

# Home Range and Group Composition of Wild Hybrid Marmosets in an Urban Forest Fragment

## Área de Vida e Composição de Grupos de Saguis Híbridos Selvagens em um Fragmento de Floresta Urbano

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### Abstract

In this study, the home range and social composition of two groups of hybrid marmosets in an urban forest fragment were reported. The georeferenced positions of two groups of hybrid marmosets (G19 and G50) were recorded by the Instantaneous Scan Sampling method, every 15 minutes during 11 months, at Viçosa town, Minas Gerais, Brazil. The home range was estimated at 2.51 ha and 3.98 ha, respectively for group G19 and G50, by the minimum convex polygon method. The G19 group presented a mode of eight individuals (variance was from 7 to 11), while G50 group presented a mode of six individuals (variance was from 5 to 7). Hybrid marmosets presented a home range size similar to the ones recorded for *Callithrix jacchus* and *C. penicillata*. The size of the groups is in agreement with that reported for the genus *Callithrix*. This is the first description of hybrid marmosets' home range.

**Keywords:** Callithrichidae. Ecology. Home Range. Urban Forest Fragment.

### Resumo

Neste estudo, relatamos a área de vida e a composição social de dois grupos de saguis híbridos em um fragmento de floresta urbana. As posições georreferenciadas de dois grupos de saguis híbridos (G19 e G50) foram registradas pelo método de amostragem de varredura instantânea, a cada 15 minutos durante 11 meses, na cidade de Viçosa, Minas Gerais, Brasil. A área de vida foi estimada em 2,51 ha e 3,98 ha, respectivamente para os grupos G19 e G50, pelo método do polígono convexo mínimo. O grupo G19 apresentou moda de oito indivíduos (variância de 7 a 11), enquanto o grupo G50 apresentou moda de seis indivíduos (variância de 5 a 7). Os saguis híbridos apresentaram um tamanho de área de vida semelhante aos registrados para *Callithrix jacchus* e *C. penicillata*. O tamanho dos grupos está de acordo com o relatado para o gênero *Callithrix*. Esta é a primeira descrição da área de vida de saguis híbridos.

**Palavras-chave:** Callithrichidae. Ecologia. Área de Vida. Fragmento Urbano Florestal.

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### 1 Introduction

Hybrid marmosets may threaten marmoset species with “pure” genotypes by reproducing and establishing in their original distribution areas (MALUKIEWICZ *et al.*, 2015). Three pure marmoset species (*Callithrix jacchus*, *C. penicillata*, and *C. geoffroyi*) were introduced in Viçosa city (state of Minas Gerais, Brazil), resulting in interbreeding, turning it in a hybrid zone. Hybrid marmosets have replaced pure genotypes of native species - *C. aurita*, whose population is rare nowadays (FUZESSY *et al.*, 2014; MALUKIEWICZ *et al.*, 2015; VITAL, 2017).

Only a few studies report the ecology of hybrid *Callithrix* groups (e.g., FRANCISCO *et al.*, 2014), which is a challenge for the wild primates management. Ecological studies are urgently necessary due the increased hybridization between marmoset species and the accelerated destruction of Atlantic Forest and Cerrado biome (MALUKIEWICZ *et al.*, 2015). For example, it is not known whether hybrid marmosets occupy larger areas such as *C. geoffroyi* (PASSAMANI, M.,

RYLANDS, 2000) or whether they can occupy smaller areas such as *C. jacchus* (CASTRO, 2003). The home range is the area used by an individual or group during their daily activities, which can vary according to the availability of resources, predation pressure, species-specific dispositions, and group composition (NILSEN *et al.*, 2008). While some species of the genus *Callithrix* live in large groups of up to 15 individuals (eg, *C. penicillata*, SILVA, 2008), others live in much smaller groups (eg, *C. geoffroyi*, PASSAMANI, RYLANDS, 2000). These characteristics have direct implications for understanding the ecology of hybrid marmosets, and planning future management strategies.

It is necessary a basic knowledge about ecology such home range and group composition to understand how the adaptation of these hybrids to urban environment is. This study is a contribution to start a cumulative understanding of hybrid marmoset ecology. Therefore, it is described herein the home range size and group size of hybrid marmosets living in an urban forest fragment.

## 2 Material and Methods

### 2.1 Study site

The study site was a 75-hectare urban forest fragment called Mata da Biologia (MB), located inside the campus of the Federal University of Viçosa - UFV (20° 45 '14 "S; 42° 52' 53" W). In this area, there are 56 houses along a paved road (Vila Gianetti) fragment. The Atlantic forest remnant at MB is a highly disturbed semideciduous seasonal forest under the process of natural regeneration (PAULA *et al.*, 2002). Inside the forest fragment, there are some exudative trees such as *Plinia trunciflora* and *Anadenanthera peregrina* var. *peregrina*. It also comprises many introduced fruit trees, such as guava (*Psidium* sp) mango (*Mangifera* sp), banana (*Musa* sp), and citrus trees.

### 2.2 Subjects of the study and sampling effort

Two groups were observed of hybrid marmosets, called G19 and G50, with phenotypic characteristics intermediate between *Callithrix jacchus* X *C. penicillata* X *C. geoffroyi* (Fig. 1a, 1b), as described by FUZESSY *et al.*, 2014). Reproductive female marmosets have a preponderant role in the group activity and cohesion (STEVENSON; RYLANDS, 1987). Thus, it was decided that they would be the social unit and would indicate the group center where the attention should be focused for observations. To estimate the home range, marmosets were observed by the Instantaneous Scan Sampling Method (ALTMANN, 1974), every 15 minutes, in the afternoon or morning shift, for 11 months, totaling 68 hours of observations for the G19 and 66 hours for the G50. At each snapshot, the position was recorded of the reproductive female with a GPS (eTrex; Garmin, USA) and the number of individuals around the female. The geographical points captured by the GPS were plotted and analyzed with the Excel software, GPS TrackMaker, and Google Earth software.

To estimate the groups home range area (express in hectares = ha) a minimum convex polygon was created (MPC) by connecting the points at the reproductive female edges (JENNRICH; TUNER, 1969). The study was approved by the Federal University of Viçosa Ethics Committee in Animal Use (number: 89/2011) and the Brazilian Institute of Environment and Natural Resources (SISBIO/ ICMBio, protocol number: 28632-1).

**Figure 1a** - Reproductive female of the G19 group (*C. penicillata* x *C. jacchus*). **1b**: Reproductive female of the G50 group (*C. penicillata* x *C. geoffroyi*)



Source: Authors

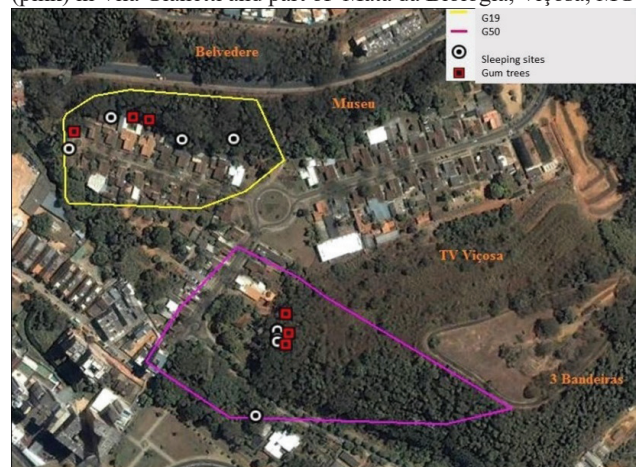
## 3 Results and Discussion

It was observed a variation in the groups composition. G19 group presented a mode of 8 individuals and varied between 7 to 11 marmosets during the study, while G50 presented a mode of 6 marmosets and varied from 5 to 7 individuals.

The observed group sizes are in line with literature reports for groups of the *Callithrix* genus, which varies from 3 to 15 individuals (STEVENSON; RYLANDS, 1988). The variations in size and composition of *Callithrix* sp. groups are common due the infants' birth, disappearances, and frequent migrations (DIGBY; FERRARI, 1994; PONTES; CRUZ, 1995). This group dynamics was similar to what was observed in this study, with four births, two individual migration, and a disappearance.

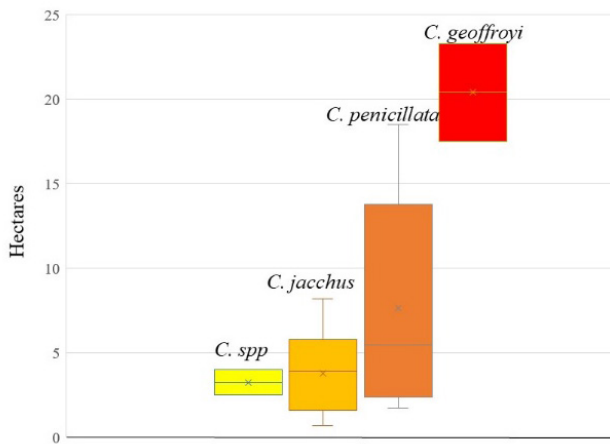
G19 presented a total home range of 2.51 ha, while G50 of 3.99 ha (Figure 2). Because of the limited availability of data on hybrid marmosets and groups of *C. geoffroyi*, it was chosen to run a descriptive statistical analysis. An Exploratory Data Analysis (MEDRI, 2011) was run, visually comparing how the home range averages of each species and hybrid marmosets are plotted on a graph (Figure 3).

**Figure 2** - Home range area of the groups G19 (yellow) and G50 (pink) in Vila Gianetti and part of Mata da Biologia, Viçosa, MG



Source: Google Earth

**Figure 3** - Average of home-range distribution of the marmosets' species *Callithrix jacchus* (6 studies), *C. penicillata* (7 studies), *C. geoffroyi* (2 studies), and hybrid marmosets (*C. jacchus* X *C. penicillata* X *C. geoffroyi*). Data from Vila Gianetti area and part of Mata da Biologia, Viçosa, MG



Source: Authors

In this study, the hybrid marmosets have a closer home-range to the pure species *C. jacchus* and *C. penicillata* (Figure 3) than marmosets of the pure species *C. geoffroyi* (*C. jacchus*: HUBRECHT, 1984; SCANLON *et al.*, 1989; PONTES; CRUZ, 1995; DIGBY; BARRETO, 1996; CASTRO, 2003; PINHEIRO; PONTES, 2015. *C. penicillata*: FONSECA *et al.*, 1980; FONSECA; LACHER, 1984; FARIA, 1986; MIRANDA; FARIA, 2001; SILVA, 2008; VILELA; DEL CLARO, 2011; SANTOS *et al.*, 2014. *C. geoffroyi*: PASSAMANI; RYLANDS, 2000; ROCHA; PASSAMANI, 2009).

More exudativorous species such as *C. penicillata* and *C. jacchus* have smaller home ranges when compared to more frugivorous species such as *C. geoffroyi* (CASTRO, 2003; RYLANDS *et al.*, 1993). The anatomical conformation of jaws and dentition of *C. jacchus* and *C. penicillata* allow them to exercise more traction and mobility to make holes in tree barks to explore gums in resinous trees (VINYARD *et al.*, 2009). These morphological and functional characteristics reflect in a more independent diet because they are less impacted the unstable seasonal disposition of fruits and insects.

Vegetal exudates are obtained by the daily scarification caused by marmosets and appear to be available throughout the year, without major fluctuations, but depends on the tree phenology (STEVENSON; RYLANDS, 1987).

Three gum trees were identified (*A. peregrina*) in the home range of each studied group, including sleeping trees close to these food sources (Figure 1). The active use of trees with exudates made by marmosets seems to be bimodal, that is, trees are visited twice a day to obtain exudates (SILVA, 2008). Marmosets that are highly dependent on exudates as a food source are believed to remain close to exudates trees for use and surveillance against neighboring groups. Therefore, active exploitation by means of scarification of some trees allows highly exudative species, such as *C. jacchus* and *C.*

*penicillata* to maintain smaller home ranges (VINYARD *et al.*, 2009). The hybrid marmosets of this study show an exudate consumption behavior similar to *C. jacchus* and *C. penicillata*.

It was observed that each group attended daily wooden platforms with food scraps or bananas provided by people who visit Vila Gianetti (FUZESSY *et al.*, 2014). Additionally to the exudate trees use, the fruits availability and the food supplementation provided by people may also have influenced the space used by the studied hybrid groups.

*C. jacchus* and *C. penicillata* species are tolerant to degraded environments such as secondary forests and prefer forest edges (STEVENSON; RYLANDS, 1987). The fragments of urban forests in Viçosa (MG) are highly disturbed forest patches (PAULA *et al.*, 2002), with narrow edges (Figure 2). The species *C. jacchus* and *C. penicillata* seem to adapt better than other species of marmosets in disturbed environment, which is a characteristic present in the hybrid marmosets that was observed herein. Many studies have reported that marmosets of the species *C. jacchus* and *C. penicillata* seem to be more tolerant to human activity and often exploit food provided by people or fruits from domestic fruit trees (STEVENSON; RYLANDS, 1987; LEITE *et al.*, 2011). On the contrary, studies with marmoset of the species *C. geoffroyi* suggest a feeding activity more independent of human sources (STEVENSON; RYLANDS, 1987; PASSAMANI; RYLANDS, 2000), using food sources from native trees and distant from human activity. The hybrid marmosets in this study seem to follow the pattern of the species *C. jacchus* and *C. penicillata* with food exploitation and association with human activity.

G19 and G50 groups are not isolated, as their home ranges are in contact with the other four hybrid marmoset areas. Equally reported in other studies (HUBRECHT, 1984; STEVENSON; RYLANDS, 1987), it is believed that the presence of neighboring groups may have also contributed to the small size of the home range. It was not observed overlapping with other groups in the G50 area, but it was observed that the G19 area overlapped with the groups called "Belvedere" and "Museu" (Figure 1). It was observed the G19's marmosets in agonistic interactions with the "Museu" group, suggesting disputes over territories (personal observation).

#### 4 Conclusion

The home range of the hybrid marmosets in this study were more similar to the home ranges of *C. jacchus* and *C. penicillata* than other species of the same genus. The size of the groups is in agreement with that reported for the genus *Callithrix*. This study presents the first description of the hybrid marmosets' home range, which have expanded to areas where original pure species are distributed.



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