



Research Paper

STUDY OF PATERNAL CARE IN A MULTI-MALE BISEXUAL TROOP OF HANUMAN LANGUR, *Semnopithecus entellus* IN AND AROUND JODHPUR

Anil Kumar Meena, Goutam Sharma and Lal Singh Rajpurohit

Animal Behaviour Unit
Department of Zoology, J.N.V. University
Jodhpur- 342005 (Rajasthan).

Abstract

A 18 months study on a paternal care in a multi-male bisexual troop of Hanuman langur (*Semnopithecus entellus*) around Jodhpur, Western Rajasthan is conducted during 2014-15. The study troop Kailana- Canal (B-18) had five males including resident male. They all stayed in this bisexual troop comprising 30 members total (5 males and 25 other members). There were 12 adult females, 13 infants and juveniles in this troop. All the five males lived together, groom each other, groomed by troop females and juveniles and troop looked normal. Many of the time the alpha (resident) male observed more hostile towards other adult males available in the troop but he never harm to male juvenile and infants. Although there were sub adult males also in troop but resident never attacked on them. On the other hand beta male was attacked by resident in several cases. Sometimes the resident showed his neutral behaviour towards infants. But other times it was observed when resident showed positive responses towards infants and juveniles. Other males also showed protective behaviour towards them. No incident of infanticide was observed and no resident male change took place during the study period. The study supported the prediction derived from the selection hypothesis i.e. new dominating male may allow the male juvenile and sub adult males to stay in same uni-male bisexual troop leading to multi-male situation. The resident male is quite likely to face much competition over resources particularly receptive females, but he may get additional advantage from those fellow and or rival males in cooperative defense against conspecifics and predator, thereby increasing reproductive success. The study further supports that the resident shows his positive response for infants and also for sub-adult males, while feeding, playing and resting.

Key words: *Semnopithecus entellus*, bisexual troop, Paternal Care. Jodhpur.

INTRODUCTION

Defense and care taken by parents to their offspring for successful continuation of race is known as 'Parental care'. Parental care is instinctive behaviour and it is species specific. Parental care is a form of altruism in which apparent contributes his or her genes in their offsprings and spend time and energy to secure to survival. Maternal care when female (mother) protects and cares

her offspring, and paternal care when male (presumed father) cares and/or protects his offspring.

In Hanuman langurs (*Semnopithecus entellus* Dufresne, 1797) female usually gives birth to a single infant, but twin births are not uncommon. The newborn langur clings to mother's belly and retain grip even when she is running, jumping or climbing trees. Paternal behaviour comprises contacts between adult or sub adult males and juveniles or infants (i.e. immature). Primatologists, who have studied maternal behaviour, have largely ignored the paternal behaviour in nonhuman primates. Nevertheless, the descriptions from literature on paternal behaviour in nonhuman primates are often incomplete and preliminary.

Study Animal

The Hanuman langur, (*Semnopithecus entellus*) is the most adaptable and widespread south Asian colobine non-human primate of the Indian subcontinent. The species has been the subject of investigation because of its unique behaviour pattern including infanticide (Sugiyama, 1965; Hrdy, 1974; Roonwal and Mohnot, 1977; Mohnot, 1971a; Makwana, 1979; Sommer and Mohnot, 1985; Agoramoorthy and Mohnot, 1988; Rajpurohit, et.al., 2003, 2008).

These langurs live in a wide range of habitats from the Himalayas (v 3600m) and peninsular forests to semiarid woodlands, in villages and towns and in cultivated lands (Roonwal and Mohnot, 1977; Vogel, 1977). These animals are known for their remarkable adaptability, the species also has a highly variable social organization. The two basic types of social groups are bisexual troops and all-male bands. Troops are matrilineal groups of adult females and offsprings with either one adult male (unimale bisexual troop or 'harems') or more than one adult male (multi-male troops).

The percentage of one-male troops versus multi-male troops and the corresponding number of extra troop band males varies from site to site (Newton, 1988). Mostly, the reproductive units of the Jodhpur langurs are one-male bisexual troops. Mohnot et. al. (1981) presented 11 years census data (i.e. 1968-78), Mohnot et. al. (1987) a 4 years demographic work (i.e. 1983-86) and Rajpurohit et.al. (2006) provided 7 years of data on population dynamics of these langurs (i.e. 1995-2001) which enabled us to establish perspective and background of the study animal.

Study Area and Material- Methods

Jodhpur is located in western Rajasthan (altitude about 241 m, Latitude 26° 18' N and longitude 73° 08 E) at the eastern edge of the Great Indian Desert. The town was erected on a hilly sandstone plateau of approximately 150 km² surrounded by flat semi-desert. This diagonal plateau is inhabited by a geographically isolated pocket population of 1850-1900 langurs (Mohnot, et al, 1981; 1987; Rajpurohit et.al., 2006) which has been studied by various Indian and Foreign researchers for more than 40 years now.

The number of bisexual troop varied between 30 and 35 (c.f. Mohnot, et.al. 1981; Winker, 1988; Rajpurohit, 1987; Rajpurohit & Sommer, 1991; Rajpurohit, et.al. 2006). The mean troop size is 38.5 members (range 7-120 members). The number of all male band is about 13; averaging 11.8 member (range 2-47 members). All male bands invade home range of bisexual troops is an unpredictable pattern, some time resulting in rapid or gradual replacement of the resident male (Rajpurohit, 1987; Rajpurohit et al., 2003).

The climate is dry, with maximum heat about 48° C in May/ June and minimum around 0° in December/January. Jodhpur used to receive its 90 % scanty rainfall (average 360 mm) during the monsoon from July to September. The natural open scrub vegetation is dominated by xerophytic plants including *Prosopis juliflora*, *Acacia Senegal*, *Calotropis procera*, *Caparis deciduas*, and *Euphorbia caducifolia*. Water is available to all langur groups in this area.

The Langurs around Jodhpur are easy to observe since they are not to shy and are available on ground for longer daytime. The present paper deals with some observations on

protective care in langurs around Jodhpur during May 2014 to April 2015. For data collection focal animal sampling scans and *ad libitum* sampling methods will be used (Altmann, 1974). And the protocols format followed as per Techniques in Primate Population Ecology (1981).

OBSERVATION & RESULTS

The present study on paternal care in Hanuman langurs (*Semnopithecus entellus*) demonstrates that in multi-male bisexual troop resident shows his paternity towards infants and juveniles. It was also observed that resident was not as much of violent for juveniles and sub-adult males in multi-male bisexual troop comparison to uni-male bisexual troop. And the rate of hostileness is less then that in one-male bisexual troop. There was not a single incident of infanticide observed during this study period. At the time of daily activity it was observed that resident was showing indirect paternity (safety) towards infants. At the time of playing activity of infant, the resident shows positive response. Although there was no any incident of taking and carrying the infants was seen in field but resident never objected them and allowed sitting close. And didn't show aggressiveness when they touch him and climb on him. In general the resident shows his neutral behaviour. There are 56 incidents observed when his behaviour was positive at the time of playing.

Resident was observed showing paternity many of times during this study period. Some of incidents of paternity were noted at the time of feeding (37), inter troop interaction (10), when interacted with outer animal (37), and in normal way (29). Many of times, resident was observed grooming the infants. In multi-male bisexual troop resident showed aggressiveness towards other males when they chase the infants and juveniles of the troop. At this time, resident's behaviour found like group leader or a father. Some times other males of troop also friendly interact with infants and juvenile. In the late weaning phase when infants are 11-14 months old, they stay close to resident (presumed father), try to touch his tail, smell his back, and may hit him if the latter do not respond. On the other hand, if the resident male is a non-father, the infants do not come that close. After weaning, infants become independent (at 12 -15 months of age;) and play vigorously which includes jumping, hitting, and pushing any member coming in the way except the resident. The non-father resident may become more aggressive and always tries to keep male juveniles away by threats, air-biting, chasing, attacks, etc. The resident father may tolerate activities of young males and occasionally hit or threaten them when the latter disturb their sexual interactions or other members of the troop, but without inflicting any injury.

Adult male (in bisexual troop) of the most of the old world monkeys rarely associate with and care for infant. Resident male behaved paternally towards the younger male by grooming them; by allowing them to sit close to him and protecting them from predation by dogs.

DISCUSSION

Hypothesis about the evolution of sociability and social organization in primate are usually based on biological explanation, such as the predator-defence hypothesis and the resource- defense hypothesis (e.g. Wrangham 1980; Van Schaik 1989; Terboggh and Janson 1986). The coerecion- defence hypothesis and conspecific- threat hypothesis emphasis that female correlate with males for shelter against threat from strange males (Brereton 1995; Sterck et.al. 1997; Treves and Chapman 1996; Van Schaik 1996; Treves 1998). The male's position as infant protector is rather obvious in one-male (as the assumed father and guardian) was replaced (review in Struhsakar and Leland 1987).

In general the rate of infanticide is often supposed to be much lower in multi male groups than in one- male groups (e.g. Sommer 1994; Newton and Dunbar 1994; Leland et.al. 1984; Altmann 1990; Capman and Hausfater 1979, Borries, 1997). Only a small number of reports on protector males living in multi-male group are to be found in the Primatological

literature. Male olive baboon (*Papio anubis*) were observed to charge towards strange male after "Weaned or un weaned young juveniles" screamed. This result in the newcomer moving away from the juveniles (Packer 1979). In Chacma baboon (*Papio ursinus*), an infant carrying by adult male was interpreted as protecting the infant from potentially infanticidal immigrants (Busse and Hamilton 1981). In Hanuman langur also observed when some other animal come or time of inter-troop attack resident shows his activeness and care to infants. At the time of inter-troop attack infants start to scream, this time resident take a position and start to whoop call and jump from one rock to another.

The sexual- selection hypothesis appear to explain infanticide in both matrilineal harem culture and patrilineal multi-male culture. Why has infanticide not been found in colobine matrilineal multi-male troop? Leland et.al. (1984) propose that a unimale troop structure predisposes to infanticides because intermale reproduction competition and variance in mating success in such populations are greater than in multi-male society. Infanticide will be facilitated as incoming males are unlikely to be closely related to troop infant and there are no other males present who might defend infants and contest post take-over reproductive access. In contrast, in multi-male societies, struggle for mating will happen within the troop, rather than between troop and band. Promiscuity will confuse paternity, increasing the probability that an infanticidal male would kill and that other male's would defend to victim. In addition, the chances that the infanticidal male would breed with the victim's mother are reduced (Hrdy, 1979; Leland et.al. 1984).

When infant is about 10 months old, a male infant establishes relationship with resident male, which involves a series of particular gestures and vocalizations. It runs squealing to the moving adult male and touches him. Once it gain self-assurance it touches the male's hindquarters. Within a week it approaches and pulls tail of adult male. This approach to the adult is maintained until the infant is of 2-3 years and there is no resident male change. In contrast, female infants of similar ages have almost very little or no contact with adult male.

New resident male or a male from an invading all-male band occasionally may kill one or more infants by violently snatching it away from the mother and biting it and injuring it severely. The mother chases the male for a short while and then gives up. Within a few days (6-12) the mother may present herself to the killer male who establishes itself in the group and assumes the dominant status in triggering mating and copulations to develop reproductive band (Mohnot, 1971a). Sugiyama (1965) also observed males killing infants. Hrdy (1974), Sommer and Mohnot (1985), Agoramoorthy and Mohnot (1988) and Rajpurohit et.al., 2003 added more examples of infanticide by males and discussed the theoretical aspects and biological significance of this phenomenon observed in langurs.

Male care of infants has been described in baboons (Stein, 1984; Smuts, 1985; Packer, 1980; Strum, 1984) and macaques (Taub, 1984; Busse and Hamilton, 1981), even though these species form multi-male groups in which paternity is doubtful. It has been suggested that the male infant care seen in these species is not really paternal investment; instead, it is a tactic used to gain access to females during future estrous cycles (Smuts, 1985; Strum, 1987; Whitten, 1987). Other ideas on this behavior include using infants as an agonistic buffer against violence from other males (Deag and Crook, 1971), and protecting infants from attack by potentially infanticidal immigrant males (Busse and Hamilton, 1981).

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REFERENCES

- Agoramoorthy G, Mohnot SM, 1988. Infanticide and juvenilicide in Hanuman langur (*Presbytis entellus*) around Jodhpur, India. Hum. Evol. 3: 279-296.
- Altmann J, 1974. Observational study of behaviour: Sampling methods. Behaviour 49: 227-267.
- Altmann J, 1990. Primate males go where the females are. Anim Behav. 39: 193-195.
- Bercovitch FB, 1991. Social stratification, social strategies, and reproductive success in primates. *Ethol Sociobiol* 12:315-333.
- Borries C, 1997. Infanticide in seasonally breeding multi-male groups of Hanuman langurs (*Presbytis entellus*) in Ramnagar (South Nepal). Behav. Ecol. Sociobiol. 41: 139-150.
- Brereton AR, 1995. Coercion-defence hypothesis: the evolution of primate sociality. *Folia Primatol* 64: 207-214.
- Busse CD, Hamilton WJ III, 1981. Infant carrying by male chacma baboons. Science 212: 1281-1283.
- Chapman M, Hausfater G, 1979. The reproductive consequences of infanticide in langurs: a mathematical model. Behav. Ecol. Sociobiol 5: 227-240.
- Deag JM, Crook JM, 1971. Social behavior and "agonistic buffering" in the wild Barbary macaque *Macaca sylvana* L. *Folia Primatol* 15: 183-200.
- Dufresne P, 1977. Sur une nouvelle espece de singe, park. Dufresne (Description d'une nouvelle spece de guenon, sous le nom d' antelle). Bulletin de societies d' philo mathique (Paris) 1:7: 49.
- Hrdy SB, 1974. Male-male competition and infanticide among the langurs (*Presbytis entellus*) of Abu, Rajasthan. *Folia Primatol* 22: 19-58.
- Hrdy SB, 1979. Infanticide among animals: a review, classification and examination of the implications for the reproductive strategies of females. *Ethology and sociobiology* 1, 13-40.
- Jay PC, 1963. The social behaviour of the langur monkey. Ph.D. thesis, University of Chicago, Illinois.
- Leland L, Struhsaker TT, Butynski TM, 1984. Infanticide by adult males in the primate species of the Kibale forest, Uganda: a test of hypotheses. In: Hausfater G, Hrdy SB (eds) Infanticide- comparative and evolutionary perspectives. Aldine New York pp 151-172.
- Makwana SC, 1979. Infanticide and social change in two groups of Hanuman langur, *Semnopithecus entellus* at Jodhpur. *Primates* 20 (2): 293-300.
- Mohnot SM, 1971a. Some aspects of social change and infant-killing in Hanuman langur, *Presbytis entellus* (Primates: *Cercopithecidae*) in western India. *Mammalia* 35 (2): 175-198.
- Mohnot SM, 1974. Ecology and Behaviour of the Common Indian Langur, *Presbytis entellus*. Ph.D. thesis, Univ. of Jodhpur, Jodhpur.
- Mohnot SM, Gadgil M, Makawana SC, 1981. The dynamics of the Hanuman langurs population of Jodhpur, Rajasthan, India. *Primates* 22: 182-191.
- Mohnot SM, Agoramoorthy G, Rajpurohit LS, Srivastava A, 1987. Ecobehavioural studies of Hanuman langur, *Presbytis entellus*. Technical Report (1983-86). MAB Project, Department of Environment Govt of India New Delhi. pp. iv + 89.
- Newton PN, 1988. The variable social organisation of Hanuman langur (*Presbytis entellus*), infanticide and the monopolisation of females. *Int. J. Primatol*, 9: 59-77.
- Newton PN, Dunbar RIM, 1994. Colobine monkey society. pp. 311-346 IN Davies, A. G. & Oates, J. F. (Ed.), Colobine Monkeys: Their Ecology, Behaviour and Evolution Cambridge: Cambridge University Press.
- Packer C, 1979. Inter-troop transfer and inbreeding avoidance in *Papio anubis*. *Anim Behav* 27: 1-36.
- Packer C, 1980. Male care and exploitation of infants in *Papio anubis*. *Ani. Behav* 27: 37-45. Perspectives. New York: Aldine. 598.
- Rajpurohit LS, 1987. Male social organization in Hanuman langurs (*Presbytis entellus*). Ph.D. thesis, Univ. of Jodhpur, Jodhpur.

- Rajpurohit LS, Sommer V, 1991. Sex differences in mortality among langurs (*Presbytis entellus*) of Jodhpur, Rajasthan. *Folia Primatol* 56:17-27.
- Rajpurohit LS, Chhangani AK, Rajpurohit RS, Mohnot SM, 2003. Observation on abrupt resident male replacements in a unimale bisexual troop of Hanuman langur, *Semnopithecus entellus* around Jodhpur. *Folia Primatol.*, 74: 85-87.
- Rajpurohit LS, Chhangani AK, Mohnot SM, 2006 Population dynamics of Hanuman langur, *Semnopithecus entellus* around Jodhpur (India) during 1995-2001). *PROC NAT ACAD SCI INDIA Vol. 76 (B), II*: 141-147.
- Rajpurohit LS, Chhangani AK, Rajpurohit RS, Bhaker NR, Rajpurohit DS, Sharma G, 2008. Recent observation on resident male change followed by infanticide in Hanuman langur (*Semnopithecus entellus*) around Jodhpur. *Primate Report*, 75: 33-40.
- Roonwal L, Mohnot SM, 1977. *Primates of south Asia: Ecology, sociobiology and Behaviour*. XVIII + 421 pp. Cambridge Mass Harvard Univ.
- Schaik van CP, 1989. The ecology of social relationship amongst female primates. In: Standen, V. Foley RA (eds) *comparative socioecology- the behavioral ecology of human and other mammals*. Blackwell Oxford pp 195-218.
- Schaik van CP, 1996. Social evolution in primates: the role of ecological factors and male behaviour. *Proc Br Acad* 88: 9-31.
- Smut BB, 1985. *Sex and Friendship in Baboons*, Aldine Press Hawthorne New York.
- Sommer V, Mohnot SM, 1985. New observation on infanticides among Hanuman langur, *Presbytis entellus* near Jodhpur, Rajasthan (India). *Behav Ecol Sociobiol* 16: 245-248.
- Sommer V, 1994. Infanticide among the langurs of the Jodhpur: testing the sexual selection hypothesis with along-term record. In: Parmigiani S, Sall FS vom (eds) *Infanticide and parental care*. Harwood Chur pp 155-198.
- Stein D, 1984. Ontogeny of infant adult male relationship during the first year of life for yellow baboons (*Papio cynocephalus*). In D.M. Taub (ed.) *Primate Paternalism*, Van Nostrand Reinhold New York, pp. 213-243.
- Sterck EHM, Watts DP, Schaik van CP, 1997. The evoloutation of females social relationships in nonhuman primates. *Behav Ecol Sociobiol* 41: 291-309.
- Struhsaker TT, Leland L, 1987. Colobines: infanticide by adult males. In: Smuts BB, Cheney DL, seyfarth RM, Wrangham RW, Struhsaker TT (eds) *Primate societies*. University of Chicago Press Chicago, pp 83-97.
- Strum S, 1984. Why males use infants In D.M. Taub (ed.) *Primate Paternalism*, Van Nostrand Reinhold, New York pp. 146-185.
- Strum S, 1987. *Almost Human*, University of Chicago Press, Chicago.
- Sugiyama Y, 1965. On the social change of Hanuman langurs (*Presbytis entellus*) in their natural conditions. *Primates* 6: 381-417.
- Taub DM, 1984. Male caretaking behaviour amoung wild Barbary macaques (*Macaca sylvanus*). In Taub, D.M. (ed.) *Primate Paternalism*, Van Nostrand Reinhold, New York, pp. 20-55.
- Terborgh J, Janson CH, 1986. The sociology of primate groups. *Annual Review of Ecology and Systematic* 17, 111-35.
- Treves A, 1998. Primate social systems: conspecific threat and coercion-defence hypotheses. *Folia Primatol* 69: 81-88.
- Treves A, Chapman CA, 1996. Conspecific threat, predation avoidance, and resource defence: implications for grouping in langurs. *Behav Ecol Sociobiology* 39: 43-53.
- Vogel C, 1977. Ecology and Sociology of *Presbytis entellus*. In: *Use of non-human primates in Biochemical Research* (Ed. By Prasad, Anand Kumar), Indian Nat Sci Acad New Delhi. pp. 24-45
- Whitten PL, 1987. Infants and adult males. In smuts, B.B. Cheney, D.L., Seyfarth, R.M., Wrangham, R.M., and Struhsaker, T.T. (eds.), *primate Societies*, University of Chicago Press, Chicago. Pp. 343-357.
- Winkler P, 1988. Feeding behaviour of a food-enhanced troop of Hanuman langurs, *Presbytis entellus* in Jodhpur-India. In: *The Ecology and Behaviour of food enhanced primate groups*. NY (ed. by John E.F. & Charles H. Southwick) Alan R Liss Pp. 3-24.

Wrangham RW, 1980. An ecological model of female-bonded primate groups. Behaviour 75:262-300.