








Ground Nesting Behavior of *Aotus griseimembra*: Rare Terrestrial Evidence in A Strictly Arboreal Species

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Resumen

Reportamos una observación novedosa del comportamiento de anidación en el suelo en una pareja de *Aotus griseimembra*, dentro de un parche sucesional de bosque interandino en Colombia. Este comportamiento, previamente no registrado para primates estrictamente arbóreos del género *Aotus*, desafía la comprensión convencional. Los monos exhibieron acciones típicas de la especie, pero buscaron refugio en el suelo, posiblemente influenciados por alteraciones del hábitat. Sus visitas al sitio de descanso en el suelo fueron monitoreadas y confirmaron la vulnerabilidad a depredadores y competidores en el parche de bosque. Estos hallazgos destacan la necesidad de nuevas investigaciones sobre las estrategias de respuesta de los primates neotropicales a los factores estresantes ambientales y la perturbación del hábitat

Palabras clave: Fragmentación del bosque, Monos nocturnos del Caribe, Primates neotropicales.

Abstract

We report a novel observation of ground nesting behavior in a couple of *Aotus griseimembra* within a successional inter-Andean Forest patch of Colombia. This behavior, previously unrecorded for strictly arboreal primates of the Genus *Aotus*, challenges conventional understanding. The monkeys exhibited typical species actions but sought refuge on the ground, possibly influenced by habitat alterations. Their visits to the ground sleeping site were monitored and confirmed the vulnerability to predators, competitors in the forest patch. These findings call the attention for further research into the response strategies of neotropical primates to environmental stressors and habitat disturbance.

Keywords: Caribbean Owl monkey, Forest fragmentation, Neotropical primates.

Neotropical primates are one of the most threatened mammal groups due to their ecology restricted to forest habitats (Alfaro *et al.*, 2015; Benchimol & Peres 2014; Túnez *et al.*, 2021). These populations in central and South America are declining as their ideal habitats are reduced by the expansion of agricultural frontiers, deforestation, pollution, and climate change (de Almeida *et al.*, 2017; Estrada *et al.*, 2017; Carvalho *et al.*, 2019). In response to these environmental stressors, Neotropical primates may exhibit behavioural changes in response to these new challenges (Jung *et al.*, 2015; Morelos-Juárez *et al.* 2015; Corrêa *et al.*, 2018). These changes include alterations in foraging strategies, social structures, and ranging patterns to cope with habitat fragmentation and resource scarcity (Schwitzer *et al.*, 2011; Estrada *et al.*, 2012; de Almeida *et al.*, 2017; Ramsay *et al.*, 2023). Additionally, shifts in reproductive behaviors and increased tolerance to human presence show an adaptive response to habitat disturbance (Tokuda *et al.* 2018; Mancini *et al.* 2023). While vulnerability increases over time due to habitat loss, some resilient species as *Sapajus nigritus* and *Alouatta guariba clamitans* underscore their capacity to persist in human-altered landscapes (Corrêa *et al.*, 2018; Tokuda *et al.* 2018).

Terrestrial behavior, recognized as those activities performed by primates on the ground rather than in trees, has been poorly studied in the Neotropics because most monkey species are highly associated with the forest canopy (Campbell *et al.*, 2005; Eppley *et al.*, 2016; Souza-Alvez *et al.*, 2019; Monteza-Moreno *et al.*, 2020; Eppley *et al.*, 2022). However, some patterns have been detailed, such as: (i) use of stones and sticks on the ground to open shelled fruits and extract insects in *Cebus* spp. (Waga *et al.*, 2006), use of waterholes during dry season (Freese 1978). (ii) Foraging behavior at terrestrial salt licks and waterholes in *Ateles* spp. and *Alouatta* spp. (Campbell 2005; Ferrari 2008; Link *et al.*, 2010, 2011). (iii) Ground vocalizations near highly degraded forests by *Aotus* spp. (Shanee & Shanee 2011). And finally, and more generally, (iv) road crossings by various groups of neotropical primates, that may result in roadkills (Praill *et al.*, 2023). However, no nesting or sleeping sites on the ground have been recorded before for strictly arboreal primates of the genus *Aotus*. Here we report an abnormal sleeping site behavior on the ground by *Aotus griseimembra* in the inter-Andean basin of Colombia.

During field trips from April 2 to May 2, 2024, we identified an adult pair of *Aotus griseimembra* in the Santa Lucia rural area, vereda La Rochela, Simacota, Santander, within the inter-Andean basin of the Mid-Magdalena River Basin, Colombia (latitude: 6°44'7.43" N, longitude: 73°52'14.34" W). These observations occurred in a successional forest patch surrounded by mixed grasslands and two nearby roadways at an elevation of 100 m.

The first observation occurred on April 4, 2024, at 09:59 h, when we detected the male at the forest boundaries on the ground, possibly altered by human presence. On April 8, 2024, at 12:47 h and 16:10 h, we observed the pair heading towards a sleeping site based on a tree of the species *Xilopia aromatica* (Annonaceae). The animals were resting and covering themselves with a mixed structure of sticks, leaves, and leaf litter on the ground, a type of structure already documented in trees but different from the usual holes or cavities in trees (Aquino & Encarnación 1986; Case 2013; Helenbrook *et al.*, 2019). Throughout our observations, we identified the male climbing in and out of the trees and returning to the sleeping sites (possibly by the researcher's presence); however, the female remained in the refuge, a possible territorial display like other neotropical primates (Rutberg 1983;

Janson, 1986; Spence-Aizenberg et al. 2023; Figure 1; video in Supplementary material, Arango-Lozano 2024).

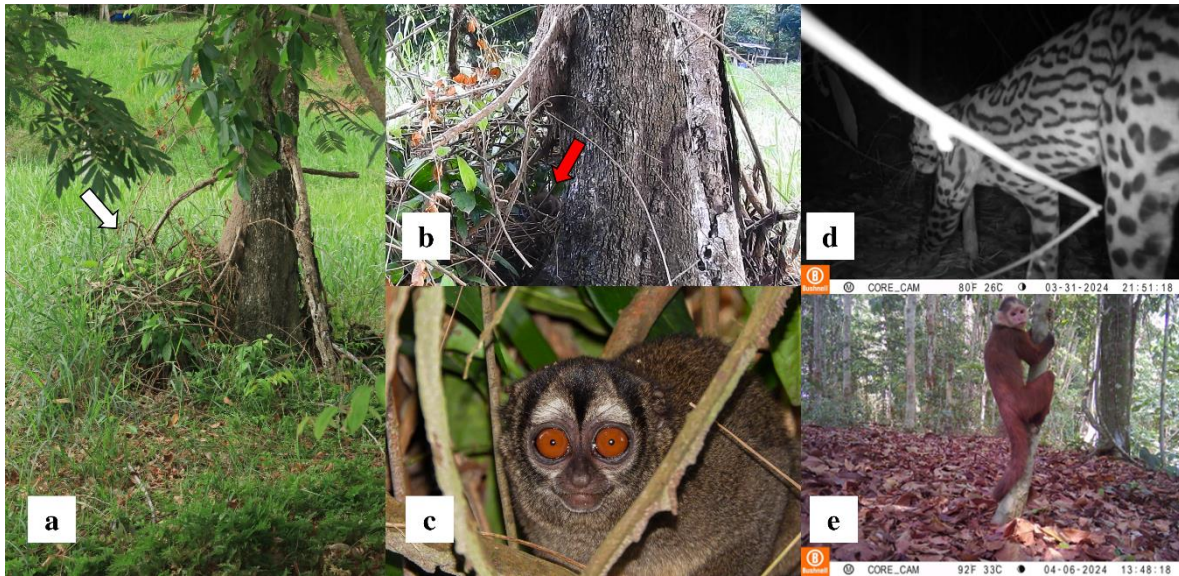


FIGURE 1. Detection site of: (a, b, c) the *A. griseimembra* ground sleeping site at the base of a *Xilopia aromatica* tree, and the night monkey couple in the sleeping site. Arrows indicate the sleeping site. (d and e) records via camera trap of the presence of *Leopardus pardalis* and *Cebus versicolor*, respectively. Video is available in Mendeley data repository (Arango-Lozano 2024, <https://data.mendeley.com/datasets/j6tcm29gnw/1>).

We conducted a total of nine separate excursions, excluding the initial encounter on April 4th when we set up camera traps to monitor the activity of the individuals at the sleeping site. These excursions took place on April 5th, 8th, 9th, 14th, 17th, 21st, 22nd, and 23rd, and May 2nd, between 17:00 and 24:00 hours. It is noteworthy that between April 9th and April 21st, there were no sightings of the pair, either at the sleeping site or on the camera trap footage. However, on April 22nd at 19:30 hours, the pair was observed in the gallery forest association, moving through the canopy of trees, but not near the ground sleeping site. This observation was repeated on April 23rd at 19:15 hours.

Aotus griseimembra is a night monkey species highly associated to forest cover, categorized as Vulnerable (VU) due to illegal trade, transformation, and degradation of habitat (Defler, 2003; Mantilla-Meluk & Ortega 2011; Henao-Díaz et al., 2020; Montilla et al., 2021). This night monkey inhabits from conserved to highly degraded forest patches in the Caribbean and inter Andean valleys of Colombia and the western slopes of Northern Venezuela always restricted below 1000 m in elevation (Shanee et al., 2023). Several authors have called the attention about the *A. griseimembra* tolerance to inhabiting degraded patches in Colombia, using the surrounding available resources for feeding and sleeping site in the canopy trees (Garcés-Restrepo et al., 2016; Montilla et al., 2021, Shanee et al., 2023). For *A. griseimembra*, however, this is the first evidence using of roosts other than tree holes. It is also the first observation of ground-level sleeping sites for night monkeys.

We are not sure what led this night monkey couple to use a terrestrial sleeping site. However, with camera traps records and recognized traces we identified the presence of a pair of *Leopardus pardalis* and a troop of *Cebus versicolor* (Figure 1d and 3e). The former is a potential predator (Miranda *et al.*, 2005; Bianchi & Mendes 2007; de Oliveira *et al.*, 2009), and the latter is a potential resource competitor (Link *et al.*, 2010; Marsh *et al.*, 2016). This could indicate that resources such as fruit or leaves for primates are not scarce in the mixed matrix of grasslands and remnant successional forest. Additionally, the persistence of this nest may be due to the behavior of the *Aotus* genus, which is known to maintain multiple sleeping sites within their home range (Bustamante-Manrique *et al.*, 2021; Montilla *et al.*, 2021). It is possible that the ground sleeping site served as a previously established refuge for the night monkey pair, which they continued to visit after the structure collapsed from the tree due to unknown circumstances.

The proximity to the ground heightens the vulnerability of these primates to predators such as wild cats, both during the day and night. Additionally, it increases the likelihood of encounters with domestic cats and dogs, thereby exposing them to zoonotic diseases like *Toxoplasma gondii*, as observed in other primates, including those of the *Aotus* genus (Gyimesi *et al.*, 2006). Despite this unexpected behavior, the couple exhibited typical characteristics of their species, displaying heightened responsiveness to stimuli, and seeking refuge in canopy cover when humans were present (Shanee *et al.*, 2023). However, due to the rarity of this occurrence, we are motivated to maintain non-invasive surveillance of the couple using camera traps to gather more comprehensive data. Currently, we are seeking permission from the owners of private properties surrounding the forest patch where the encounter took place to monitor the couple's movements and ascertain whether they are attempting to access other nearby forest remnants.

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