Hybridization in Free-Ranging Callithrix flaviceps and the Taxonomy of the Atlantic Forest Marmosets

Marmosets of the genus Callithrix are usually placed in two species groups on the basis of their morphology and distribution: The Callithrix argentata and the Callithrix jacchus groups. The tufted-ear marmosets, Callithrix jacchus, C. aurita, C. flaviceps, C. geoffroyi, C. penicillata consisting only of hybrids were not observed. In Santa Teresa as C. penicillata, which Hershkovitz (1977) considered to be a C. flaviceps x C. geoffroyi hybrid. Groups composed of individuals appearing to be C. flaviceps x C. aurita hybrids were observed at two localities in forest fragments near Carangola. Some of the individuals were similar in coloration to either C. flaviceps or C. aurita, while the majority exhibited intermediate patterns. A group with similar intermediate color patterns.
was observed in Ipanema, about 10 km from the Estação Biológica de Caratinga, where *C. flaviceps* has been studied by Ferrari and Diego (1992).

The formation of reproductive mixed groups and the production of hybrids between *C. geoffroyi* and *C. flaviceps* indicates that reproductive isolation is incomplete. Nonetheless, the presence of apparently non-hybrid groups next to the hybrids suggest that genetic interchange is reduced, indicating a degree of reproductive isolation consistent with the view of these two forms as distinct species. This is reinforced by the aberrant color patterns of the *C. flaviceps* x *C. geoffroyi* hybrids, which possibly resemble an ancestral phenotype. The existence of reproductive groups apparently composed entirely of hybrids of *C. flaviceps* with *C. aurita* with intermediate color patterns suggests that reproductive barriers between these two forms are less well defined than those between *C. flaviceps* and *C. geoffroyi*. The closer phylogenetic proximity between *C. flaviceps* and *C. aurita* in relation to other *C. jacchus* group forms has been pointed out by Hershkovitz (1977) and Natori (1986), supporting Coimbra-Filho’s (1990) position that they are forms of the same species and the suggestion of Rylands et al. (1993) for a new grouping: the “Aurita group” (*C. aurita* and *C. flaviceps*) and the “Jacchus group” (*C. jacchus*, *C. kuhli*, and *C. geoffroyi*). My analyses of the vocalizations of the traditional *C. jacchus* group are consistent with this grouping, but stronger evidence may be required to justify treating the “Aurita group” as a single species and the new “Jacchus group” as four species.

I agree with Marroig (1995) that natural hybridization in itself does not justify classifying the *Callithrix* forms as subspecies. However, the present data demonstrate that there are different degrees of reproductive isolation among neighboring forms of the *C. jacchus* group and across different hybrid zones. Genetic studies on hybrids and neighboring populations are needed. Unfortunately, habitat destruction in eastern Brazil has been a serious problem for the native marmoset population and makes these kinds of studies sometimes extremely difficult to conduct.

Perhaps the controversy about *Callithrix* will persist despite our efforts to understand the phylogeny and taxonomy of these primates. I believe that the debate is, in fact, very useful in that it has stimulated new research in comparative morphology, biogeography, genetics, behavior and ecology, and has been a driving force in the development of our knowledge of these marmosets.

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**TERRESTRIAL TRAVEL IN MURIQUIS (BRACHYTELES ARACHNOIDES) ACROSS A FOREST CLEARING AT THE ESTAÇÃO BIOLÓGICA DE CARATINGA, MINAS GERAIAS, BRAZIL**

Muriqui monkeys (*Brachyteles arachnoides*) have been the subjects of systematic studies at the Estação Biológica de Caratinga (EBC) in Minas Gerais, Brazil, since 1983 (Fonseca, 1983; Strier, 1986, 1992; Mendes, 1990, 1995; Odalila Rímoli, 1992; Rímoli, 1994; Nogueira, 1996). As in many other populations, the EBC muriquis are confined to a protected tract of forest isolated from other forest patches by pasture and fields (Strier and Fonseca, in press). Over the years, researchers have occasionally observed members of the main study group descend to the ground to cross gaps in the canopy or to drink or feed within the forest (Valle et al., 1984). Observations of quadrupedal terrestrial travel have increased over the years as the group has become more habituated to the presence of researchers in remote parts of the forest (Strier, 1992). Nevertheless, it is still rare for muriquis to travel more than a few meters on the ground before climbing back into the canopy, where they spend most of their time and where, until recently, all of their long distance travel occurred.

On 18 November 1996, a subgroup of 41 individuals belonging to the 59 member main study group was monitored as it crossed an open clearing in the forest measuring 20 meters in width. Researchers had been accompanying the muriquis in a part of the forest they seldom use. After a long rest period, the muriquis started to travel until they reached the edge of the open clearing. They stopped suddenly at the forest edge, and began to embrace one another while vocalizing in a prolonged display. Their display was typical of their response during tense situations, such as intergroup encounters (Valle et al., 1984; Strier, 1992) or the proximity of potential predators (Printes et al., 1996). Adults of both sexes participated in the display, which persisted for 39 minutes without pause.

At 1220 h, AR, the only adult female in the subgroup without an infant, was identified at the other side of the clearing although she had not been observed to cross it. She emitted a series of long neighs, which were answered by other members of the group from the far side of the clearing. At 1259 h, CL, one of the oldest adult males present, descended to the ground and walked (quadrupedally) across the 20 m clearing. The rest of the subgroup followed after him in a single line. The sequence of the progression following him was: nine other adult males, then the other 12 adult females with their infants and juveniles, and the last two adult males in the subgroup at the rear. Once the muriquis reached the trees on the far side of the clearing, they resumed traveling in the direction they had originally been heading.

Such a progression is not exceptional, for muriquis at the EBC commonly travel in a single file through the canopy when they are moving rapidly from one part of the forest to another, or when they descend to the ground between adjacent trees. It is also common for older adult females or males to take the lead in group movements, as they did when they crossed the clearing.

Adults are usually active participants during displays toward potential threats. They may have displayed at the clearing in the same way they respond to other threats because they were surprised to discover such an extensive gap in the forest, or because they perceived their vulnerability to predators if they were to cross such an open expanse. Despite their obvious tension, the fact that they ultimately crossed the clearing instead of returning by safer arboreal routes to where they had previously been suggests that foraging needs may have outweighed these other concerns.

The risk of attack from terrestrial predators may be high for muriquis traveling long distances on the ground, particularly in rural areas where semi-feral dogs frequently hunt. The only other report of long distance terrestrial travel we know of for muriquis involved a solitary female from the Rio Casca population, whose only dispersal option from her natal group required her unsuccessful attempt at crossing a pasture to reach a different forest tract (Lemos de Sá, 1988).

Although the EBC muriquis were evidently disturbed when they reached the forest clearing, the fact that this large social unit traversed an expanse of ground may be indicative of their potential to move between forest patches to increase the area of forest available to them. As protected populations such as that at the EBC expand in size (Strier, 1996), such terrestrial movements may permit them to colonize new forests.

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