AGONISTIC COMPETITION FOR FRUIT AMONG MEMBERS OF A TITI MONKEY (*CALLICEBUS COIMBRAI*) GROUP DURING A SEVERE DROUGHT

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Titi monkeys (*Callicebus* spp.) rarely exhibit overtly agonistic behavior except in the context of intergroup encounters, possibly because social groups are almost invariably composed of a breeding pair and their immature offspring (Bicca-Marques and Heymann, 2013). Long-term data on *Callicebus coimbrai* from two sites in the Brazilian state of Sergipe indicate that the species is primarily frugivorous-folivorous (Souza-Alves et al., 2011; Santana, 2011), but that the composition of the diet fluctuates considerably between seasons and among years. During 2012, the long-term drought affecting northeastern Brazil appeared to have a marked effect on the diet of one study group, at the Fazenda Trapsa, in the municipality of Itaporanga d'Ajuda (11°12'S, 37°14'W), which became increasingly folivorous in comparison with previous years (Souza-Alves, 2013). The present study describes social interactions observed in the group during a three-day period in January 2013 (January 2nd-4th). The group consisted of an adult male, an adult female, and a juvenile male, all presumed to be siblings, based on the long-term monitoring of the group (Souza-Alves and Ferrari, 2012). For the present report, data on social interactions were collected by behavioral sampling (cf. Martin and Bateson, 1993) during the monitoring of the group for the collection of feeding tree focal samples, as part of an ongoing study of seed dispersal (see Baião, 2013). During all-day follows, all events of significant social interactions (affiliative and agonistic) were recorded, with detailed data taken on the individuals involved, and the sequence and timing of events.

Results

During the study period, the group members fed mainly on leaves which was typical of the group's diet during the same period (mid-dry season) in previous years (Souza-Alves et al., 2011). Unlike previous years, however, the consumption of fruit was observed very rarely, on only three occasions during the three days of monitoring. On all three of these occasions, the group member feeding on the fruit was approached and displaced agonistically by a second group member, which obtained and ingested the fruit. On January 2nd, at approximately 09:00 h, the adult male dropped a partially-eaten *Passiflora contracta* (Passifloraceae) fruit, which the juvenile retrieved from the ground. As the juvenile began to feed on a branch at a height of 2 m, the female approached immediately from a distance of 1m and displaced the juvenile, pushing him away approximately 0.5 m with both hands while taking the fruit, which she ingested. No vocalizations were emitted by either individual during this sequence of events.

Fruit feeding was next observed on the third day of monitoring, January 4th. On the first occasion, during fruit feeding in a *Xylopia frutescens* (Annonaceae) tree at around 08:30h, the adult male vocalized aggressively and grimaced, displaying his teeth, as he approached the female and displaced her without physical contact to gain access to an unripe fruit. The female lost her balance and almost fell as the male approached, and then she moved away approximately 5 m to an adjacent tree crown. At 10:20 h, the group visited a second fruiting tree of an unidentified species, known locally as "pau coceira", a small drupe, where the juvenile was feeding on a fruit. The adult male leapt silently onto the branch on which the juvenile was sitting and approached him rapidly and surreptitiously, making physical contact and pushing him away with his hands, although it is not clear whether the adult actually bit the juvenile. The juvenile squealed loudly when displaced and continued vocalizing in apparent distress as it moved immediately to the adjacent tree crown.

During the same three-day period, the study group visited 10 trees to feed on leaves, but on none of these occasions was any agonistic behavior observed. This suggests clearly that the agonistic behavior was motivated primarily by the perceived nutritional value of the food item. The local field assistant, Adriano Rodrigues, reported that the adult male repeatedly displaced the juvenile during visits to fruiting trees in November 2012, although similar behavior was not observed during December, which was marked by a birth and atypical behavior patterns (see Correia et al., 2013). Overall, then, while the number of events was small, the adult male appeared to be the dominant member of the group, and the juvenile, the most subordinate.

Discussion

With a few exceptions (see e.g., Cäsar et al., 2008), agonistic behavior in titi monkeys (including *C. coimbrai*) is generally limited to intergroup encounters or interactions between same-sex adults in the context of dispersal from the natal group (Fernandez-Duque et al., 2000; Bicca-Marques and Heymann, 2013). The present study group is unusual for a number of reasons, however, including the fact that all the members were probably siblings, rather than parents and their offspring (the female and juvenile were born into the study group to the same parents, and the adult male was present as a nonbreeding member when monitoring began). The group had been monitored more or less continuously since the second half of 2009, and a large body of data has been collected on the composition of its diet (Souza-Alves *et al.*, 2011; Souza-Alves, 2013). While fruit is a major component, its contribution may decline considerably during some dry season months. 2012 represents the second of two consecutive La Niña years, during which

severe droughts were recorded in northeastern Brazil and appeared to greatly reduce the availability of fruit at the study site, both in general, and during the dry season, in particular. Disputes for access to food items were never observed during the first two years of monitoring, when the composition of the group was more typical, i.e., a breeding pair and their offspring. While the sum of the evidence indicates that resource scarcity during an atypical dry season was a primary factor determining the observed agonistic encounters, it remains unclear whether and to what extent the composition of the group may have contributed.

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References

Baião, S. A. A. 2013. Macaco guigó (*Callicebus coimbrai*): dispersão de sementes e conhecimento ecológico na Mata Atlântica de Sergipe. MSc thesis, Universidade Federal de Sergipe, São Cristovão, Brazil.

Bicca-Marques, J. C. and Heymann, E. W. 2013. Ecology and behavior of titi monkeys (genus *Callicebus*). In: *Evolutionary Biology and Conservation of Titis, Sakis, and Uacaris*, L.M. Veiga, A.A. Barnett, S.F. Ferrari and M.A.Norconk (eds.), pp. 196–207. Cambridge University Press, Cambridge.

Cäsar, C., Franco, E. S., Soares, G. C. N. and Young, R. J. 2008. Observed case of maternal infanticide in a wild group of black-fronted titi monkeys (*Callicebus nigrifrons*). *Primates* 49: 143–145.

Correia, F. B. A., Baião, S. A. A. and Ferarri, S. F. 2013. Dysfunctional parenting behavior in a male titi (*Callicebus coimbrai)*. II Congresso Latino Americano de Primatologia/XV Congresso Brasileiro de Primatologia, Recife, Brazil.

Fernandez-Duque, E., Valeggia, C. R. and Mason, W. A. 2000 Effects of pair-bond and social context on male–female interactions in captive titi monkeys (*Callicebus moloch*, Primates: Cebidae). *Ethology* 106: 1067–1082.

Martin, P. and Bateson, P. 1993 *Measuring Behavior: an Introductory Guide*. Cambridge University Press, Cambridge.

Santana, M. M. 2012. Comportamento, dieta e uso de espaço em um grupo de guigó-de-Coimbra (*Callicebus coimbrai* Kobayashi &Langguth, 1999) no RVS Mata do Junco, Capela-SE. MSc thesis, Universidade Federal de Sergipe, São Cristóvão, Brazil.

Souza-Alves, J. P. 2013. Ecology and life-history of Coimbra-Filho's titi monkeys (*Callicebus coimbrai*) in the Brazilian Atlantic Forest. Doctoral dissertation, Universidade Federal da Paraíba, João Pessoa, Brazil.

Souza-Alves, J. P., Fontes, I. P., Chagas, R. R. D. and Ferrari, S. F. 2011. Seasonal versatility in the feeding ecology of a group of titis (*Callicebus coimbrai*) in the northern Brazilian Atlantic Forest. *Am. J. Primatol.* 73: 1199–1209.

Souza-Alves, J. P. and Ferrari, S. F. 2012. Unwanted homecoming: an adult male titi (*Callicebus coimbrai*) returns to its natal group. XXIV Congress of the International Primatological Society, Cancún, Mexico.

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 (Dionivá), whereas G3 was composed of one adult male (Morfeu), two adult females (Caraya and