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Interspecific association between two primate species in an urban park

Associação interespecífica entre duas espécies de primatas em um parque urbano

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Abstract

As with Amazonian primates, mixed associations between species in the Atlantic Forest are also influenced by ecological factors. However, Atlantic Forest primates may face additional challenges, such as isolation pressures and fragmentation of forest habitats, which may increase the frequency of these arrangements. The main of this work is to report a sympatry with possible interaction between individuals of two species of primates of the Pitheciidae and Callitrichidae families: *Callicebus nigrifrons* (Spix 1823) and *Callithrix aurita* (É. Geoffroy Saint-Hilaire 1812) in an urban park in the south of the state of Minas Gerais. Individuals were observed interacting during foraging and displacement. The association of individuals of the two species can be explained by the low quality of the forest fragment, as it can increases the chances of obtaining food resources and configures a dilution strategy against predator attacks.

Keywords: Neotropical primates; Mixed-species troops; Atlantic Forest; Callitrichidae; Pitheciidae.

Resumo

Assim como ocorre com os primatas amazônicos, as associações mistas entre espécies na Mata Atlântica também são influenciadas por fatores ecológicos. No entanto, os primatas da Mata Atlântica podem enfrentar desafios adicionais, como pressões de isolamento e fragmentação de *habitats* florestais, que podem aumentar a frequência desses arranjos. O objetivo deste trabalho é apresentar um relato de simpatia com possível interação entre indivíduos de duas espécies de primatas das famílias Pitheciidae e Callitrichidae: *Callicebus nigrifrons* (Spix 1823) e *Callithrix*

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aurita (É. Geoffroy Saint-Hilaire 1812) em um parque urbano no sul do estado de Minas Gerais. Foram observados indivíduos interagindo durante o forrageio e deslocamento. A associação de indivíduos das duas espécies pode ser explicada devido à baixa qualidade do fragmento florestal, pois pode aumentar as chances de obter recursos alimentares e configura uma estratégia de diluição de contra-ataques de predadores.

Palavras-chave: Primatas neotropicais; Tropas de espécies mistas; Mata Atlântica; Callitrichidae. Pitheciidae.

Introduction

Considered a global biodiversity hotspot, the Brazilian Atlantic Forest has only 28% of its original coverage, in a highly fragmented landscape, due to the impacts from agriculture expansion and urbanization.[1-2] Specialists and forest-dependent primates[3] are among the species most affected by the forest fragmentation and habitat transformation in the biome,[4] representing one of the most threatened groups in the Atlantic Forest.[5]

The primates' species occurring in the Atlantic Forest remnants are isolated and their populations exhibit behaviors related to this pressure.[6-7] Territorial patterns can change when primate species are confined to small forest fragments, and the dynamic to dispute and share resources is strongly impacted.[8] In this context, the formation of mixed-species groups increases the chances of obtaining food resources and provides a dilution effect against predators' attack.[9-10] The interspecific associations can also increase the susceptibility to infection and disease transmission.[11]

Interspecific interactions have already been reported among Amazonian primates,[12-14] with study approaches linked to ecological processes and the cost-benefit of these arrangements.[13,15-17,36] Mixed primate's associations have been less or uncommon reported in the Atlantic Forest, and few studies discussed biogeographic aspects of this type of interaction.[18]

Two Brazilian primate endemic species, the black-fronted titi monkey *Callicebus nigrifrons* (Spix 1823) and the buffy-tufted-ear marmoset *Callithrix aurita* (É. Geoffroy Saint-Hilaire 1812) are recognized as part of mammalian regional community, being *C. aurita* endemic of the Atlantic Forest.[19] The buffy-tufted-ear marmoset is classified as endangered locally and globally[20-21] and black-fronted titi monkey diverge its classification locally at least concern and globally as near threatened; both have decreasing populations in Brazil.[20,22]

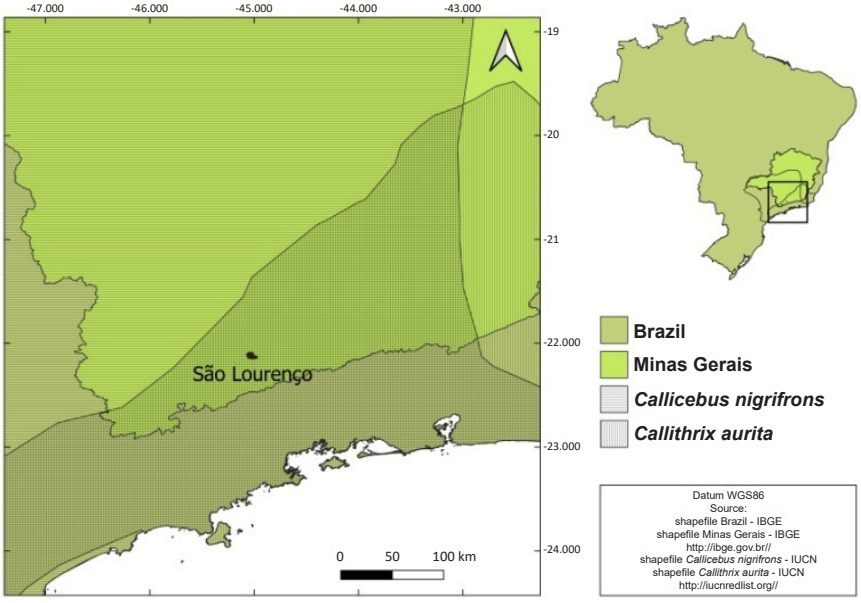
The two species occur in sympatry at the most different conservation conditions from parks and protected areas to secondary forest fragments and nearby urbanized areas.[23-24] Here, we report a sympatry and possible interspecific association between individuals of *C. nigrifrons* and *C. aurita* in Parque das Águas de São Lourenço, Minas Gerais State, Brazil.

Material and Methods

The Parque das Águas (22° 06' 61" S and 45° 03' 03" W) is located in the urban area of the municipality of São Lourenço (Figure 1) in the Rio Verde River basin. It is a tourist site made up of approximately nine mineral water springs that were formerly used for commercialization. Currently, this park has 43 hectares of land open to the public for visitation and leisure, with the remaining vegetation occupying 18 hectares and is characterized as an Atlantic Forest biome with secondary growth of dense Ombrophylous Forest.

The mixed-troop consisted of three individuals of *C. nigrifrons* and two individuals of *C. aurita* (Figure 2). The group cannot be registered in photo all together, due to their rapid movement. The record of the interaction was made in September 15 2015, between 13:00h and 14:00h. We used the *ad libitum* method[25] to describe the behaviors and interactions.

Figure 1 - Localization of municipality of São Lourenço, Minas Gerais State, Brazil, with the range distribution of *Callithrix aurita* and *Callicebus nigrifrons*.



Source: the authors.

Results and discussion

We observed a stratification mechanism during foraging. *Callicebus nigrifrons* was observed foraging from medium stratum to the ground, while *Callithrix aurita* was foraging from medium stratum to the canopy. Although they moved together, these species may use different types of locomotion patterns, substrates and heights, suggesting a form of spatial segregation.[26] The group made up of individuals of these two species foraged together for a period of one hour, in the edge of the forest. A mechanism of shared defense was also registered, in which the individual of *C. aurita* emitted an alarm call to park visitors that was arriving. There was no record of agonistic interactions between individuals of the two species during the follow-up, and the shortest distance between species was recorded during the joint movements.

Figure 2 - Photo record of specimens in posture, face profile, and full body from buffy-tufted-ear marmoset (left) and black-fronted titi monkey (right).

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Continuation

Source: the authors (photos by Marcelo Okamura Arasaki).

In addition to this vertical stratification in the form of foraging, these species exhibit slightly different feeding strategies,[27-29] which makes overlapping home ranges possible. In this way, a low competitiveness for resources between species can be observed, which fits with the absence of agonistic interactions between the species recorded here. On the other hand, both species are "confined" in a reduced space, which could restrict resources and promote competition, especially in an environment with strong levels of anthropization. Although, the socialization in primates is an efficient way to overcome the pressure of the environment.[30]

Mixed associations can be considered adaptations to achieve an optimal balance between protection from predators and better feeding efficiency.[31] For callitrichids, the proportion between the body mass of species in association explains the establishment of mixed groups.[32] Similar body weights dictate a similar feeding ecology, with a lot of competition to allow stable associations.[13]

Both species occur naturally in higher densities, which explains the association.[33-34] However, mixed associations in primates require a high energy cost, as a large group depletes food resources faster, requiring more travelling.[10] This is supported by the increased rate of spatial movement between partner species in a mixed primate association.[35]

The associations between primates are explained by the cost-benefit of living in groups and dilution effect. These associations seem to occur in ecosystems with a wide variety of habitats, rarely being found in primary forests.[37] In addition, the attributes of the landscape such as the habitat connectivity and isolation can determine the strategies of the local assemblies. It is notable that the isolation condition of the Parque das Águas is the main pressure between these species to increase

long-term persistence. This is the mechanism possibly linked to the formation of the primates mixed associations.

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