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Multiple Breeding Females and Allo-Nursing in a Wild Group of Moustached Tamarins (*Saguinus mystax*)

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Introduction

Callitrichines show flexible social organization and mating patterns (Goldizen, 1988; Ferrari and Lopes Ferrari, 1989). Instances of multiple breeding females have been reported in all genera (Table 1) except *Cebuella* and seem to be the rule in *Callimico* (Christen, 1998; Encarnación and Heymann, 1998). Except for *Callimico*, this circumstance has been observed to result in reduced offspring survival or live births for one of the breeding females. However, allo-nursing, a highly co-operative behavior, has also been reported in *Callithrix jacchus*, *C. aurita* and *C. flaviceps* groups with multiple breeding females (Table 1). Here, we present observations of two female *Saguinus mystax* breeding simultaneously and the subsequent allo-nursing of the surviving offspring.

Methods

Data were collected *ad libitum* on a group of *S. mystax* during on-going studies at the Estación Biológica Quebrada Blanco (4°21'S, 73°09'W) in northeastern Peru (for details see Heymann and Hartmann, 1991). The tamarins were observed for 14–20 days each month from 14 February to 28 June 2000. The group consisted of two adult females (labeled 1 & 2), two adult males and a subadult male. The group was never trapped and was fully habituated to the presence of humans. Individuals were recognized by natural distinguishing characteristics. The group was first seen in the area in May 1999, without the second adult male who immigrated in late August/early September 1999 (Tirado Herrera, pers. obs.).

Results

On the morning of 21 February, 2000, a single male infant was seen (born to female 1). He fell to the ground shortly after the group left its sleeping site, and was later recovered by a member of the group, only to fall again shortly thereafter. He was not retrieved the second time and died at 10:10 hrs. That night, female 2 gave birth to male twins and the following morning they were observed being carried separately. Female 1 repeatedly tried to take an infant from his mother's back, but the mother resisted. Later in February the infants of female 2 were seen being nursed on five occasions by their mother and twice by female 1. The mother nursed only with her left nipple. Her right nipple did not produce milk and her breast remained unswollen and unmarked by any effects of suckling. Female 1 nursed with both nipples normally. Their swollen breast(s) indicated that both females continued to lactate until the end of May. Both infants survived to at least one year of age.

Discussion

Factors underlying the occurrence of multiple breeding females in callitrichines are largely unknown. High population density and limited opportunities for dispersal have been suggested as influencing factors in *C. jacchus* and *Leontopithecus rosalia* (De Vleeschouwer *et al.*, 2001; Digby and Ferrari, 1994; Dietz and Baker, 1993). However, in *C. aurita* polygyny occurred despite much lower population densities (Coutinho and Corrêa, 1995). Dietz and Baker (1993) found a correlation between the occurrence of polygyny and some habitat parameters in *L. rosalia*, but nevertheless excluded the polygyny threshold model as an explanation. They suggested that the balance of costs and benefits to the dominant female determines whether or not she allows a subordinate female (daughter) to breed (see also Rylands, 1996). The presence of males unrelated to the daughter may play a key role in this decision. This agrees with Savage *et al.*'s (1996) findings that incidences of two pregnant female *S. oedipus* in the same group were associated with the immigration of a novel male. It is also consistent with a greater success of multiple breeding females in captive groups of *L. chrysomelas* with unrelated males (De Vleeschouwer *et al.*, 2001).

In our case, population density and habitat quality have not changed noticeably since 1994, and hence are unlikely

Table 1. Polygynous breeding in wild callitrichines (except *Callimico goeldii*).

Species	Observations	Reference
Callithrix aurita	3/4 infants of dominant female survived, 2/3 infants of subordinate female survived; no allo-nursing observed.	Coutinho & Corrêa (1995)
Callithrix flaviceps	4/4 infants of dominant female survived, 3/5 infants of subordinate female survived; allo-nursing by all females.	Guimarães (1998)
Callithrix jacchus	8/13 infants of dominant females survived, 2/6 infants of subordinate females survived; one infanticide observed; allo-nursing by subordinate females of dominant females' infants.	Digby (1995)
	13 infants (six births) born to 2 females, 6 survived, 6 died or disappeared, 1 infanticide; allo-nursing by subordinate female.	Roda & Mendes Pontes (1998)
Leontopithecus rosalia	Polygyny in 20 of 211 group samples (10.6%); lower infant survival for offspring of subordinate females.	Dietz & Baker (1993)
Saguinus fuscicollis	One set of twins born to each of 2 females, all infants survived.	Calegaro-Marques *et al.* (1995)
	Twins born to each of 2 females in 5 groups: all infants survived in four cases, 1 set of twins probably died immediately after birth in one case.	Goldizen *et al.* (1996)
	2 simultaneously pregnant females in each of 2 groups; in 1 group, only 1 female gave birth; in the other group, 1 female gave birth to a single offspring which she killed on the day of birth; second female gave birth to twins, one of which disappeared at age 5 months.	Tirado *et al.* (2000), Tirado Herrera (pers. obs.)
Saguinus mystax	Twins born to each of 2 females, 1 set survived, 1 female died and her infants disappeared.	Ramirez (1989)
	2 pregnant females or 1 pregnant and 1 lactating female in 3 out of 13 groups, but only 1 female reared and nursed infants.	Garber *et al.* (1993)
Saguinus oedipus	2 simultaneously pregnant females in each of 2 groups; in 1 case, only 1 female delivered live offspring; in the second case, no live births were observed.	Savage *et al.* (1996)
	Pregnancy, but no subsequent offspring, observed in a daughter of a regularly reproducing female.	Savage *et al.* (1997)

to be factors. However, the coincidence of polygynous breeding observed since 1997 in *S. fuscicollis* groups living in the same area (Tirado Herrara *et al.* 2000; Tirado Herrera, pers. obs.) suggests some causal environmental factor. In addition, the immigration of the second adult male one month earlier may have provided a situation similar to those under which multiple females breed in *S. oedipus*, *L. rosalia* and *L. chrysomelas*. However, mounts by male 1 of female 2 had been observed on 10 September (Heymann, pers. obs.), suggesting that immigration of male 2 may only have been additional to environmental factors. At the same time there was tension between the two females (repeated head-grasping of female 2 by female 1, and squealing of female 2 towards female 1) (Heymann, pers. obs.). Such tension may be expected, given that in callitrichines, except *Callimico*, reproduction is usually monopolized by a single female (French, 1997).

In callitrichines, allo-nursing has only previously been observed in *Callithrix* spp. However, whether their tendency to live in larger groups than other genera (Ferrari and Lopes Ferrari, 1989; Rylands, 1993) affects the incidence of allo-nursing is unclear. One would predict that female relatedness plays a critical role in whether allo-nursing occurs, but the kinship between the two females in our study was not known. In *C. jacchus*, it is frequently the mother and daughter who breed simultaneously (Coutinho and Corrêa, 1995; Digby, 1995). All callitrichine group members are involved in infant care (Tardif *et al.*, 1993) and, at least in captivity, they will carry non-related infants (Box, 1977) and, in mixed-species groups, congeneric infants (Buchanan-Smith, pers. obs.). In the *S. mystax* group, female 1, the allo-nurse, had lost an infant, and the fact that the mother female 2 was only nursing with one nipple may have increased her willingness to let female 1 allo-nurse her infants. In *Callithrix,* females have been seen to allo-nurse while they had their own infants and also after the death or disappearance of their infants.

This is the first reported incidence of allo-nursing in a *Saguinus* spp. Although the factors affecting multiple breeding females and allo-nursing are still unclear, it is only as cases emerge and are reported that the underlying conditions will become clear. These observations provide further evidence for the high degree of flexibility and co-operation in tamarin sociality and mating patterns (Caine, 1993).

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Densidade e Conservação do Bugio (*Alouatta fusca*) no Parque Estadual Intervales

Sandra Steinmetz

Introdução