

Nilgiri Langur (*Presbytis johnii*) Territorial Behavior*

FRANK E. POIRIER

Department of Anthropology
Ohio State University
Ohio

ABSTRACT During 1250 hours of observation 84 intertroop encounters were witnessed suggesting territorial behavior. Most of these involved an exchange by adult males of visual and/or vocal signals. Chasing was rare, and when it occurred, it seemed to be "ritual chasing."

The amount of intertroop male intolerance was unexpected. Arboreal animals occupying upper story vegetation which provided an unobstructed view of the surroundings, could easily avoid contact. It is therefore interesting that males regularly sought other males to display against. Although encounters were frequent, the cost to the participants was minimal because physical contact and injury rarely occurred.

The exact function of Nilgiri langur territories is unclear. Presumably, territorial behavior regulated population dispersal, especially of adult males, and population numbers. Territorial behavior also protected core areas against incursions which indirectly prevented, or minimized, overfeeding and overcrowding.

INTRODUCTION

Behavioral reports are replete with references to territoriality among vertebrates, the richest source being the ornithological literature (i.e., HOWARD, 1920; NICE, 1941). Since ornithologists' findings, others have described territorial behavior in mammals (BOURLIÈRE, 1962; BURT, 1943; COLLIAS, 1951; HEDIGER, 1950), and CARPENTER (1964) and KAUFMANN (1962) have recently reviewed the home range and territory concepts.

Using BURT's (1943: 351) definition of territory as protection of "... some part of the home range, by fighting or aggressive gestures, from others of their kind, during some phase of their lives . . .," I hope to show territorial behavior among Nilgiri langurs. The terms "protection" or "defense" have a dual interpretation.

* This is an expanded version of a paper read at the 2nd International Congress of Primatology, Atlanta, Georgia, 1968 and published in the proceedings of that Congress. This study was made possible by Public Health Service grant MH 11099-01 attached to Fellowship 2 FI-MH-22, 140-02 (BEH).

Although both usually refer specifically to fighting, occasionally their meaning is broadened to include any behavior resulting in exclusion of conspecifics (CARPENTER, 1964). Excepting the temple-dwelling Achal tank rhesus (SOUTHWICK, 1962), defensive fighting is rare among nonhuman primates. However, there is a definite tendency for intertroop avoidance, facilitated by variable daily movement patterns, use of specific areas (often designated "core areas"), and visual and auditory location.

Nilgiri langurs are arboreal, spending 87% to 100% of the time in the trees and subsisting primarily on leaves, shoots, buds, and flowers. The Nilgiri langur is probably a subspecies of the Ceylon bear monkey, *Presbytis* spp. (POCOCK, 1928); its nearest relative is the Ceylonese form *Presbytis vetulus vetulus* (HILL, 1934).

Most Nilgiri langurs live in one-adult male bisexual troops of 8.9 animals. Adults constitute the majority of the troop; the adult male-adult female sex ratio, CARPENTER's socionomic sex ratio, was 1.2 adult females to 1 adult male. The percentage of young (infants and juveniles) to the adult-subadult (reproductive or potentially reproductive) population was 26% to 74%, or 2.9 adults or subadults to 1 infant or juvenile. In parts of Kerala, Nilgiri langurs live in larger troops of approximately 15 animals with a higher adult male-adult female ratio. Kerala troops are also one-male troops (TANAKA, 1965).

MATERIALS AND METHODS

Nilgiri langur troops living primarily in the Ootacamund area of the Nilgiri hills, Madras state, south India, were studied for 1250 hours over a 12 month period, ending late August, 1966. Observational techniques included familiarization with each animal and noting its and the troop's daily routine. Recordings of social interactions involved noting the time, place, duration, and participants of each sequence. A record of daily movement and activity patterns was also maintained. Each evening while the day's activities could still be vividly recalled, notes were typed, indexed, and reviewed. Observations usually occurred from 08:00 to 17:30 hours; however, during the course of the study, observations were made from 05:45 until 19:30 hours. Information on territorial behavior is derived primarily from observations on five troops.

ECOLOGY

The major ecological niche of the Nilgiri langur is the shola, a narrow tract of forest surrounded by grassland and drained by a slow-moving watercourse, which is most common in wind sheltered valleys 5000 to 7000 feet above sea level. Sholas are prevalent in divided valleys dotting the surface of grassy undulating hills characteristic of the plateau interior. Shola vegetation is typically three-story, the shrub

story is a closed canopy tightly bound by creepers into a solid mass of foliage. The understory contains a variety of trees ranging from 15 to 30 feet in height, and the upper-story is an irregular layer of trees attaining a height of 40 to 70 feet. (A fuller ecological description appears in POIRIER, 1968a, b).

CHARACTERISTICS OF THE HOME RANGE

Size: Nilgiri langurs restricted their daily activities to areas of approximately one-quarter to one square mile. The extent of the home range was determined by noting daily troop locations on a hand-drawn map. The size of each troop's home range differed for various reasons, some of which follow. (1) The size and composition of the troop was related to the size of its home range. Larger troops of eight to ten adults occupied larger areas, presumably to meet increased nutritional requirements. (2) The size and proximity of neighboring troops influenced home range size. Troops in high population density areas had smaller home ranges than troops in low population density areas. In high density areas, a reduced home range probably represented a combination of behavioral-ecological requirements. Smaller ranges in densely populated areas reduced the incidence of intertroop encounters, due to a reduction or elimination of overlapping home ranges. (3) The concentration and type of food plant in the home range played a major role in determining its size. Troops inhabiting sholas lacking a food source such as the *Acacia melanoxylon* or *molissima* tree, had larger home ranges than troops in areas where *Acacia* was abundant. *Acacia* leaves, flowers, and fruits provided an abundant year-round food source which minimized the need for extensive movement to fulfill nutritional requirements. (4) There is the additional possibility that more dominant troops (but troop dominance rankings could not be determined) occupied larger home ranges than their subordinate neighbors.

Seasonal Usage: Nilgiri langurs utilized portions of the home range on a seasonal basis. The cyclical fruiting and flowering of many food sources noticeably influenced troop movement. Particularly during the early days of the fruiting of *Acacia* trees, many troops modified their movement patterns to take advantage of this food source. Not uncommonly, troops spent as long as one week feeding in one stand of *Acacia* trees. Thus, the Nilgiri langurs derived the greatest benefit from various available food sources.

In April and May when *Acacia* seeds were nearly exhausted, those trees containing seeds were contested if they existed in overlapping areas of two or more home ranges. Troop males often ascended surrounding trees and displayed vocally at the approach of neighboring troops. Such vocal battles continued until one troop left the area. The last stands of seed-bearing *Acacia* were centers of rather intense activity.

Range of Movement: Some individuals ranged more widely within the home range than others. Adult females, especially mothers, remained in the most familiar areas of the home range, which were often synonymous with the core areas. Adult males, however, often passed from one region to another, especially during intertroop encounters when they frequently left their home range (page 357). This behavioral difference is discussed more fully by POIRIER (1968b).

Core Areas: Nilgiri langurs utilized certain portions of their home range more than others. Areas of frequent use containing sleeping trees, resting sites, and preferred food sources, were designated "core areas." As much as 70% of the time was spent in the core area. Areas of heavy temporary use, often frequented when a desired food source was available, but not before or after, were not included. Within the core area travel routes formed a dense, tangled web of tracings; outside the core area, activity was less conspicuously concentrated (KAUFMANN, 1962). Core areas always contained some tall trees which provided a good view of the surrounding area. The ground about the sleeping trees within the core area was often heavily marked with stool and the rocks glistened from the dried urine; in addition, the area was often fetid. Considerable portions of a home range often overlapped home ranges of neighboring troops, but core areas never overlapped.

DYNAMICS OF TROOP SEPARATION

Troop separation was maintained by variable movement patterns, the male whoop display, and male vigilance behavior. The daily routine usually maintained troop separation; seldom did daily or seasonal movement patterns of adjacent troops overlap. The existence of alternate core areas further reduced contact between adjacent troops. When a troop occupied a core area near one edge of its home range, its neighbor often moved to a portion of its range removed from the vicinity of that troop.

The morning whoop, a sonorous, booming, male vocalization audible over long distances, located troops in their respective home ranges. Adult males vocalized shortly after rising; the first call evoked a similar response from surrounding adult males and the forest soon resounded with their calls. Although the vocal pattern was indistinguishable, the morning whoop differed motivationally from the whoop produced when adult males of adjacent troops vocally challenged one another. Morning whoops were not accompanied by the frenetic movement characteristic of the display whoop (as described on page 357). A male giving the morning whoop simply moved to the tree tops and vocalized, other males responded. In contrast, an integral part of the whoop display, used when males challenged each other, was the display jump. Males also emitted the whoop vocalization, frequently minus the display jump component, prior to any long movement following a resting period. Similar

vocal mechanisms are described for gibbons (CARPENTER, 1940), howlers (CARPENTER, 1934), *Callicebus* (MASON, 1966), north and south Indian langurs (JAY, 1965; SUGIYAMA, 1967; POIRIER, 1968a), and the Ceylon gray langur (RIPLEY, 1967).

The earliest whoop vocalization noted during the study was recorded at 05:45 the last at 19:00. There was a definite clustering of the vocalization around the peak periods of morning movement and feeding, e.g. between 07:30 and 10:00. A second peak occurred during the afternoon feeding and movement period from 14:00 to 15:30.

The pattern of male vigilance behavior described by RIPLEY (1967) for the Ceylon gray langur and HALL (1960; 1965), who calls it "dominance vigilance," for the chacma baboon and patas monkey, agrees with the behavior of the Nilgiri langur male. Adult Nilgiri langur males were sensitive to any and all disturbances; they often occupied the tree tops and scanned the surrounding environs. In contrast to females, who spent much of the non-feeding period resting, the males maintained a constant visual alert. Nilgiri langur males seemed to be on the alert for other troops, rather than for danger from other sources. Male vigilance was not a means of avoiding another troop; rather, it often resulted in an episode leading to an inter-troop vocal battle. A Nilgiri langur male spotting a male of another troop, fixed his gaze in its direction and emitted a low grunting vocalization, which was frequently supplanted by the whoop display.

INTERTROOP RELATIONS

Nilgiri langur intertroop relations assumed various forms including peaceful feeding in proximity, peaceful withdrawal of one troop, or, most often, exchange by the males of visual and/or vocal displays, and occasionally chasing. Eighty percent of the 109 communicative acts (e.g. any gestural, vocal, or postural exchange, or combination of these, involving two or more animals) occurring in 84 aggressive encounters, were an exchange of vocal and gestural patterns, 18% involved chasing and in 2%, contact occurred. Four times one troop peacefully withdrew from another and ten times two troops fed in proximity.

It was not positively determined what influenced the mode of interaction between adjacent troops, or more specifically, between the adult males. Although some males constantly displayed against and challenged others, others were rarely involved in exchanges and ignored one another (see Table 1). For example, the males of troop II maintained an aggressive attitude towards the males of three of the four troops in the immediate vicinity; however, they often fed peacefully within 15 feet of the male of the fourth troop.¹⁾ Troop size might be a factor influencing the mode of interac-

1) Troop II was unusual because it contained four adult males in a total population of ten animals.

tion; that is, males of smaller troops might avoid males of larger troops. However, there is not enough data to confirm this. Four other possibilities exist. (1) Over time, males of adjacent troops could become habituated to each other and this familiarity might result in either a peaceful or antagonistic relationship. Very likely, individuals were recognized and treated in light of past experiences. (2) There is a possibility that members of different troops tolerating each other originally belonged to the same troop. (3) Sudden unexpected meetings between troops, which were rare, were aggressive. (4) The kind and quality of the sign stimuli presented by a male could influence another's response to it.

Occasionally a resident male tolerated minor incursions of his territory, or he delayed his attack until another troop had been in his territory awhile. In the latter, it is as if the continuous or minor stimuli caused by the intruder's presence finally triggered a reaction in the resident male. This is somewhat analogous to nervous summation (KOFORD, 1957).

Intertroop encounters are tabulated in Table 1. The figures are not presented according to wins or losses as this was not easy, and often impossible, to discern.

Table 1.

Troop	I	II	III	V	VI	VIII	XIII	XIV	Y*	Total
I		17			2	5	2		1	27
II			10	8			18	3	5	44
III				5			3		1	9
VI									1	1
VIII									1	1
XIII									1	1
Y									1	1
										84

* Y refers to unidentified troops.

Patterns of Troop Interaction

Although encounters occurred throughout the day, the first being observed at 06:05 and the last at 18:00, most altercations were witnessed between 08:00 and 16:00. Hours of peak excitement occurred between 09:00 and 12:00 and 14:00 and 16:00. Excluding the period from 11:00 to 12:00, all were intervals of major movement and/or feeding. Monthly heights of antagonism occurred in January, March, and April. January immediately followed the winter birth peak, March and April immediately preceded the spring peak.

Elapsed encounter time varied from less than one minute to over four hours; the latter occurred once. Most interactions lasted from minus one to 15 minutes.

Characteristics of Encounters

Intertroop encounters rarely involved physical contact; in fact, contact was established just twice. Most interactions only involved male exchanges of visual and/or vocal displays. Approximately 91% of all vocalizations recorded in 84 intertroop encounters were calling-attention-to vocalizations or calls indicative of aggression. The major vocalization was the whoop display, opposing males moved to the tree tops and limb ends where they were clearly visible and vocalized. Upon completion of the vocalization, the challenged males responded likewise; occasionally, opposing males displayed simultaneously. As much as 500 yards often separated the displaying males. The male display was differentiated into two components, the whoop vocalization and the bounding about through the trees (the "display jump," RIPLEY, 1967). Displaying males jumped between branches and trees in a taut, heavy manner, producing a noisy clamor. Branches often broke under the weight of their impact and came crashing to the ground. The objective appeared to be to create as much noise as possible. There is little doubt that the noise produced communicated with conspecifics over considerable distances. The rapid bounding through the trees also provided an unavoidably striking visual contrast between the buff-brown hair tuft and black body hair.

Four characteristics differentiated the display whoop from the morning whoop: (1) the display jump was not a requisite component of the morning whoop and only infrequently accompanied it; (2) a displaying male was often separated as much as 300 yards from, and out of sight of, his troop; (3) a male usually repeated the display sequence several times; and (4) upon completion of the display, the male returned to his troop vocalizing frequently. The display whoop manifested more tension than the morning whoop; upon completion of the former, the male often sat hiccuping and grunting (both vocalizations indicated tension) for several minutes. Urination and defecation frequently accompanied the display whoop.

Chasing was rare during encounters, but when it occurred, it was sometimes terrestrial. When opposing males chased each other, it appeared to be "ritual chasing." During the chase, the males frequently maintained a separation of approximately three feet. At times physical contact appeared imminent, but it occurred only twice. The animals frequently interrupted the chase, sitting a few feet apart exchanging threats. A pursuing male often traveled far from its home range, but upon approaching the opposing troop's core area there was an immediate reversal of the pursuer-pursued roles. Penetration by the pursuing male was characterized by a series of displacement involving occupying the branch or approximate spot on the ground vacated by the pursued male. Displacements continued until the pursued male turned and attacked the intruder. There was repeated jockeying back and forth until both males came to a standstill at some point of balance from where they threatened each other and eventually returned, noisily, to their respective troops. Such interactions could last over an hour. The following example, taken from my

An Example of a Prolonged Intertroop Altercation*

Time from start of encounter		Event	Duration of event	
min.	sec.		min.	sec.
	00	Troop III male moves into troop II's home range. The beta male of troop II moves away. Canine grinding begins.	1	30
1	30	The alpha and beta males of troop II move along the ground towards the opposing male. The troop III male moves closer. Pant and grinding vocalizations are emitted; defecation is common. The males sit ten feet apart.	2	00
3	30	The troop III male breaks for his own home range. The alpha male of troop II chases him along the ground, the beta male through the trees. A wave of defecation comes from the animals in both troops; the fecal odor is overpowering. One of the males vocalizes during the chase. The males stop running and sit within five feet of each other canine grinding.	3	00
6	30	The males begin chasing again. Suddenly a number of animals of both troops become involved; there is chasing on the ground and through the trees. Canine grinding, rough grunts, and screeches are common. No physical contact is established, however.	3	00
9	30	The alpha and beta males of troop II are on the ground biting air at the troop III male. The young animals of both troops squeak loudly.	0	15
9	45	The alpha and beta males move about on the ground. The troop III male shifts positions in the trees.	0	15
10	00	The alpha and beta males sit on the ground. The troop III male begins to grind, he receives no response.	2	30
12	30	The alpha male moves into the opposing male's home range; the troop III male chases him out along the ground.		

* Recorded on April 16, 1966.

Time from start of encounter		Event	Duration of event	
min.	sec.		min.	sec.
		The alpha male runs into his own home range, grunting loudly.	2	00
14	30	The alpha male feeds on <i>Litasae</i> leaves.	3	00
17	30	The beta male emits a few gruff barks and the whoop vocalization, then he chases the opposing male through the trees. The alpha male stops eating and moves towards the opposing male's home range.	0	30
18	00	Grunts and grinding begin. The alpha male shifts positions as the beta male returns to his home range.	2	30
20	30	The troop III male moves closer to the alpha and beta males, grunting loudly. The alpha and beta males just sit.	1	30
22	00	The opposing male begins to canine grind. The alpha male moves to a tree which is within 20 feet of the opposing male. The alpha male pants and bites air, the opposing male grinds. The alpha male moves again as the grinding gets louder.	2	30
24	30	The alpha male feeds on <i>Litasae</i> and then moves on the ground into his own home range as the opposing male forces him back by a series of displacements.	3	00
27	30	The alpha male feeds. The troop III male grunts. Canine grinding is heard again.	7	00
34	30	The alpha male moves further into his own home range. The smell of stool is overpowering.	1	00

field notes, illustrates "ritual chasing."

The alpha male of troop II descends to the ground and faces the adult male of troop V; they exchange grunts and bite air at each other. The alpha male rises and begins to chase the troop V male. They bound across the ground with their tails arched over their backs. The alpha male approaches to within 2 feet of the troop V male and maintains this distance for 20 yards before sitting. The troop V male stops running and turns to face him; they again bite air at each other. The alpha male turns and runs back to his own home range, the troop V male follows. At one point, they are little more than an arm's reach apart, but again, they never touch. Once within his own home range the alpha male stops running, and sits facing the onrushing troop V male, who stops about eight feet from him. They face one another grunting loudly. The alpha male rises and begins to chase the troop V male, they penetrate troop V's home range. At one point they are within touching distance. Once in his home range, the troop V male stops running. They face each other for the fourth time. They exchange grunts and bite air. Following 20 minutes of jockeying back and forth, the alpha male returns to his own home range; he grunts as he moves. The troop V male returns to his troop (March 31, 1966).

Excitement was high during chasing bouts; defecation and urination were constant, not only by the males involved, but occasionally by members of their respective troops. The fecal odor was overpowering, raising the possibility that olfaction was a component of the interaction. If chasing occurred in the midst of one of the opposing male's troops, his troop members abandoned all caution and the observer was pressed to dodge them as they scurried and jumped about him, raining dead branches, moss, and lichens to the ground.

An example of a prolonged encounter between males of two opposing troops is

Table 2

Status	Percentage of total assumed defense of group	
Alpha male	45%	
Beta male	30%	
Gamma male	20%	
Delta male	5%	

Status	Assumed defensive role x times more frequently than x male	Status
Alpha male	1.5 times	Beta male
	2.25 times	Gamma male
	9 times	Delta male
Beta male	1.5 times	Gamma male
	6 times	Delta male
Gamma male	4 times	Delta male

given on pages 358 and 359.

Eighty percent of all intertroop encounters involved solely adult males. In one multi-male troop, the alpha male assumed the aggressive role 45% of the time, nine times more frequently than the delta male. The frequency of male involvement in multi-male troop II, is given in Table 2.

In multi-male troops, more than one adult male was rarely involved in any single encounter, and unless an encounter occurred in proximity to them, other adult males avoided it. Troop members not involved ignored the commotion. Females, especially, avoided the male encounters and continued to feed calmly at the height of the activity. Just once was a female involved in an intertroop encounter. She directed a short sequence of facial threats at a female of an opposing troop. A male penetrating the interior of an opposing male's troop occasionally chased a female or youngster briefly, but he never physically attacked them.

DISCUSSION

The large amount of antagonism between the males of different Nilgiri langur troops was totally unexpected. As arboreal animals occupying upper story vegetation which provided an unobstructed view of the surroundings, they could easily avoid contact. It is therefore of considerable interest that Nilgiri langur adult males regularly sought adult males of other troops to display against. Adult males frequently deserted their troops and moved 500 yards to challenge another adult male at equal distance. This behavior is striking because Nilgiri langurs possessed means of signalling troop location and avoidance which could substitute for adult male aggression in the spacing of troops. Furthermore, within the troop, Nilgiri langurs were characteristically lethargic and seldom aggressively involved. Although encounters between males of adjacent troops were frequent, the participant cost was minimal because physical contact and injury were very rare.

Nilgiri langur intertroop encounters frequently occurred well inside a home range and did not result from accidental meetings, were not directly related to competition for food or water, nor the result of population crowding. The function of Nilgiri langur territories remains unclear. The fact that territories protect females and young from harm by alien males was of little or no advantage, as alien males were not aggressive toward them. On the other hand, Nilgiri langur territorial behavior protected core areas against incursions by neighboring troops and indirectly prevented, or minimized, overfeeding and overcrowding. The territorial displays of Nilgiri langur males might provide social stimuli helpful in reproductive success (DARLING, 1952), although there is no information to support this. Nilgiri langur territorial behavior may also be a factor in the distribution of adult males. Most troops were one-male troops and there was continual antagonism between males of adjacent troops.

It is assumed that Nilgiri langur territorial behavior regulated population dispersal and perhaps, indirectly, population numbers. Animals excluded from territories and from breeding groups were largely, but not wholly, prohibited from contributing to the gene pool (POIRIER, 1969).

COMPARATIVE DATA

The Nilgiri langur spacing mechanisms of varied movement patterns and intertroop vocalizations are shared wholly or partially by other monkeys and apes. However, the predominant use of vocal patterns is primarily an arboreal characteristic. In macaques and baboons, visual communication often substitutes for loud vocalizations in the spacing of troops.

SOUTHWICK (1962) attempted to classify patterns of intertroop relations in some nonhuman primates by distinguishing passive and active behavioral types. The African redbellied monkey, gorilla, and common langur were listed as examples of the former, the temple-dwelling rhesus of north India, gibbons, and howlers were presented as exemplary of the latter. In view of SUGIYAMA's (1967) and RIPLEY's (1967) material, the inclusion of *Presbytis entellus* in the passive category is not entirely justified.

There is a strong resemblance to the relationship characteristic of Nilgiri langur males of adjacent troops (see also TANAKA, 1965) and those described for the Ceylon gray langur (RIPLEY, 1967), *Presbytis cristatus* (BERNSTEIN, in press), and the south Indian langur (SUGIYAMA, 1965a, b; 1967). However, Ceylon langur encounters are more aggressive than Nilgiri langur encounters and Ceylon langur females are often involved. The peaceful avoidance noted for north Indian langurs contrasts sharply; when two north Indian langur troops were in proximity, they did not threaten each other and fighting between troops was never witnessed. "Fighting between two troops was never observed; if they both happen to be nearby, the larger group usually takes precedence and the smaller remains at a distance until the larger moves away" (JAY, 1965: 212).

Contrasting with the chief role assumed by the alpha male, in multi-male Nilgiri langur troops, during intertroop encounters, is the Ceylon langur and rhesus macaque pattern. The gamma and, to a lesser extent, the beta male, accounted for most of the aggressive intertroop encounters among Ceylon gray langurs. "The alpha male became involved in chases and at times, was an instigator, but he frequently took second place in the attacks" (RIPLEY, 1967: 247). Among rhesus on Cayo Santiago, the beta or gamma male more often assumed the belligerent position. "It is a remarkable fact that the male of highest prestige. . . frequently does not engage immediately in intergroup fights" (CARPENTER, 1964: 381).

SUMMARY

Although Nilgiri langurs seem to be definitely territorial, evidence is insufficient to relate adult male antagonism directly to either breeding and rearing or to the food and shelter type of mammalian territorial behavior. Rather, a prime function of Nilgiri langur territories seems to be the spacing of males and the indirect prevention of overfeeding and overcrowding. Future studies will probably uncover different kinds and degrees of territorial behavior. Renewed investigations of the existence of territoriality among nonhuman primates might prove fruitful, for present information suggests that territoriality characterizes the adaptive behavior of four langur species. The phenomenon will likely be related to ecological conditions.

REFERENCES

- BERNSTEIN, I., in press. The lutong of Kuala Selangor.
- BOURLIERE, F., 1962. *Natural History of Mammals*. Alfred A. Knopf and Sons, New York.
- BURT, W. H., 1943. Territoriality and home range concepts as applied to mammals. *J. Mam.*, 24: 346-352.
- CARPENTER, C. R., 1934. A field study of the behavior and social relations of the howling monkeys (*Alouatta palliata*). *Comp. Psychol. Monogr.*, 10: 1-168.
- , 1940. A field study of the behavior and social relations of the gibbon (*Hylobates lar*). *Comp. Psychol. Monogr.*, 15 (5): 1-212.
- , 1964. *Naturalistic Behavior of Nonhuman Primates*. The Pennsylvania State University Press, University Park.
- COLLIAS, N. E., 1951. Problems and principles of animal sociology. In: *Comp. Psychol.*, C. P. STONE (ed.): 388-422.
- DARLING, F. F., 1952. Social life in ungulates. *Structure et physiologie des societes animaux*, 134: 221-226.
- HALL, K. R. L., 1960. Social vigilance behavior of the chacma baboon. *Behav.*, 16: 261-294.
- , 1965. Behavior and ecology of the wild patas monkeys, *Erythrocebus patas*, in Uganda. *J. Zool.*, 148: 15-87.
- HEDIGER, H., 1950. *Wild Animals in Captivity*. Butterworth's Scientific Publications, London.
- HILL, W. C. O., 1934. A monograph on the purple-face leaf-monkeys (*Pithecus vetulus*). *Ceylon J. Sci.*, (b) Vol. XIX Pr. 1: 23-89.
- HOWARD, H. E., 1920. *Territory in Bird Life*. John Murray, London.
- JAY, P., 1965. The common langur of north India. In: *Primate Behavior*, I. DEVORE (ed.): 197-250.
- KAUFMANN, J. H., 1962. *Ecology and Social Behavior of the Coati, Nasua narica on Barro Colorado Island, Panama*. University of California Press, Berkeley.
- KOFORD, C. B., 1957. The vicuna and the puna. *Eco. Monogr.*, 27: 153-219.
- MASON, W. A., 1966. Social organization of the South American monkey *Callicebus moloch*: A preliminary report. *Tulane Studies in Zool.*, 13: 23-28.
- NICE, M. M., 1941. The role of territory in bird life. *Am. Midland Nat.*, 26(3): 441-487.
- POCOCK, R. I., 1928. The langurs or leaf-monkeys of British India. *J. Bombay Nat. Hist.*

- Soc.*, 32(1-2): 472-505.
- POIRIER, F. E., 1968a. *The Ecology and Social Behavior of the Nilgiri Langur (Presbytis johnii) of South India*. University Microfilms, Inc., Ann Arbor.
- , 1968b. Analysis of a Nilgiri langur (*Presbytis johnii*) home range change. *Primates*, 9(1-2): 29-43.
- , 1969. The Nilgiri langur (*Presbytis johnii*) troop. Its composition, structure, function, and change. *Folia primat.*, 10: 20-47.
- RIPLEY, S., 1967. Intertroop encounter among Ceylon langurs (*Presbytis entellus*). In: *Social Communication among Primates*, S. A. ALTMANN (ed.): 237-255.
- SOUTHWICK, C. F., 1962. Patterns of intergroup social behavior in primates with special reference to rhesus and howling monkeys. In: *The Relatives of Man*, J. BUETTNER-JANUSCH (ed.): 436-455.
- SUGIYAMA, Y., 1965a. Home range, mating season, the male group and intertroop relations in hanuman langurs (*Presbytis entellus*). *Primates*, 6(1): 73-106.
- , 1965b. On the social change of hanuman langurs (*Presbytis entellus*) in their natural condition. *Primates*, 6(3-4): 381-418.
- , 1967. Social organization of hanuman langurs. In: *Social Communication among Primates*, S. A. ALTMANN (ed.): 221-236.
- TANAKA, J., 1965. Social structure of Nilgiri langurs. *Primates*, 6(1): 107-122.

[Received June 19, 1968]