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THE ROLE OF SCENT MARKING IN THE BREEDING BEHAVIOR OF TIGER AND OTHER BIG CATS

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ABSTRACT

Marking objects and prominent spots with their urine borne pheromones is believed to be related with the establishment of their territories by the big cats. A study carried out on snow leopards, tigers and leopards at Darjeeling Zoo revealed that these big cats marked objects with their scents in order to induce breeding condition in partners of opposite sex. The paper presents the observation on the role of scent marking in the breeding behavior of big cats including the tiger.

Key words: Tiger (*Panthera tigris*), Snow Leopard (*Uncia uncia*), breeding Behavior, Territoriality, Scent marking.

Introduction

From anecdotal accounts to scientific studies significant advances have been made in the documented information on tiger (*Panthera tigris*), leopard (*Panthera pardus*), lion (*Panthera leo*), jaguar (*Panthera onca*) and snow leopard (*Uncia uncia*). The tiger (*Pathera tigris*) is probably the most widely studied subject on the big cats in the wild. But most of the data deals extensively with the habitat and prey preferences, and the dynamics of the populations of the species. The study on the relationship between their behavior of marking spots and objects from time to time with their urine borne scent did not go beyond interpreting its value as a marker of land tenures established by the tigers.

Tigers seek or avoid social contact, depending on the context, using a complex communication system based on scent marking, visual marking and vocalizations (Smith *et al.,* 1989). There are innumerable scientific studies known to establish that tiger defines land tenures as territories, by scent-marking objects and spots at the boundaries of their territories to proclaim their presence; and that these marked areas are vigorously defended against intrusion by other tigers of the same sex (McDougal, 1977, 1979; Karanth and Chundawat, 2001; Panwar 1979;). The land tenure system of the tiger appears to be in some respects similar to that of the lion, as described by Guggisberg (Schaller, 1967). Lions also mark their territories to avoid direct confrontations with trespasser lions (Rashid, 1992). Leopards have equally strong instinct to establish their territories and defend them from intruders (Corbett, 1947).

But the information on the role of marking in the breeding behavior of tiger is quite meager. The study on the relationship between the breeding biology and scent marking was carried out in Simlipal Tiger Reserve of Odisha (Choudhury, 1999). From his studies very valuable observations came on the relationship between scent marking and breeding condition of Khairi, a tigress raised by him in semi-captivity

According to him marking by tiger is urine borne and the marking pheromones are highly volatile amines fixed on neutral lipids; scent marking is stimulated by possessive instinct, not only of territory but also of property; scent marking by tiger can have relevance to olfactory identification of marks left by other tigers in the area only if the tiger has such microscopy in its nose to identify the individual specific minimal variations in conspecific markings; a tiger's nose should necessarily be sensitive enough to make out and remember each code of differential combination of different amines in its own marking and separately of every other conspecific. That the tiger does have such a sensitive nose with lasting memory was confirmed by his observations on Khairi's olfaction. (Choudhury, 1979).

This is perhaps the only study of its kind on tiger biology. No further development has taken place on the hypothesis that the activity of scent marking by the tiger, or any other big cat, is linked with their mate selection and breeding behavior.

Management of snow leopard breeding project at the Padmaja Naidu Himalayan Zoological Park provided an opportunity to study the breeding behavior of the endangered species for its *ex-situ* conservation. The study was initiated in 1988 and the initial results from this

Scent marking by big cats is not limited to the demarcation of territories but it has important bearing on the breeding behaviour of big cats.

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study helped in successful breeding of a new pair of snow leopards in 1989 – a first in the south-east Asia, and second in Asia on that date.

After snow leopards the study was extended to the Siberian tigers (*Panthera tigris altaica*) and common leopards in the zoo. The results were common to all the three species in establishing the relationship between scent marking and breeding behavior of the big cats.

Methods

Observations were made by visual monitoring of the behavior of the snow leopards round the clock, 7 days a week and 365 days a year between 1988 and 1992. The marking behavior in tigers and leopards was observed during the daylight hours on random basis during this period for comparison with the snow leopard behavior. The observations were recorded in the format of an ethogram devised for the purpose (Rishi, 2009). It timed the periods and type of activity, mainly of rest, sleep, calls, scent marking, body rolls, body rubbing, feeding, play, and feeding and defecation. In the case of the tigers and the leopards additional observations were made during 1990 and 1991.

Full time observations were permanently recorded in a bound register of ethogram sheets in 8 hourly shifts to cover 24 hours every day by trained and dedicated zoo staff. Assistance of the students of zoology from Govt. College, Darjeeling and from St. Paul's School, Darjeeling in overseeing the study was also utilized as and when available. The comparative study on four Siberian tigers (two pairs) and seven leopards (two females and five males kept separately) was carried out under the direct supervision of the author.

The items of behavior on snow leopards were broad based since there was not enough data available on the species for use in conservation breeding in a zoo. The collection of data on the Siberian tigers was specific to the two pairs of tigers kept together; they were possessive of their mates and aggressive towards the other pair in the neighboring enclosure. The leopards were not paired and the data on the leopards was focused on the scent marking and the response of other leopards when they were released into the open enclosure where marking had taken place. In the case of leopards the limited accommodation was utilized for observing one leopard at a time for marking, response to the marked spot by others, and the response that indicated the coming into estrus of the leopardesses.

The investigations were specific to the following questions:

1. Do tigers, leopards and snow leopards exhibit scent marking behavior all the year round?
2. How do the individuals of either sex react towards the spots marked by an individual of their own species?

Results

The analysis of collected data shows that :

1. The scent marking behavior is not a year long activity in tigers, leopards as well as in snow leopards. The scent marking behavior was observable mainly during midsummer and the winter season, and it subsided during mating days; and in the case of females of the species, scent marking stopped soon after fertilization took place. For the rest of the year scent marking was not observed in any of the big cats kept in the zoo.
2. The pattern of marking by any individual of all the three species of big cats during the midsummer and winter seasons consisted of a series of alternately active and subdued, occasionally even passive, scent marking phases, i.e., after a few days of active scent marking of objects there was a lull in the marking frequency for a few days before once again active scent marking was resumed to be followed by a passive phase. The number of days in the active phase varied with individuals while the number of days in passive phase varied with individual as well as with external stimuli.
3. The adult individuals of opposite sex were attracted by the marked spots.
4. The examination of a marked spot started by sniffing of the spot.
5. In case the spot was marked by an individual of the opposite sex, it was followed by vigorous sniffing, rubbing of head, cheeks and chin on the spot or by licking the spot and exhibiting flehmen.
6. Flehmen was exhibited by adult individuals after sniffing or licking the spot freshly marked by themselves as well when marked by an individual of the opposite sex. Spots marked by individuals of the same sex were quickly covered by spraying their own scent over them.
7. Marking was not done by any adult if he or she was not in breeding condition.
8. The cubs of the Siberian tigers and snow leopards did not indicate any interest in the marked spots before they were weaned. Their mothers sniffed at the spots in a perfunctory manner and did not return to the marked spots again. A cub of the snow leopard exhibited flehmen for the first time at the age of seven months.

9. Individuals spent more time in examining the spots marked by opposite sex. The period spent examining a spot marked by a member of opposite sex varied between 6-12 minutes, whereas the time spent in examining spots marked by an individual of the same sex seldom exceeded 3 minutes.
10. The frequency of scent marking varied on day to day basis and reached a peak about the middle of the active scent marking phase. No two individuals exhibited similar pattern of variation in the frequency of scent marking.
11. Scent marking by an active individual appeared to induce the passive individual into scent marking. The temporal distance between the peaks in scent marking by individuals of opposite sex kept together gradually reduced before the individuals mated.
12. During mating period all scent marking activity subsided. Mating period was followed by a passive phase before active scent marking phase started.

The patterns of olfactory responses and behavior relating to scent marking and estrus in Khairi, a tigress reared under human care (Choudhury, 1999) were found to be similar in the Siberian tigers, leopards and snow leopards. The analysis of the observations confirmed the observations made by Choudhary (1979) on Khairi that estrus is induced in the tigresses by repeated smelling and licking of the marking and urine of male tigers.

Validation of the findings

The findings on the relationship between the scent marking and breeding behavior of the pair of snow leopards brought to the zoo in 1986 was applied to the new pair of snow leopards brought to the zoo in January 1989. It brought success to the conservation breeding project for the snow leopard at Padmaja Naidu Himalayan Zoological Park, Darjeeling. The project was supported and monitored by the International Snow Leopard Trust. The success had eluded the first pair of snow leopards brought to the zoo in 1986, and it was apprehended that the second pair of snow leopards brought in the mid-winter breeding season of the snow leopards may also fail. Snow leopards had not bred in Asian zoos during their century old history in captivity, except once in China, the species had earned a reputation for being a difficult breeder. The two prospective mates brought together in middle of natural mating season were total strangers to each other, the male – 3 years old – was five years younger than the female, and was extremely nervous of any attention given to him by the female; even a glance from the female would send him running for the security of his den. The new environment and keepers at Darjeeling were also additional sources of his fears. The prospect of having them mate and breed did not seem to be bright at all. However, the application of the knowledge gained by the study brought forth unprecedented success.

The same techniques were applied to the Siberian tigers and leopards successfully. The Siberian tigers bred in the zoo after a long gap of 18 years of unsuccessful attempts, and the common leopards bred after a gap of 4 years.

Discussions

In the free living populations of tigers the significance of the observation made in the zoo on the function of scent marking can easily be visualized.

1. Any keen observer of wildlife may, on some occasion or the other, come across a peculiar behavior exhibited by the tiger – in which the big cat walks, seemingly purposefully, to a bush, a tree, a rock or any other prominent feature in its vicinity, smells it, turns about, raises it tail, and squirts out a fluid from its posterior end in a spray leaving the object marked by a fluid that looks like urine. The marked spot emits a peculiar scent noticeable even to the dull nosed human beings. It is commonly believed that the scent carried by such "marking posts" advertise the occupation of territory by a resident tiger so that an intruder may be forewarned against competition and confrontation with the existing occupant. However it does not hold true for the intruders belonging to the opposite sex. The results of the study buttressed by field observations suggest that the scent marking had a definite role in the breeding biology of tigers, leopards and snow leopards.
2. It explains the situations where other evidences indicated an uncertainty and contradictions in the prevalent idea that the tigers use scent marking to advertise their territories. The uncertainty arises when we find that the tigers do not mark their territories all the year round. The pheromones are volatile compounds and a tiger will need to constantly keep his extensive home range boundary marked, had the behavior been only to advertise its occupancy of the territory. This is an uncertainty of significant level in the hypothesis of territory marking.
3. The above fact is further proved by the territory marking by tigers in the mangroves of Sunderbans where rise and falls of tides perhaps do not allow tigers to settle their territories effectively because at high tide large areas of land are submerged with tidal water twice every 24 hours. This is a

contradiction in the hypothetical belief of the role of scent marking as signal for occupancy of the marked territory. But it does not contradict the hypothesis that scent marking is for advertising the breeding condition of a tiger and selection of a mate.

4. A tigress in estrus travels widely and is sometimes followed by several males. Such aggregations probably include a resident male, transient males, and a number of males from adjoining ranges through which a tigress has passed (Schaller 1967). Similar behavior has been reported in the jaguar.

5. Schaller (1967) also observed that the tigers exhibit a wide variety of land tenure patterns, from exclusive use of all area that seems to be defended against intruders to peaceful sharing of ranges. Some limiting trend, however, appeared to be operating in the tiger population on the local level, perhaps based on intraspecific intolerance when mating or sharing a kill, on various visual and factory signals left in the environment (Schaller 1967). Arjan Singh (1973) observed that a tigress territory should be seen as a loose beat rather than a defended area. Mc Dougal (1977) others maintained the tiger to have the tendency to delineate its territory and defend it against intrusion by others of the same sex. All these fall into place when we test them on the hypothesis that the role of scent marking is not just marking out a territory but is mainly mate selection and breeding.

6. While the concept of territoriality is linked with the capacity of the habitat to accommodate a hypothetical maximum number of tigers, the role of scent marking relates to breeding, selection of compatible mates and the growth potential of existing population in the area. Scent marking, instead of signaling other tigers to keep out of the area, advertises the availability of an eligible mate to proximal individuals meet. Such behavior patterns are described in the flight of Khairi to mate with a breeding male who had already secured a mate and return after mating with him (Choudhury, 1979).

The question of behavior modification under captive conditions in a zoo is not relevant here because anatomy, physiology and innate behavior are genetically controlled parameters governing the life forms. These are not affected by short term variations in the environmental gradients of the living beings. Padmaja Naidu Himalayan Zoological Park at Darjeeling had offered a unique opportunity to study these unchangeable patterns of behavior and physiological activity on a reasonable sample of 7 tigers, 6 leopards and 4 snow leopards. Under captive conditions these animals accepted the presence of observers as a part of the scene. It was possible to keep all the individuals and their scent marking posts under observation for as many hours as could be physically possible. And the parameters for study were those as do not change from wild to captive environment.

Conclusion

The study leads us to the conclusion that scent marking plays a more significant role in the breeding biology in the world of tigers, leopards, snow leopards and probably other big cats – transient, migratory, residents or dormant. It is an important factor to be considered in the management and conservation of big cats.

बाघों और अन्य बड़ी प्रजाति के बिडालों के प्रजनन व्यवहार में गंध चिन्हों की भूमिका

विनोद ऋषि

सारांश

ऐसा विश्वास है कि बड़ी प्रजातियों के बिडाल अपने अधिकार क्षेत्र पर स्वामित्व दर्शाने के लिए प्रमुख स्थानों तथा वस्तुओं पर अपने मूत्र जनित गंध चिन्ह छोड़ते हैं। दार्जलिंग चिड़ियाघर में किए गए बाघों, तेन्दुओं तथा हिम तेन्दुओं पर एक अध्ययन से ये उभर कर आया कि ये जीव अपने विपरीत लिंग के साथियों में प्रजनन अवस्था को उजागर करने के लिए ऐसे गंध चिन्हों का प्रयोग करते हैं। इस लेख में बड़ी प्रजातियों के बिडालों (बाघ सहित) की प्रजनन क्रिया में गंध चिन्हों की भूमिका का निरीक्षण प्रस्तुत किया गया है।

References

Choudhury, S.R. (1979). Olfaction, marking and oestrus in a tiger. *International Symp. on tiger*. Govt. of India. Pp.315-326.

Choudhury, S.R. (1999). *Khairi*. Natraj Publishers, Dehradun.

Corbett, J. (1947). *The man-eating leopard of Rudraprayag*. Oxford University Press. London.

Daniel J.C. (1996). *The leopard in India*. Natraj Publishers, Dehradun.

Karanth, K.U. and Chundawat, R.S. (2002). Ecology of the tiger: implications for population monitoring. In: *Monitoring tigers and their prey.* Pp 9-22, (Eds Karanth, K.U. and James D. Nichols). Centre for wildlife studies, Bangalore.

McDougal, C. (1977). *The face of the tiger*. Rivington Books. London, UK.

McDougal, C. (1979). *Some observations on the social behaviour of tigers at Royal Chitwan National Park in Nepal. Proc. International Symp. on tiger*. Govt. of India, New Delhi. Pp. 113-118.

Panwar, H.S. (1979). Population dynamics and land tenures of tiger in Kanha National Park. *Proc. International Symp. on tiger*. Govt. of India, New Delhi.

Rashid, M.A. (1992). *The Asiatic lion*. Govt. of India. 76 p.

Rishi, V. (2009). Managing First Successful Captive Breeding of Snow Leopards at Darjeeling. *Proc. Of Workshop on Snow Leopard.* PNHZP, Darjeeling, Pp. 124-135.

Schaller, G.B. (1967). *The deer and the tiger*. University of Chicago Press. Chicago, USA.

Singh, A. (1973). Tiger haven. Macmillan, London (237p.)

Smith, J.L.D., McDougal, C. and Miquelle, D. (1989). Scent marking in free ranging tigers, *Panthera tigris. Animal Behavior*, 37:1-10.