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FIRST OBSERVATIONS OF TERRESTRIAL TRAVEL FOR OLALLA'S TITI MONKEY (*CALLICEBUS OLALLAE*)

Jesús Martínez
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Introduction

Primates are characterized by a morphology and anatomy that clearly shows adaptations for an arboreal life including climbing, brachiating and swinging abilities (Chivers, 1991). Marked terrestrial habits are present in some Catarrhini members such as *Mandrillus*, *Papio* and *Macaca* in the Old World. Observations of terrestrial behaviors were also reported for some essentially arboreal Neotropical primate species such as *Alouatta*, *Cebus*, *Ateles* and *Brachyteles* to obtain some food, water or minerals and/or for geographic dispersion (Dib *et al.*, 1997; Emmons, 1999; Mandujano *et al.*, 2004; Almeida Silva *et al.*, 2005; Campbell *et al.*, 2005; Mourthe *et al.*, 2007; Pozo-Montuy & Serio-Silva, 2007). This last point is very important in fragmented forest habitats where monkeys move on the ground to reach new patches of forest but in so doing expose themselves to increased predation risks. As such, increases in forest fragmentation may affect primate conservation and survival beyond just the immediate effects of habitat loss.

Olalla brother's titi monkey (*Callicebus olallae*) has one of the most restricted distribution ranges of Neotropical primate species inhabiting a small naturally fragmented forest-savanna area in the southwestern portion of the Beni department in Bolivia, almost exclusively within the riverine forest of Yacuma River. Initial work on this species concentrated on their distribution, demography and taxonomy (Barreta *et al.*, 2007; Felton *et al.*, 2006; Lopez-Strauss & Wallace, in prep; Martínez & Wallace, 2007). To better understand the ecological requirements of this primate a behavioral ecology survey was initiated in 2007. In this note we present a series of observations concerning terrestrial movements of these monkeys obtained during this study.

Methods

The study site was at La Asunta, a cattle ranch located along the Yacuma River where, according to previous distributional knowledge, a number of *C. olallae* groups occurred (Figure 1). Two general types of forest habitats are present: gallery and fragmented forest, with the latter more evident at greater distances from the river. In July 2007 two groups inhabiting gallery forest and fragmented forest respectively, were chosen for study. Primate observations were made from 06:30 to 18:00 h, searching for study groups at sunrise and then attempting to follow them all day. We registered places visited frequently by the groups in order to record resting, feeding and sleeping sites.

Results

Observations 1 and 2

Early on in the habituation phase, the original fragmented forest group of five individuals (Quinteto, Fig. 1) abandoned their territory when two groups one of squirrel monkeys (*Saimiri boliviensis*) and another of night monkeys (*Aotus azarae*) arrived in the forest patch. Individuals of this group were observed travelling to and between

several of the forest patches adjacent to their original site, covering distances by ground of 5 to 20 m. During these displacements, the titi monkeys remained some time at the edge of the forest before jumping to the ground and jumping quickly with arms and legs moving together and the tail lifted. Upon reaching the adjacent forest patch the leading titi monkey, usually the adult male, waited for the rest of the group in a tree on the edge of the patch before together moving off in the forest.

Similar observations were recorded for gallery forest group (Rio group, Fig. 1) following the burning of a grassland area next to the forest, which forced the two adult individuals of the group to search for a new territory. The two monkeys were observed travelling along the ground between forest patches covering greater distances than in the previous case (around 40 m) due the isolation of forest islands although they looked for forest connections to avoid the ground whenever possible.

Observation 3

As the original groups mentioned in observations 1 and 2 were not yet habituated, other groups were selected for study in fragmented and gallery forests, Pistero and

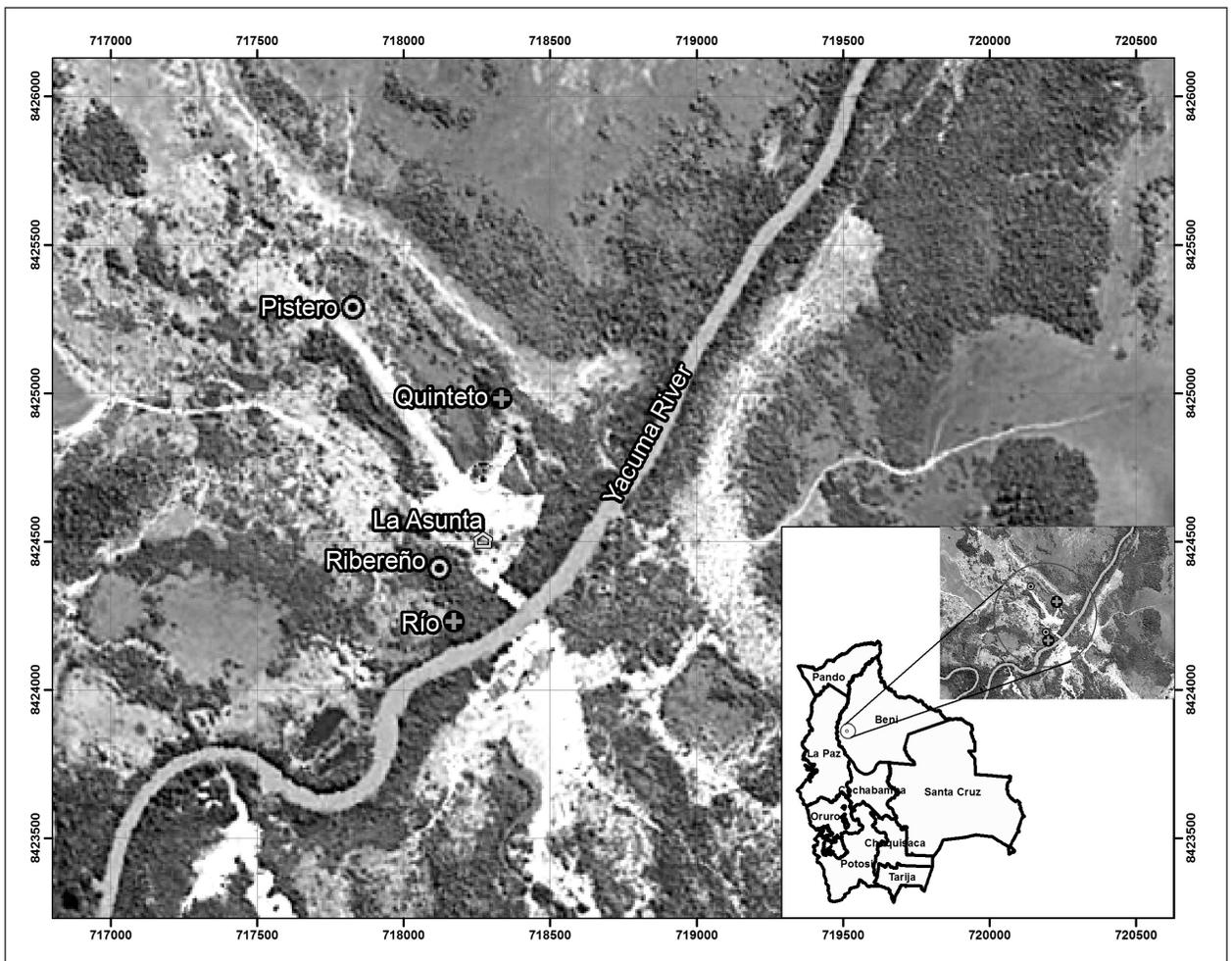


Figure 1. Location of La Asunta and observed *Callicebus olallae* groups.

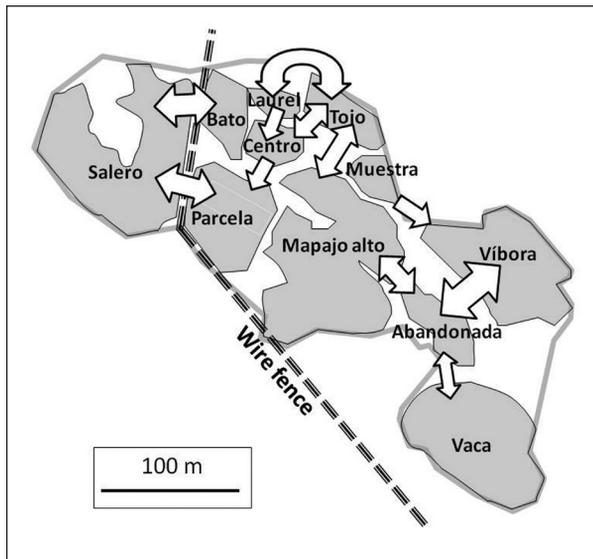


Figure 2. Map of the Pistero groups territory including reported terrestrial travel routes between forest fragments.

Ribereño, respectively. The Pistero group inhabited a highly fragmented forest area consisting of several forest islands located near each other including three larger islands. Initially, this group was observed in the largest forest patch with the highest trees and this was assumed to be the group's entire home range. However, during the course of the study we observed the group in neighboring and isolated forest islands accessible only by ground displacements (Figure 2). Terrestrial displacements were first confirmed when the group was spotted moving along a wire fence located in the middle of the group territory dividing two cattle camps. When terrestrial the monkeys showed the same jumping style of movements previously described. In total, we obtained 100 observations of these terrestrial movements from September 2007 to March 2008. The mean distance covered was 10 m (DS=4; range 5–16 m), and although these displacements represent a low proportion of the total movement records (7%), it is significant for a Neotropical primate. Finally, of 11 sites where terrestrial movements were reported in the Pistero group territory, in all except three cases the movements were in both directions (see white arrows in Fig. 2).

Conclusions

Titi monkeys are arboreal and previous studies on the diverse *Callicebus* genus show very low percentages of activities made at ground level related principally to individuals playing, falling and casual predation of insects (1%, Kinzey, 1981). According to their distribution, most of the *Callicebus* species inhabit continuous forest areas with high vegetation density (Anderson, 1997; Hershkovitz 1990; Martínez & Wallace, 2010; Van Roosmalen *et al.*, 2002). The naturally fragmented forest-savanna inhabited by *C. olallae* (Martínez & Wallace, 2007) clearly necessitates frequent terrestrial travel during ranging behavior, as was previously suggested by Felton and colleagues (2006) and confirmed

by our observations. Even if individuals inhabit large continuous forest areas, eventually they may need to travel terrestrially to look for new areas when they reach sexual maturity and form new groups (Kinzey, 1981; Wright, 1986). In all cases the monkeys travelled the shortest terrestrial route between neighboring forested areas showing an evident effort to reduce the predation risks associated with terrestrial travel. The first two observations where longer distances were covered must represent extreme risks given the small size of these primates and the diverse carnivore community associated with these forests. Indeed, when isolated small trees are on pathways to large forest areas, the monkeys climb them making their displacement in stages instead of passing directly from one forest patch to another.

In naturally fragmented habitats, terrestrial movements of monkeys may not always be related to terrestrial-based feeding or drinking behavior but also due to ranging requirements. As the world's forests become more fragmented due to human intervention these terrestrial movements may become more commonplace in primate species that normally occur in more continuous forests increasing exposure to predation risks.

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- males (Kowalewski and Garber, 2010; Di Fiore et al., 2011). Extragroup copulations (EGCs) have been reported for *A. arctoidea* (Agoramoorthy and Hsu, 2000), *A. canaya* (Kowalewski and Garber, 2010), *A. guariba clamitans* (Fialho and Setz, 2007), *A. palliata* (Glander, 1992), and *A. pigra* (Van Belle et al., 2008). EGCs in *Alouatta* spp. have been related to a female strategy to increase paternity confusion (both inside and outside the group) and decrease the risk of infanticide following alpha male takeover (Kowalewski and Garber, 2010) and to female choice of higher quality or unfamiliar males (Fialho and Setz, 2007). Considering that fertility and compatibility may vary among males, EGCs may also maximize the reproductive success of promiscuous females (Reeder, 2003). These hypotheses are not mutually exclusive.

Here we report seven EGCs between an adult male brown howler monkey (*Alouatta guariba clamitans*) from a group monitored from dawn to dusk during 26 days from January to July 2011 in a ca. 1-ha forest fragment (30°19'57"S, 51°00'47"W; ca. 45 m a.n.s.l.) in Itapuá District, Viamão, state of Rio Grande do Sul, Brazil, with an adult female from a neighboring group. In January, our study group was composed of six individuals: an adult male (Jorge), two adult females, one juvenile, and two infants. An adult female died electrocuted in a power line in March. In May, a birth increased group size to six individuals again. Also, the juvenile was classified as subadult and the infants as juveniles beginning this month. The neighboring group was composed of, at least, four individuals, including two adult males, an adult female (Jane), and a subadult male. We have no information about the degree of relatedness between individuals both within and between groups. The forest fragments that they inhabited are separated by a 20 m-wide dirty road.

Intergroup interactions were witnessed between April and July. These are described in chronological order below.

When Jorge reached the canopy, the neighboring adult males chased him back to the post. Jorge rubbed his chin at the post and was supplanted by a male. Then, the male also rubbed his chin in the same place, while Jorge observed him from the electric wire. When the adult male left the pole and returned to a place behind Jane in the canopy, Jorge attempted to approach her again and was once more chased by her male mates. Finally, Jorge went back to the other side of the road and his group left the border of the fragment.

June 22nd: At noon, all members of the study group ran to a strip of forest near the road. At 12:15, Jorge and the three males were howling at their home range borders. Jorge moved to the electric post at the other side using the cables and came back without trying to get closer to Jane. At 13:00, Jane crossed the road using the cable. Jorge unsuccessfully attempted to mate with her on the cable and they almost fell to the ground. After that, the couple

EXTRAGROUP COPULATIONS IN *ALOUATTA GUARIBA CLAMITANS*

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Howler monkeys often live in unimale-multifemale or multimale-multifemale cohesive groups in which the alpha male may monopolize estrus females, although females may mate promiscuously with subordinate and extragroup