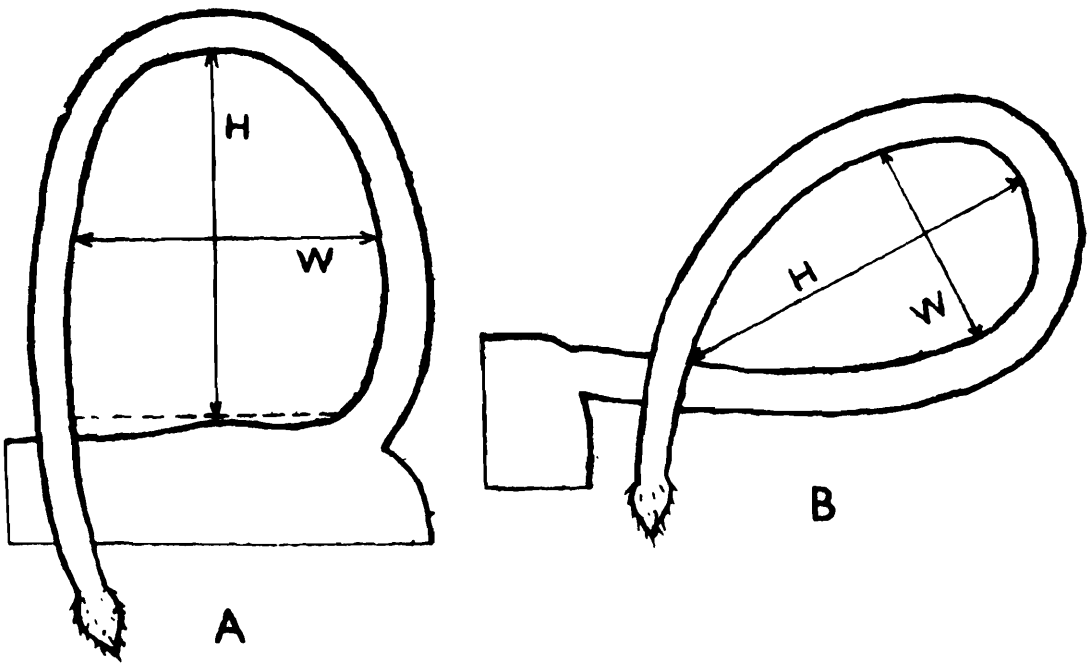
The tail is normally looped. We have termed the looped period as an 'episode', and the intervening, unwound period as an 'interruption' The two periods often alternate within seconds or minutes. To facilitate quick and continuous noting of the tail stance (see below), the following mode of recording of individual episodes and stance was adopted, the hour being noted at the commencement and the end and as often as possible in between :—

R	/	R	/	R	/	R	/	R	/	L
		S		St		Rn		J		

/	R	/	R	/	R	/	M	/	R	/
	Rn		St		W		J			

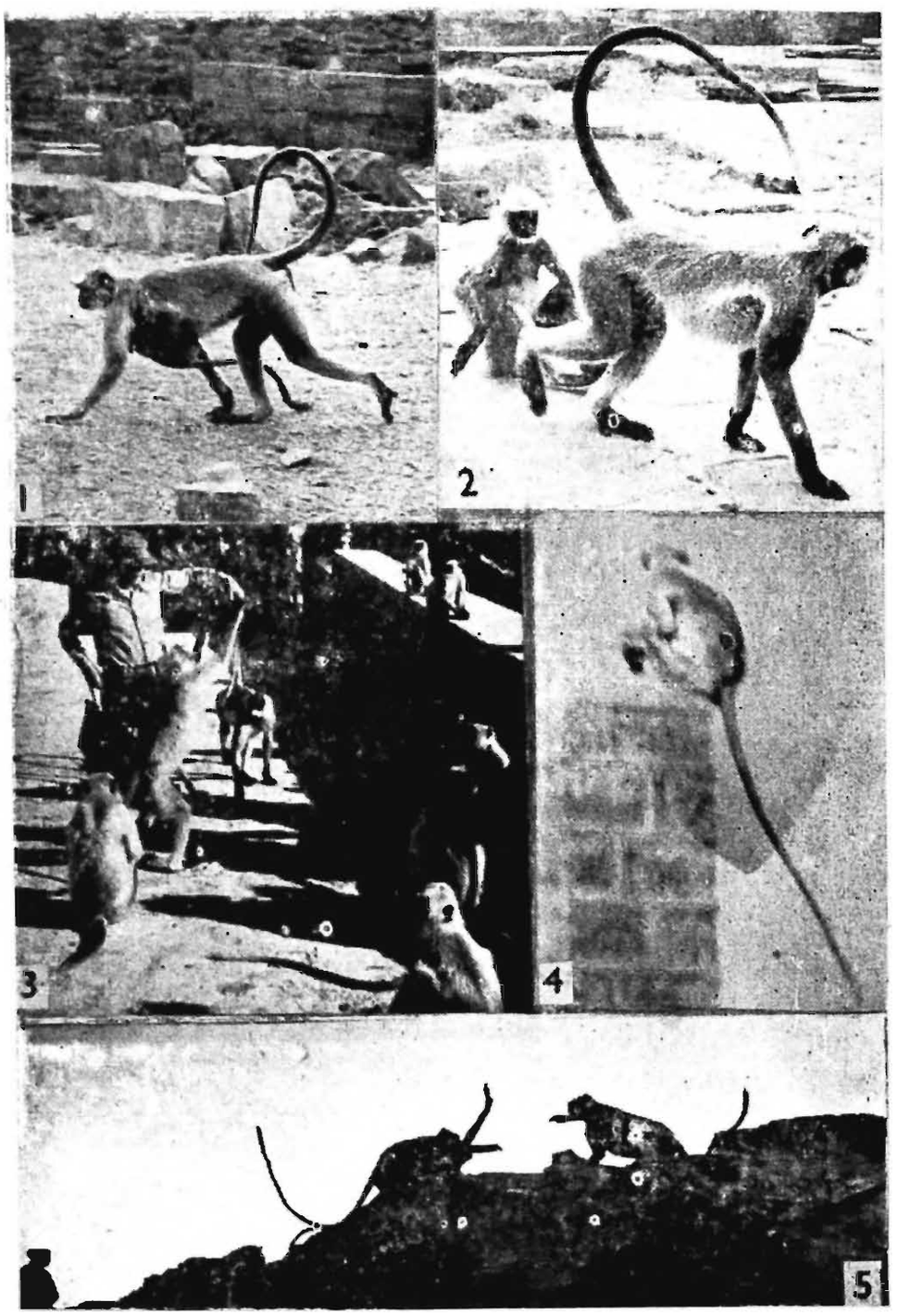
15.30 — 15.35 — 15.39 (ran away)

The following abbreviations were used: J, jumping; L, left, M, middle, and R, right stance of tail loop; Rn, running; S, sitting; St standing; W, walking; /, an interruption between two looped periods or episodes. Other abbreviations used where necessary were: Ad, adult, SA, subadult; I, infant; Jn, juvenile.



Text-fig. 2. Tail loops in adults of *Presbytis entellus entellus* at Jodhpur, to show method of measurement of height (H) and width (W), to determine at the Loop Index (W/H). and width (W), to determine at the Loop Index (W/H). (A) Normal, relaxed loop ('open'). (B) Temporary phase ('closed' loop).

ROONWAL PLATE VI



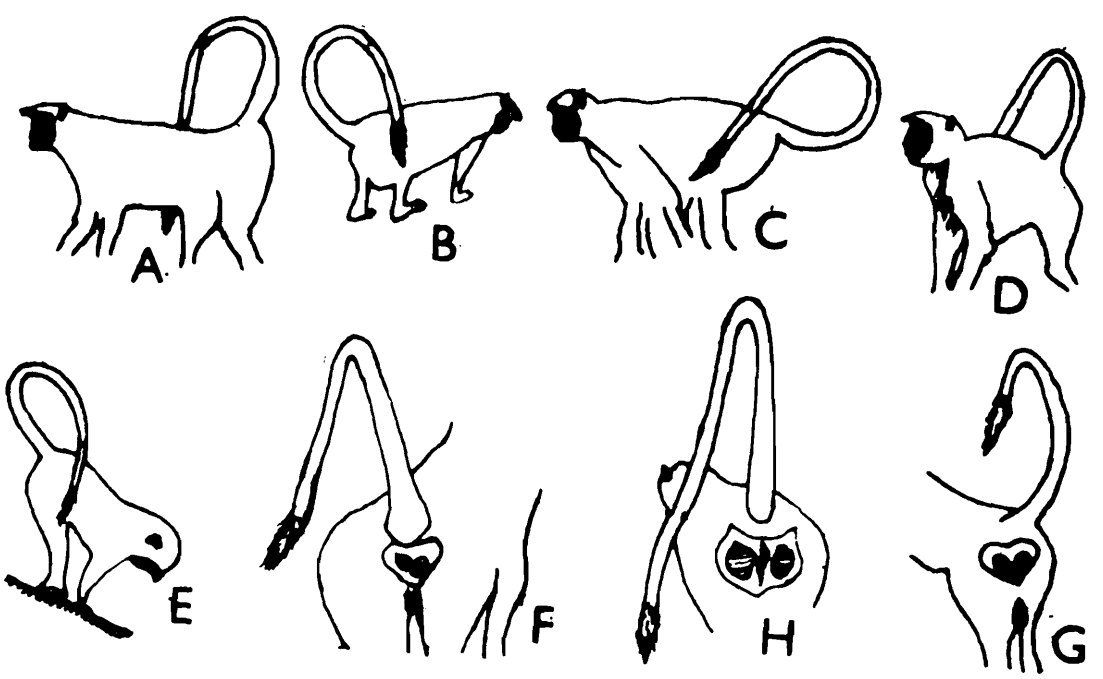
Photographs of *Presbytis entellus entellus* (all are adults except Fig. 4) at Jodhpur, to show tail carriage. (1) Walking ♀ with infant. (2) ♂, walking. (3) A group, in various positions. (4) Juvenile sitting on a ledge, the tail swinging slowly from side to side. (5) Three ♂♂, fighting; note that the tail loop has become unwound and assumed, a bow-shape. (Figs. 1, 2 ex Strain.)

The loop shape, which was studied in lateral photographs, is mostly round- to elongate-oval and can be expressed as the ratio Width/Height (Loop Index). The height is measured as the maximum length from a point on the inside of the tail opposite its insertion, and the width as the maximum width across the height line (Text-Fig. 2A). Occassionally, the loop is 'closed'; the height is then measured from the point of tail crossing (Text-Fig. 2B).

Results

1. *Tail Carriage (General)*

In adults and subadults the normal mode of tail carriage in relaxed, nonstress situations (standing, walking, slow running) is as an 'open', forwardly directed, urpright loop (Text-Fig. 3 and Pl. VI,), with the distal part either just touching the back or trailing along the sides of the body to the left or right, and the tip reaching down to well below the belly (c. 15 cm or so). Under stress (fast running, fighting) the loop is partly or wholely unwound and the tail acquires a bow- or a S-shape (Pl. VI,Fig.5), In repose, while sitting (Pl. VI, Figs. 3 and 4), the tail is either stretched



Text-fig. 3. Tail carriage in adults of *Presbytis entellus entellus* at Jodhpur, to show tail loop stance. (Outlines from photographs; H ex Mohnot, rest original). (A) ♂, walking, loop stance right. (B) ♂, standing, right stance. (C) Running, left stance. (D) ♀, running slow, right stance. (E) ♂, dsscending, right stance. (F) ♂, standing, left stance. (G) ♂, standing, middle stance. (H) ♀, standing, left stance.

flat on the ground (temporarily, for a very brief duration, it may form a closed loop by crossing in the distal half, Fig. 2A), or, if the animal is on a ledge or a tree branch, it hangs down limp and straight and may swing from side to side (Pl.IV,Fig. 4). (It is in the hanging position that infants

TABLE 1. The frequency of occurrence (%) of tail position with respect to tail tip in adults of *Presbytis entellus entellus* at Jodhpur.

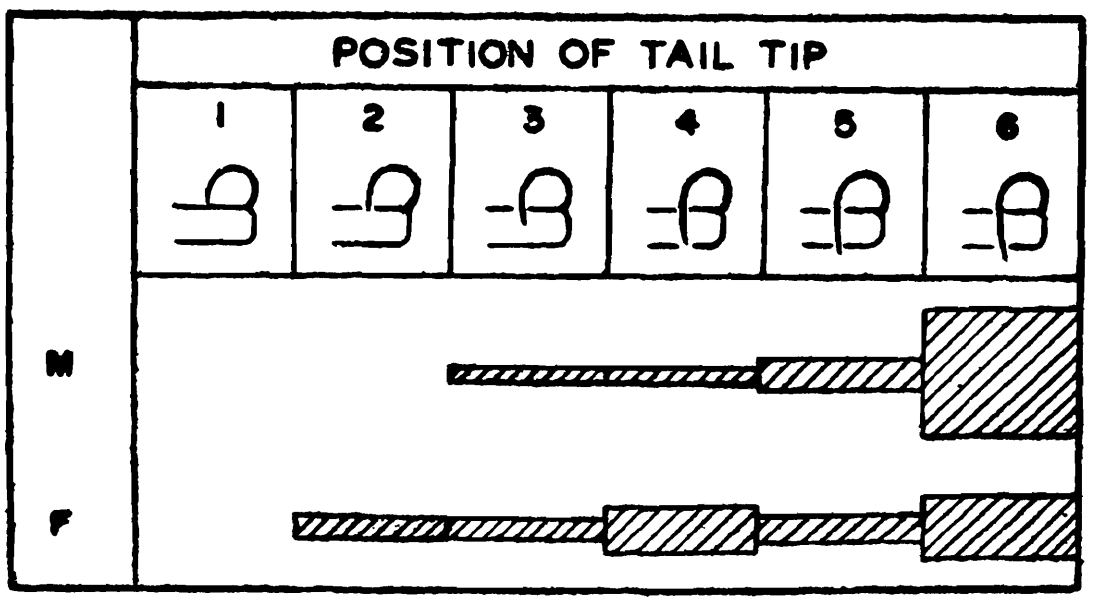
Position of tail tip	Percentage					
	1	2	3	4	5	6
	(a little above back)	(touching back)	(middle of back and belly)	(bottom of belly)	(a little below belly)	(well below belly)
20 ♂♂	0	0	5	5	10	80
25 ♀♀	0	7.4	7.4	22.2	18.5	44.5

and juveniles climb each other's and the mother's tail for swinging.) In *coupla* also the tails hang limp. The loop is reformed as soon as the animal gets up, and remains more or less in tact, though occasional unwinding and reforming may occur. Subadults carry the tail as in adults, while in infants and jueveniles there is no fixed mode of tail carriage and the loop is generally wanting though it may sometimes be formed casually for a brief duration.

2. *Position of the Tail Tip*

(Text-Fig. 4; and Table 1)

The position of the tail tip was examined in 45 adults (20 males in 10 different groups, one all-male and the rest bisexual-unimale; and 25 females in 6 different groups, all bisexual-unimale). The number of adult males in a group ranged from 1 (in bisexual groups) to 7 (in all-male groups); that of females from 4 to 36. A total of 1,451 'episodes' were observed (1,027 in males, with 10-326 episodes for each individual; and 424 in females, with 4-65 episodes for each). Records were grouped into six categories with regard to the position of tail tip, thus: (1) A little above the back. (2) Touching the back. (3) Middle of the back and belly. (4) Bottom of the belly. (5) A little below the belly (up to 3 cm). (6) Well below the belly (3-15 cm). The following are the principal conclusions: (1) The tail tip always reaches the back, and often goes below it, in many cases well below (3-15 cm) the belly. (2) Variation ranged over five positions (Nos. 2-6, none being found in position No. 1 except very excep-



Text-fig. 4. *Presbytis entellus entellus*. Jodhpur. Variation in position of tail tip in adults (F, females; M, males). Size of shaded rectangles indicate approximate relative frequency of each position-type. Position of tail tip : 1. A little above the back (none). 2. Touching the back. 3. Middle of the back and belly. 4. Bottom of the belly. 5. A little below the belly. 6. Well below the belly.

tionally and temporarily). (3) Within this range, there is, in both sexes, a strong tendency for individual constancy, and in every episode the tip returns again and again to the position which is characteristic for that individual; exceptions were rare and occured only in females. (4) A marked degree of sexual dimorphism is noticeable (Text-Fig. 4; and Table 1). Males ranged from positions 3-6 (with heavy concentration, 80%, in No. 6), and an almost absolute individual constancy. Females ranged from positions 2-6, still substantially concentrated (44.5%) in position No. 6, but the spread is more even (Table 1) and there is less, but still substantial, constancy than in males (out of 25 females, 23 had a 'single' position and the remaining two had two different but neighbouring positions, viz., Nos. 5, 6 and 4, 5).

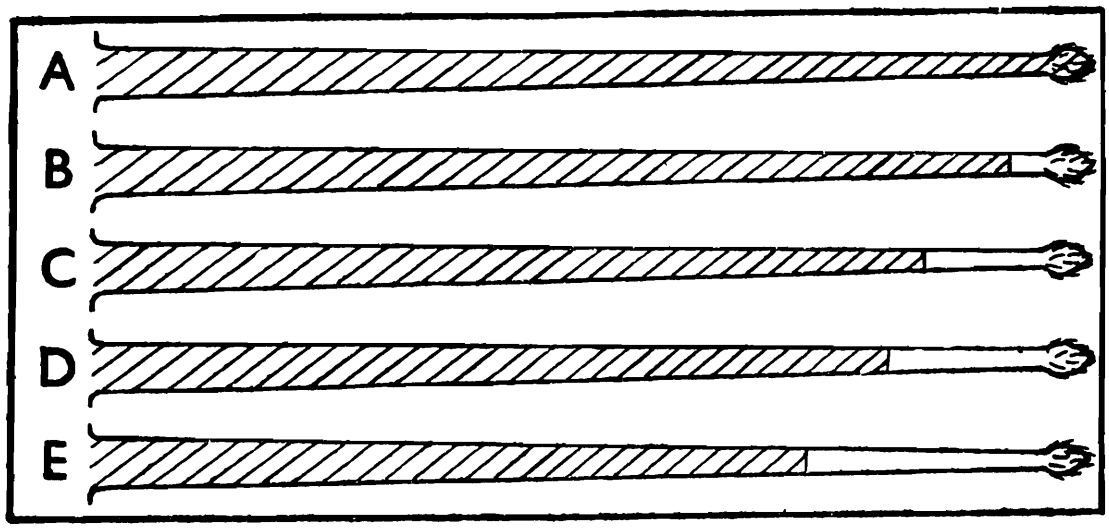
3. *Tail Loop and the Left-Right Stance*

(a) *Loop shape and index*

The normal upright, forwardly directed loop is of the 'open' type (Text-Figs. 2A and 3), i.e., the tail does not cross at any point. Occasionally, a 'crossed' loop may occur temporarily (Text-Fig. 2B). In 19 adults and subadults, the Loop Index (W/H) in open loopes varied from 0.3-1.0, with the maximum concentration (83 %) well above 0.5 (0.6-0.9); the loop thus tends to be round-oval. Data are inadequate to determine sexual or other differences. (The crossed loop is also generally round-oval.)

(b) *Extent and portion of tail involved in the loop*

The extent and portion of the tail involved in the loop varies with



Text-fig. 5. The extent of tail involved in the loop (shaded part) in *Presbytis entellus entellus* at Jodhpur in various situations of tail tip (cf. Fig. 4). (A) Tip touching the back. (B) Tip a little below the back. (C) Tip at the middle of the back and belly. (D) Tip from bottom of the belly to a little below it. (E) Tip well below the belly.

TABLE 2. *Presbytis entellus entellus* at Jodhpur. A few examples (taken at random from among the 68 individuals studied) to illustrate the near-constancy (c. 80-100%) of tail loop stance in individuals.

Sl. No. of observations	Total No. of episodes observed	Tail stance, %			Remarks
		Left	Right	Middle	
		(A) *Male (from a unimale- bisexual group, Bijolai A)*			
1	10	0	100	0	Observed on 8 different days in 8 different sets of observations (period ranging from 5-45 min.)
2	23	17.4	82.6	0	
3	56	14.3	85.7	0	
4	16	0	100	0	
5	14	0	100	0	
6	43	4.7	95.3	0	
7	33	12.1	87.9	0	
8	38	5.2	94.8	0	
Total and Range	233	0–17.4	82.6–100	0	
		(B) *Male (from an all-male group, Kaga B)*			
1	16	100	0	0	Observed on 4 different days in 4 different sets of observations (period ranging from 15-40 min.)
2	28	82.2	17.8	0	
3	47	95.7	2.2	2.1	
4	19	95	0	5	
Total and Range	110	82.2–100	0–17.8	0–5	

(C) *Female (from a unimale-bisexual group, Bijolai A)*

1	20	85	15	0	Observed on 7 different days in 7 different sets of observations (period ranging from 9-40 min.)
2	23	91.3	8.7	0	
3	10	100	0	0	
4	55	87.3	12.7	0	
5	40	100	0	0	
6	22	100	0	0	
7	10	100	0	0	
Total and Range	180	85–100	0–15	0	

TABLE 3. *Presbytis entellus entellus*, Jodhpur. Mean percentage of the frequency of occurrence of tail loop stance.

Category	Total No. of individuals observed	Total No. of episodes observed	Mean % (± S. E.) of tail loop stance		
			Left	Right	Middle
1. Adult males from unimale-bisexual groups)	18	2,769	45.96 ± 0.94	50.35 ± 0.94	3.69 ± 0.06
2. Adults males (from all-male groups)	27	682	64.40 ± 0.92	35.10 ± 0.91	0.50 ± 0.37
3. Subadult males (from all-male groups)	8	424	54.00 ± 1.76	43.40 ± 1 75	2.60 ± 0.55
(Males) :	(53)	(3,875)	(45.96–64.40)	(35.10–50.94)	(0.50–3.69)
4. Adult females (from unimale-bisexual groups)	15	1,024	90.40 ± 0.76	8.24 ± 0.70	1.35 ± 0.29
All individuals	68	4,899	61.74 ± 0.55	36.27 ± 0.54	1.08 ± 0.16

Chi- square tests showed significant differences, at 1% level of drobability, between the following category-pairs:-
Adult males (from bisexual groups) vs. adult females.
Adult males (from all- male groups) vs. adult females.
Adult males (from all- male groups) vs. subadult males (from all- male groups).
Adult males (from bisexual groups) vs. adult males (from all- male groups).

the position, down the sides, reached by the tail tip. When the tip just reaches the back, the entire tail forms the loopl. With the extension of the tail further down the sides, the portion of the tail (always the proximal) forming the loop gradually declines to about three-fourths of the tail length (Text-Fig. 5).

(c) *Loop stance*

Where the tail tip reaches below the back, the tail runs down the body sides to the right or left. In a few cases, where the tail just reaches the back (or temporarily remains a little above it), a 'middle' stance is observed. As noted in 4,899 'episodes' in 68 different langurs, individuals show a near-constancy (c. 80-100 %) of loop stance, and in episode after episode the tail resumes, after each 'interruption', the stance which is characteristic of that individual. This feature is illustrated in Table 2 in a few examples taken at random from among the 68 individuals studied. Strong tendencies of sexual differences, as well as differences between males from different types of groups, are noticeable (chi^2 tests) (Table 3).

(i) *Adult and subadult males*: Observations on 3,875 episodes in 53 males from 22 groups show (Table 3) the following characteristics:- (1) The loop stance is nearly evenly distributed between left and right (means: left (L) 45.96-64.40 %, right (R) 35.10-50.94 %, middle (M) 0.50-3.69 %.* (2) Significant differences in the mean L : R : M proportions occur between adult males from bisexual groups and those from all-male groups, the former tending toward a right stance, the latter toward a left; the prportions are: bisexual 45.96: 50.35 : 3.69; all-male 64.40 : 35.10 : 0.50. (3) Males in all-male groups show a marked tendency towards intragroup† constancy. In Chopar B group all the 7 males had a wholely right stance, while in Bijolai C group all the 4 males had a largely left stance. In Kaga B group, with 15 males, all except one had a predominantly left stance; the exceptional male had an almost wholely *middle* stance (99.3 %; this was the sole exception of this kind in the entire material studies at Jodhpur).

(ii) *Adult females:* Observations on 1,024 peisodes in 15 femalee from 12 groups (all bisexual-unimale) show (Table 3) the loop stance to be overwhelmingly left, the mean L : R : M proportions being 90.40 : 8.25 : 1.35. (In an exceptional female, in the Sidhnath group, it was mostly right, 86.5 %.) The middle stance is generally absent and was observed only occasionally in three females (2.6 %—9 %).

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* In the preliminary note (Roonwal and Makwana, 1976, the male stance was given as predominantly right, the mean L : R : M proportions being 32 : 57: 11.

† In the preliminary note (Roonwal and Makwana, 1976 .p. 83) this was misprinted as "intergroup constancy".

(iii) *Younger stages*: Subadults tend to be like adults. Juveniles and infants show no constancy in tail carriage.

Discussion

The Jodhpur population

The theoretical implications of the above mentioned findings on the Jodhpur population (*P. e. entellus*) can be fully understood only if complete information on genealogies of individuals and group-histories is available. Such information is almost impossible to obtain in large, wild populations. Some general tendencies may, however, be discussed as seen in adults (subadults have adult characterists; but infants and juveniles have no constancy of tail carriage, and a study of the ontogeny of tail carriage should be ofconsiderabe interest).

In the relaxed state, at Jodhpur, the tail is looped forward in a large, suboval loop over the back. (The direction and shape of the loop shows geographical, subspecific and clinal variations, Roonwal 1979.) Under stress (fast running, fighting) the loop tends to become unwound The near-constancy of loop stance (left or right) in individuals, and its sex-linkage (in females it is predominantly left, mean 90.4%; in males it is more evenly distributed) suggest a genetical origin. Furthermore, intergroup differences are noticeable. The loop stance in adult males from bisexual groups differs significantly from all-male groups; in the former the right stance is more common, in the latter the left. How these differences arise and are maintained is not clear. Intragroup constancy is noticed among males in all-male groups. The origin of this uniformity cannot be understood without a knowledge of genealogies. Does uniformity ensure recognition between group members and coherence within a group?

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Summary

1. Tail carriage was studied in adults of an isolated population comprising about 900 individuals of *Presbytis entellus entellus* (Dufresne) in Jodhpur and its vicinity at the eastern fringe of the Great Indian Desert. A total of 68 individuals from 22 groups (both bisexual-unimale

and all-male) were studied in 4,899 different 'episodes' during a 2-year period.

2. In the relaxed state (standing, walking, slow running) the tail is carried in a large, round- to elongate-oval, forwardly directed loop over the body. Under stress (fast running, fighting) the loop tends to open out and the tail assumes a bow- or a S-shape. In repose (sitting) the tail is spread irregularly on the ground, or hangs limp.

3. The tail tip reaches the back and often runs further down the sides to well below the bellly. In males the tip largely (80%) reaches well low the belly; females show a wider and more even spread.

4. Variations in the shape of the oval loop can be gauged by the Loop Index (Width W/ Height H) which ranges between c. 0.3-1.0, with the maximum concentration at 0.6-0.9.

5. The extent and portion of tail involved in the loop varies with the position, down the sides, reached by the tail tip, and is the least (about three-fourths of the tail length) when the tip is farthest down the belly.

6. Loop stance: The tail may run down the body sides to the left or right, or remain in the 'middle' (when it just reaches the back), the last condition being uncommon. Individuals show a near-constancy of loop stance. Sexual dimorphism and differences between types of groups are noticeable. In males the loop stance is nearly evenly distributed between the left and right; in females the stance is overwhelmingly left (c. 90 %).

7. Subadults tend to be like adults. Juveniles and infants show no constancy in tail carriage.

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