

Intertroop Agonistic Behavior of a Feral Rhesus Macaque Troop Ranging in Town and Forest Areas in India

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The intertroop agonistic behavior of a troop of *Macaca mulatta villosa* was studied in both forested and urban areas. Intertroop contacts lasted longer and were more likely to involve aggression in the town than in the forest. In particular, adult males and adult females when in urban areas showed a significantly higher rate of the most extreme forms of agonism, such as attacks, chases, and fights, than when in the forest. Data are explained in relation to feeding patterns and environmental differences and show the great flexibility of social behavior in these primates. Genetic selection for a high level of aggression in an urban population of macaques is not considered likely.

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Key words: intertroop agonism, behavioral flexibility, *Macaca mulatta villosa*

INTRODUCTION

Agonistic behavior in primates frequently varies in populations that live in different habitats and under different ecological conditions. Competition for food and for females and high density are all factors that can increase this behavior [Singh, 1969; Southwick et al, 1976; Wilson and Boelkins, 1970].

In rhesus monkeys, each troop uses a home range (partially shared with other troops) and avoids close proximity with neighbouring troops. Encounters between troops vary from no agonism to very aggressive encounters with fights and chases. The level of agonism depends on the previous history of the troops, familiarity of the members, rank of the troops, and location of the encounter [Hausfater, 1972; Chapais, 1983; Vessey, 1968].

It is commonly believed that Indian rhesus populations can be divided into two distinct groups: those living in towns and those living in the forest. On the contrary,

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in the population studied here all the troops shifted daily from a high altitude coniferous forest to a town and vice versa [Camperio Ciani, 1983]. Singh [1969] compared rural with urban populations of rhesus in laboratory tests and concluded that the latter were more aggressive.

Very few field studies have facilitated an assessment of behavioral flexibility and of the ways in which social groups of primate species respond to the local variation of ecological parameters [see exceptions in Kummer et al, 1970; Lee, 1983]. The Simla troops of macaques, with their daily use of two different ecological settings, offered a natural opportunity to assess the effects of ecological variables on intertroop relationships. We attempted to determine if the same animals showed different patterns of agonistic behavior in the town vs the forest by selecting a focal troop for study. It was hoped that these data would help clarify whether behavioral differences between rural and urban macaques have a genetic base as has been proposed [Southwick et al, 1965; Singh, 1969]. A change in aggressive behavior by the same troop in different ecological settings would indicate a high degree of behavioral flexibility in response to different environments [Rowell, 1969; Mason, 1976; Nagel and Kummer, 1974; Scott, 1974].

METHODS

Study Site and Population Structure

The free ranging population of *Macaca mulatta villosa* [True, 1894], the Himalayan subspecies of rhesus monkey observed here, lives in the area of Simla (31°6'N, 77°10'E), a town of Himachal Pradesh (India). Temperatures ranged from -5 to 18°C, and heavy snows occurred four times during the study period. The study site was an area of 1.05 km² between the eastern area of the town of Simla and a high mountainous forested area on Jackoo hill (2,800 m) and corresponded to the home range of the troop under observation (Fig. 1). The predominant trees were the deodar (*Cedrus deodara*) and the oak (*Quercus incana*); undergrowth was relatively scarce. A census in this area indicated a total of 235 rhesus divided into six troops. The largest troop contained 74 individuals, the smallest contained 15, and the population density was 217/km² [Camperio Ciani, 1984]. A focal troop of 15 individuals was then chosen to record intertroop agonistic behavior and feeding patterns; the choice of this troop was dictated by the ease of individual identification.

Data Collection

Two observers scored the location of the troop in the area by 5-minute interval scannings. If the troop was moving from the town to the forest or vice versa, then the location of the focal animal was taken as the location of the whole troop. Contact of the focal troop with other troops was also recorded. A contact between two troops occurred when the closest individual to the neighboring troop was less than 30 m away and some members of the two troops could see each other. Visibility was better in the forest owing to the relative lack of thick undergrowth. In the town, buildings, narrow streets, and humans reduced the ease of visual contact in observers and monkeys (this reduced visibility may produce an underestimation of actual town contacts). Whenever possible, the duration of the contact and the result (displacement or intertroop conflict) was recorded.

During the troop contacts, blocks of 5-minute focal animal sampling were consecutively recorded [Altmann, 1974]. Data were collected on the behavior of four age/sex classes of individuals: namely, 3 adult resident males (estimated over 7 years of age), 4 adult females (parous over 5 years of age), 2 juvenile males, and 2 juvenile females (between 2 and 4 years of age). Four other dependent infants were not included in this study.

Subsequently each block of 5 minutes observation was classified as follows: "mild" if no visible agonism was recorded between the focal animal and the other troops during the 5 minutes; "threatening" if the focal animal directed or received signals of open mouth threat, ocular threat, and head and body jerks from members of the other troop; "attack & chases" if the focal animal was involved in unidirectional or reciprocal chases including slaps with members of the other troop, but no physical injuries occurred; and "fighting" if the focal subject was involved in intertroop aggression with reciprocal bites and scratches. Feeding behavior was also studied using scan observations on the focal animal at 5-minute intervals. It was recorded whether the subject was feeding and what was being eaten, ie, natural forest food items or town items such as garbage, Hindu offering, or food stolen from markets or homes.

Observations were made from dawn to dusk; effective data recording started from the time of first contact with the focal troop. Two observers collected 50 hours of

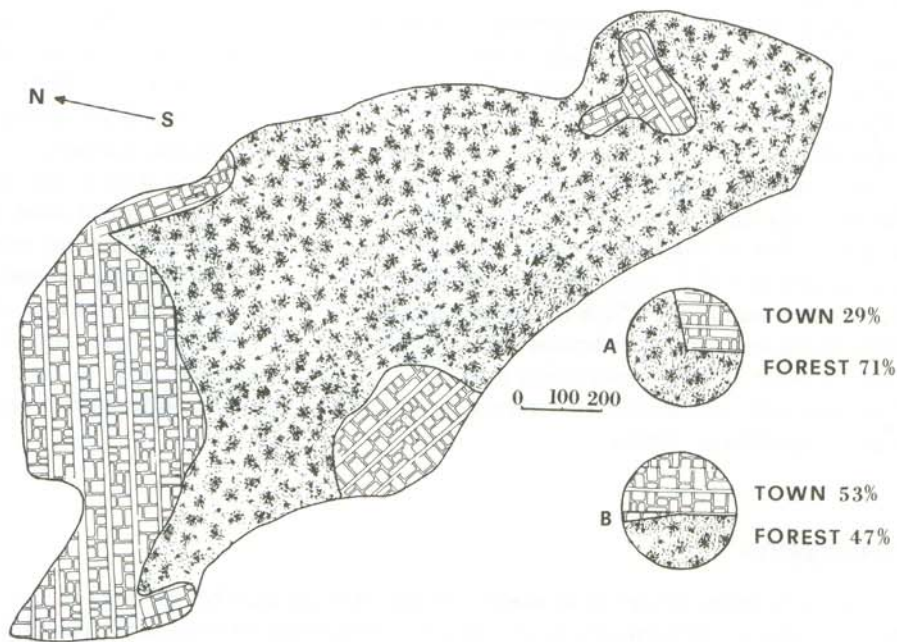


Fig. 1. Shape and size of the home range of the Simla macaques troops. This area included the southern part of Simla town (left), a part of Oak wood village (middle), and a temple area (right); the rest was coniferous montane forest. Circogram A represents relative proportion of urban and forested areas in the home range. Circogram B represents the relative time spent by the focal troop in the town and in the forest during 200 hours of observations. Size is approximate and is represented in meters.

scan observations and 200 hours of focal animal observation from November 1981 to February 1982. The 607 blocks of focal observation correspond to 50 hours for each age/sex class of the troop. Observations were equally distributed among all members of each class according to a randomized table. Statistical tests were one-tailed and were done on raw data. The null hypothesis was that agonism was lower in the town than in the forest.

RESULTS

The home range of the troop was not uniformly exploited, and although the town area accounted for only 29% of the range, the troop spent 53% of the total observation time there (see Fig 1). The focal troop encountered all other troops both in the town and the forest. It was one of the lowest ranking troops in the area, and in contacts with all other troops it was the troop that was most frequently displaced.

Intertroop contact time was longer in the town. Contacts were recorded for 62% of town scan observations (206 out of 331) but dropped to 43% in the forest (120 out of 276) ($\chi^2 = 21.29$, $P < .01$). The frequency of encounters between troops was not significantly different in the two environments: 0.43/h in town vs 0.47/h in the forest. Significantly more agonistic encounters were recorded in town between this troop and others: 69% (33/48) but in the forest only 30% (13/43) terminated in such behavior ($\chi^2 = 13.46$, $P < .01$). The mean duration of encounters was significantly longer in town than in forest (21 vs 14 min, Student's $t = 2.03$, $P < .05$).

Predictably, the kinds of intertroop agonism differed markedly for different age/sex classes of the troop. The results of the four age/sex classes are presented in Table I. Adult males showed more extreme forms of aggression in town ($\chi^2 = 12.55$, $P < .01$) than did adult females ($\chi^2 = 12.21$, $P < .01$). No such significant differences were observed for juveniles. Feeding behavior when divided between forest and town showed some comparable differences between the age/sex classes of the troop. Males fed for only 22% of total observation time, of which 33% fed on forest food items and 67% fed on town ones. Town feeding included 35% food stolen from markets and houses and 65% from garbage and Hindu offerings. Adult females fed for 52% of the observation time, 51% on forest items and 49% on town items. In town, stolen food accounted for 4%, whereas 96% was garbage and offerings. Juveniles of both sexes fed for 58% of observation time, 57% on town items and 63% in the forest. The town diet consisted of 4% stolen food and 96% garbage and offerings (Camperio Ciani, unpublished thesis).

DISCUSSION

The home range of the focal troop overlapped areas used by six other troops. The home ranges of different troops of macaques commonly overlap, and related troops originating from troop fissions often use the same core areas at different times, respecting hierarchical orders [Southwick, 1962; Hausfater, 1972; Vessey, 1968; Furuya, 1968].

The relative density of the Simla macaque population was very high. With the exception of the totally urban populations, this is the highest recorded density for free-ranging Indian rhesus monkeys [Lindburg, 1971; Jolly, 1972]. If one considers that all the troops generally converge on the town at the same time (eg, in the

Teas et al [1982] reported that in a rhesus population in the temple of Katmandu, an environment similar to the Simla one, the females most frequently started aggressive encounters. This discrepancy may reflect varied observational procedures. The presence of more females in a troop might be the only reason why Teas et al [1982] observed more agonistic acts started by females. The focal animal sampling method, used in the present study, has the advantage of cancelling the effect of sex ratio [Altmann, 1974; Altmann and Altmann, 1977]. Unfortunately, Teas et al [1982] did not distinguish between inter- and intratroup aggressions, and therefore comparison with their data becomes impossible.

In the scrub island of La Parguera, Vessey [1968], in a population in which the density of animals was even higher, reported an hourly intertroup interaction rate of 0.36 that is 20% lower than our average (0.45). This difference could be because observations in Simla were made during the mating season, which is known to be a time of the year characterized by agonistic behavior and by intertroup contacts rising in frequency [Wilson and Boelkins, 1970; Teas et al, 1982]. There is, however, presently no evidence that mating activity and access to females are different between the town and the forest.

CONCLUSIONS

Although the results of this study are preliminary, some conclusions can be drawn. During the winter, the town—owing to its open food markets, houses, and people from whom to steal food or to beg—is very attractive for monkeys. These resources may induce competition with other troops. The differences in aggressive behavior reported here are expressed by the same animals and under free-ranging conditions, showing that these animals can change behavior to exploit resources from these two very different habitats. These data confirm a behavioral flexibility in these monkeys and suggest that the higher aggressiveness seen in the urban monkey populations is not the result of genetic selection.

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