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EXTRAGROUP COPULATION IN A SMALL AND ISOLATED *ALOUATTA GUARIBA CLAMITANS* POPULATION

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Copulation solicitation and promiscuity appear to characterize female mating behavior in all atelid genera so far studied (no data is available for *Oreonax*; Di Fiore et al., 2011). Extragroup copulations (EGCs), on the other hand, have been reported only in *Brachyteles* (Strier, 1997) and *Alouatta* (Kowalewski and Garber, 2010). In the latter, EGCs have been described in five taxa (*A. arctoidea*, Agoramoorthy and Hsu, 2000; *A. caraya*, Kowalewski and Garber, 2010; *A. guariba clamitans*, Fialho and Setz, 2007; Lopes and Bicca-Marques, 2011; *A. palliata*, Glander, 1992; *A. pigra*, Van Belle et al., 2009).

Here we report an EGC in a brown howler monkey (*Alouatta guariba clamitans*) population studied from February to August 2012 in a 10-ha fragment of semideciduous Atlantic forest (30°49'25.53"S, 51°47'59.87"W; ca. 75-115 m a.s.l.), Camaquã, state of Rio Grande do Sul, Brazil, near the southern limit of the species' distribution. This fragment is immersed in a matrix of crops and pastures and is about 3.5 km distant from the nearest forest potentially inhabited by howler monkeys (information from local inhabitants). This is the third report of EGC in this taxon.

Results

Three howler groups (G1 and G3=5 individuals each, G2=3 individuals) live in the fragment. In February 2012 G1 was composed of two adult males (Barba Ruiva and Damasco), two adult females (Jane and Gorda), and one juvenile male (Dionivã), whereas G3 was composed of one adult male (Morfeu), two adult females (Caraya and

Adela), one juvenile male (Feli), and one juvenile female (Amanda). An infant was born in each group during the study (G2 in April, and G1 and G3 in July), but those of G1 (mother: Jane) and G2 disappeared one month after birth due to unknown causes. The G3 infant (Bini; mother, Adela) was alive at the end of the research, increasing group size to six individuals. Each study group was followed from dawn to dusk during 4-5 days per month (27 days of data collection per group or a total sampling effort of 81 days). There is no data on the degree of relatedness within and between groups. However, aimed at its small size and spatial isolation it is likely that the study population shows a level of inbreeding higher than that found in larger populations.

A total of 19 intergroup encounters between G1 and G3 were observed during the study (February and June, $n=5$ each; March, April, and July/August, $n=3$ each). Most of them ($n=18$ or 95%) occurred at important food trees (*Ficus cestrifolia*, *Ficus luschnathiana* or *Schefflera morototoni*). During these encounters G1 often left the area before G3 (16 out of 18 cases or 89%; it was not possible to identify which group left first in one encounter), although each group arrived first at similar frequencies (G1: $n=11$ or 58%; G3: $n=8$ or 42%). Only in the last encounter occurred the EGC between a G1 adult female and the G3 adult male reported here. Intergroup encounters between G1 and G2 were more frequent ($n=33$), but none EGC was recorded. Intragroup copulations were recorded only twice during the study, once in February (G3, Morfeu and Adela) and another in May (G1, Barba Ruiva and Gorda).

Nine agonistic interactions were observed during the encounters between G1 and G3 (a rate of almost one interaction every two encounters). Most of them ($n=7$) involved the G3 adult male (Morfeu) chasing both G1 adult males (Barba Ruiva and Damasco). In one situation the G1 male Damasco chased a G3 adult female whose identity could not be determined. The last intergroup agonistic interaction involved both G3 females (Adela and Caraya) chasing the G1 female Jane after her EGC with Morfeu (described below).

On 2 August 2012 G1 arrived first in a fig (*Ficus cestrifolia*) tree frequently used by G3 as a food source and sleeping site (the exact time of arrival is unknown because EBD was following G3).

12:30 - G3 begins moving in the direction of the fig tree.

12:55 - All G1 individuals are resting when G3 members probably see the intruding group. G3 individuals stop moving and start to rest in another fig (*Ficus luschnathiana*) tree in front of the *F. cestrifolia* tree where G1 continues resting. Morfeu, Caraya, and a juvenile (probably Amanda) stay about 4 m from G1, whereas Adela (carrying the infant in her belly) and the other juvenile (probably Feli) are further away (2 m from their group mates).

13:20 - Morfeu moves 2 m to a place closer to G1 than the other G3 members.

13:45 - G1 members are feeding on leaves from both (*F. cestrifolia* and *F. luschnathiana*) fig trees. Morfeu, Adela (carrying the infant), and both juveniles move about 2 m toward them and they retreat about 3 m.

13:50 - Morfeu starts barking. He barks for about 4 minutes.

13:55 - G1 adult female Jane moves to the *F. cestrifolia* tree where Morfeu is barking and they copulate in a dorso-ventral posture for about 4 minutes. The other G3 members witness the EGC and the G1 members (at least some of them) may also have witnessed it. Soon after mating Jane is chased by the G3 adult females, Adela and Caraya, and runs toward her group members. Morfeu, on the other hand, rubs his chin in a trunk of the tree where they mated and starts barking.

14:10 - Morfeu is piloerected and starts howling. Adela, by his side, joins him a few seconds later. They howl for 5 minutes.

14:16 - Caraya joins the chorus and they howl until 14:30.

14:33 - G1 is about 7 m distant from G3 and starts moving in its direction.

14:36 - Morfeu chases Barba Ruiva, Damasco and an adult female running and the G1 group leaves the area.

15:00 - G3 group members feed on ripe fruit from a morototo (*Schefflera morototoni*) tree distant about 20 m from the encounter area and 15 m from the tree where the EGC took place.

Discussion

In sum, the EGC between Jane and Morfeu followed the pattern observed in previous studies, in which a female either took the initiative of leaving her group or moved with a male during intergroup encounters to a place outside the view of their respective group members to mate (for a review see Van Belle and Bicca-Marques, in press). Nevertheless, unlike Lopes and Bicca-Marques (2011), Jane was chased by the adult females of Morfeu's group. Within-group promiscuity and EGCs have been related to a female strategy of increasing paternity confusion to decrease the risk of infanticide following rank reversals or group takeovers, increasing the genetic diversity and quality of offspring, lowering the risk of male infertility or promoting sperm competition (see Van Belle and Bicca-Marques, in press). However, considering that female promiscuity probably is a primitive atelid trait and that howler monkeys tend to live in smaller groups (with less adult males) than the atelines (Di Fiore et al., 2011), it is also possible that *Alouatta* females seek EGCs to avoid within-group mating with kin males without incurring the

risks of leaving their groups. Data on individual relatedness are needed to test this hypothesis.

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