Brief Report

Received: August 29, 1990

Accepted: March 20, 1991

Folia Primatol 1991;57:156-158

Mating by Nontroop Males among the Japanese Macaques of Yakushima Island

D.S.

Sprague

Yale University, New Haven, Conn., USA

Key Words

Nontroop male
Mating strategy
Male influx
Mating seasonality
Dominance
Japanese macaque
Macaca fuscata yakui
Yakushima

David S. Sprague, Laboratory of Human Evolution Studies Faculty of Science, Kyoto University Sakyo, Kyoto 606 (Japan)

Introduction

The mating strategy of male cercopithe-cine monkeys has been described as a form of 'female defense polygyny' [1]. Such characterizations of male mating strategy generally assume that males mate within a troop of which they are members. This assumption is important for many theories concerned with the role of dominance in mating or with the number of males living in a troop. For example, the resident male of a one-male troop is expected to maintain exclusive access to the females of a troop [1], while in multimale groups the subordinate males are expected to live in the group only if the dominant males cannot exclude them from mating [1,2]. However, many researchers have reported influxes of nontroop males during the mating season for Old World monkey species with both one-male and multimale group structures (*Macaca fuscata* [3], *M. mulatta* [4], *Presbytis entellus* [5], *Cercopithecus mitis stuhlmanni* [6], *C. mitis albogularis* [7], *C. ascanius* [8], *Erythrocebus patas* [9]). Many of these intruding males copulate successfully. These observations call into question current assumptions about the relationship between mating success and male troop membership. Yamagiwa [3] has reported that nontroop males often succeeded in mating among the Japanese macaques (*Macaca fuscata yakui*) of Yakushima Island. This paper reports further research on mating by nontroop males in the Yakushima study site, showing that nontroop males accounted for a large proportion of the mating in this population.

Field Site and Methods

The study site is located on the northwestern coast of Yakushima Island within the Kirishima-Yaku National Park, Kagoshima Prefecture, Japan. The study troops live in continuous, largely undisturbed forest and are surrounded by many other troops. At the time this study began in 1984, three troops had been habit-

Mating by Nontroop Males

uated without provisioning [10]. One troop fissioned during the study. Yaku macaques live in multimale troops; the study troops included an average of 6.8 sexually mature male and 7.3 sexually mature female monkeys during the study period [11].

At this field site, the mating season is from late September to early January, with a peak in mating activity in October. The data consist of the number of completed mounting series, with ejaculation, observed in the 1984, 1985 and 1986 mating seasons. The data were collected by 6 observers and include matings noted during both focal animal follows and ad libitum observations.

Nontroop males were defined as those males first observed interacting with the monkeys of a study troop after the start of the mating season.

Results

Many nontroop males were observed interacting with the study troops during the mating season. Nontroop males included animals from outside the study area as well as members of one study troop that interacted with another study troop. Although a few nontroop males subsequently remained with the troop concerned, most left the troop by the end of the mating season. Counting the number of nontroop males was difficult because of the possibility of misidentification or double counts. The average number of nontroop males was 10.6 per troop per season according to a conservative estimate based on only well-identified males that were observed on at least 2 days.

Nontroop males accounted for 41 % of all observed copulations (table 1), mostly in isolated consortships. Such consortships started with displays by a nontroop male near a troop. The male sometimes just sat quietly within sight of a troop or performed a tree-shaking display with loud barking. A female responded to these displays by leaving the troop and joining the nontroop male. Troop

males, individually or cooperatively, sometimes chased the female or attempted to attack the visitor, but herding the females or driving away a visitor seemed to be difficult, and the troop males often failed to prevent mating by nontroop males.

Discussion

Mating by nontroop males has been reported in many early studies on Japanese macaques [12]. Even in the provisioned and relatively isolated Arashiyama troop, Wolfe [13] reported that 30% of the females traveled out of the troop to mate with nontroop males. Furthermore, mating by nontroop males has been reported for a wide range of Old World monkey species (cited above), including the case of a troop of blue monkeys (*C. mitis*) in which all of the mating was carried out by nontroop males and none by the resident male [5]. These data show that the pool of potential mating partners, even in a single mating season, is much larger than the membership of any one troop for both males and females [14].

The Japanese macaque and the species in the studies cited above have mating seasons, or at least a pronounced annual mating peak,

Table 1. Copulations by nontroop males

Male types

n %

Troop Nontroop

266 59 186 41

Total

452 100

n = Number of completed mounting series with ejaculation.

158

Sprague

implying that mating seasonality may encourage nontroop male influxes. Several females in estrus during a short period are not easily defended by resident males, while providing more mating opportunities for males in the larger community of troops. Thus, influxes of males during short periods may not occur in species without mating seasons.

Although 'female defense polygyny' may indeed be a mating strategy of some male Old World monkeys, researchers must reformulate theories of mate choice and male troop membership to incorporate observations of mating by nontroop males.

Acknowledgments

I thank T. Maruhashi, J. Yamagiwa, Y. Takahata, N. Okayasu and T. Tsukahara for their unpublished data and A.F. Richard, D.A. Hill, Y. Takahata and M.A. Huffman for their criticisms of an earlier draft. This study was supported by the Wenner-Gren Foundation and the Cooperative Research Fund of the Kyoto University Primate Research Institute.

References

Berenstain L, Wade TD: Intrasexual selection and male mating strategies in baboons and macaques. *Int J Primatol* 1983;4:201–235.

Ridley M: The number of males in a primate troop. *Anim Behav* 1986;34:1848–1858.

Yamagiwa J: Socio-sexual factors of troop fission in wild Japanese monkeys (*Macaca fuscata yakui*) on Yakushima island, Japan. *Primates* 1985;26: 105–120.

Lindburg DG: Rhesus monkeys: Mating season mobility of adult males. *Science* 1969;166:1176–1178.

Laws JW, Vonder Haar Laws J: Social interactions among adult male langurs (*Presbytis entellus*) at Rajaji wildlife sanctuary. *Int J Primatol* 1984;5: 31–50.

Cords M, Mitchell BJ, Tsingalia HM, Rowell TE: Promiscuous mating among blue monkeys in the Kakamega forest, Kenya. *Ethology* 1986;72:214–226.

Henzi SP, Lawes M: Breeding season influxes and the behaviour of adult male samango monkeys (*Cercopithecus mitis albogularis*). *Folia Primatol* 1987;48:125–136.

Jones WT, Bush BB: Movement and reproductive behavior of solitary male redbellied guenons (*Cercopithecus ascanius*). *Am J Primatol* 1988; 14:203–222.

Harding RSO, Olson DK: Patterns of mating among male patas monkeys (*Erythrocebus patas*) in Kenya. *Am J Primatol* 1986;11:343–358.

Maruhashi T: An ecological study of troop fissions of Japanese monkeys (*Macaca fuscata yakui*) on Yakushima island, Japan. *Primates* 1982;23:317–337.

Sprague DS: Inter-troop Mobility of Males during the Mating Seasons among the Japanese Macaques (*Macaca fuscata yakui*) of Yakushima Island, Japan; PhD thesis Yale University, 1989.

Nishida T: A sociological study of solitary male monkeys. *Primates* 1966;7:141–204.

Wolfe LD: Display behavior of three troops of Japanese monkeys. *Primates* 1981;22:24–32.

Richard A: Social boundaries in a Malagasy pro-simian, the sifaka (*Propithecus verreauxi*). *Int J Primatol* 1985;6:553–568.