NOTES

Mammalogy Notes ISSN 2382-3704
https://doi.org/10.47603/mano.v7n2.270

Natural History

Observations on the diet of *Aotus nigriceps* (Primates: Cebidae) in an urban and peri-urban area in Rondônia state, Brazil

João Vitor Chaves dos Santos[1,2]*, Alexandre Henrique de Sousa Lima[1,3], André da Costa Tavares[1,3], Raul Afonso Pommer-Barbosa[1,2,4], Sam Shanee[5], Marcela Alvares Oliveira[1,2,3]

1 Projeto Sagui-de-Rondônia, Associação de Defesa Etnoambiental Kanindé, Porto Velho, Rondônia, Brasil.
2 Universidade Federal de Rondônia, Porto Velho, Rondônia, Brasil.
3 Centro Universitário Aparício Carvalho, Porto Velho, Rondônia, Brasil.
4 Clube de Astronomia e Ciências de Rondônia, Porto Velho, Brasil.
5 Neotropical Primate Conservation, Cornwall, United Kingdom
*Correspondencia: tenoriojvc5@gmail.com

Resumen

El mono nocturno de cabeza negra (*Aotus nigriceps*) es un primate neotropical predominantemente frugívoro. Debido a esta característica, el registro de diferentes ítems de su composición dietética es fundamental. En el presente estudio describimos el primer registro del consumo de inflorescencias de *Calliandra brevipes* en la zona periurbana y de inflorescencias de *Cocos nucifera*, frutos de *Eugenia uniflora* y artrópodos en la región urbana de la ciudad de Porto Velho, en el suroeste de la Amazonia.

Palabras clave: Amazonas, Artrópodos, Inflorescencia, Mono nocturno.

Abstract

The black-headed night monkey (*Aotus nigriceps*) is a predominantly frugivorous nocturnal neotropical primate. As such, records of different dietary items are fundamental. In the present study, we describe the first record of the consumption of *Calliandra brevipes* inflorescence in the peri-urban, and *Cocos nucifera* inflorescence, *Eugenia uniflora* fruits, and arthropods in the urban, region of the city of Porto Velho, in the southwestern Brazilian Amazon.

Key words: Amazon, Arthropods, Inflorescence, Night monkey.

Primates of the genus *Aotus* are the only nocturnal Neotropical primates (Fernandez-Duque et al. 2013). Their relatively small body size, cryptic nature, and nocturnality make direct observation extremely difficult (Shanee et al. 2013). They are socially monogamous primates, living in small groups composed of an adult breeding pair and their offspring (Helenbrook et al. 2020). *Aotus* are predominantly frugivorous (Shanee et al. 2013; Montilla

et al. 2021), but also include leaves, seeds, nectar, insects, and flowers in their diets (Wright 2011). Studies on the diet of *Aotus*, and particularly *A. nigriceps* are lacking for Brazil, making clear the importance of opportunistic records of the species' diet. The genus *Aotus* can, at least for a time, persist in forest fragments smaller than 1.4 hectares in an agricultural matrix, and are tolerant of human presence (Castaño et al. 2010; Shanee et al. 2013; Henao-Isaza et al. 2020). They occupy both primary and secondary forests and have been recorded in secondary forests and cultivated areas (Shanee et al. 2013; Guzmán et al. 2016; Montilla et al. 2021; Silva et al. 2021).

The black-headed night monkey (*Aotus nigriceps*) is a small Neotropical primate. The body measures between 24 and 47 centimeters, weighing a maximum of 750 grams. This species' distribution includes parts of Bolivia and Peru, and the Brazilian states of Amazonas, Acre, and Rondônia (Shanee et al. 2021). The main threat to the species is habitat loss for agriculture and the expansion of urban areas, as well as hunting and capture for consumption and the illegal pet trade (Oliveira & Calouro 2020; Shanee et al. 2021). In the last two decades over 132,908 km^2 (18%) of the original forest cover of their range has been lost, leading to the estimated loss of 1.6 million individuals. A further 94,458 km^2 of habitat is predicted to be lost in the next decade (Helenbrook & Valdez 2021).

In this paper, we describe observations of feeding by *A. nigriceps* on introduced plant species in a peri-urban and urban area of the city of Porto Velho, Rondônia state, located in the Brazilian Amazon. The municipality of Porto Velho is the capital of the state of Rondônia and is located in the south-western portion of the Amazon basin, it is the third largest capital of the Northern region of Brazil. Growth in the urban area of Porto Velho has led to the reduction of urban green areas, especially due to fires and housing construction (Guimarães & Silva 2015), which has led to the loss of 66.4% of green areas (Silva et al. 2017).

FIGURE 1. Locality of the observation, peri-urban (A) and urban (B) areas of the city of Porto Velho, Rondônia, Brazil.

Our first observations were made in a remnant primary forest fragment of 1.46 hectares in the peri-urban portion of Porto Velho city. The fragment lies about nine kilometers from the center of the urban perimeter (8°49'46.85" S, 63°53'56.56" W, WGS84) (Figure 1a). The forest in the area is classified as Ombrophylous Open Forest (Veloso et al. 1991), embedded in a mosaic of plantations, pastureland, and small urban clusters. As well as *A. nigriceps*, other primate species found in the area include Rondon's marmoset (*Mico rondoni*),

Weddell's saddle-back tamarin (*Leontocebus weddelli*), and the brown titi monkey (*Plecturocebus brunneus*). Residents have built suspended feeding platforms where the fruit is placed for the primates. The second observation was in the urban residential area of the city of Porto Velho (8°44'49.07" S, 63°53'44.90" W WGS84) (Figure 1b). At the site of the record, there are coconut (*Cocos nucifera*) and pitanga (*Eugenia uniflora*) trees, and in the surrounding residences, there are banana (*Musa paradisiaca*) and guava (*Psidium guajava*) trees. The nearest forested area is approximately 300 meters away. The distance between the sites is 9.18 kilometers.

The first record occurred at 20:31 on June 10, 2021. The group consisted of three adult individuals of undefined sex. The group was seen in an area of shrubs on a pink powderpuff (*Calliandra brevipes;* Fabaceae) (Figure 2) at the forest edge, near buildings. Pink powderpuff is a very abundant plant in the area. The primate group ate the entire inflorescence, including the calyx. The feeding period extended over 10 minutes and multiple inflorescences were consumed. When asked, the property owners stated that the night monkeys are often spotted in the same location throughout the flowering period of the species and that during the peak of flowering, it is common to see them on consecutive nights. The botanical material was identified as an Adelciano Soares Alves member of the Rondoniense Herbarium João Geraldo Kuhlmann (RON) at the Federal University of Rondônia.

FIGURE 2. (A) *Calliandra brevipes* inflorescence was present in the locality where the event was recorded. (B) and (C) Individuals of *Aotus nigriceps* consuming *Calliandra brevipes* inflorescence in peri-urban area of the city of Porto Velho, Rondônia, Brazil. Photos: Rúbia Luz da Silva.

The second record occurred at 01:34 on August 28, 2022. A single adult individual of undefined sex was observed consuming the fruits of the Surinam cherry (*Eugenia uniflora*; Myrtaceae) and later went to a coconut palm (*Cocos nucifera*; Arecaceae), consuming inflorescences and insects, which were not possible to identify. Consumption of inflorescences and arthropods was observed for 10 minutes (Figure 3). *Cocos nucifera* was also used as a sleeping tree by the individual.

FIGURA 3. An Adult individual of *Aotus nigriceps* feeding on *Cocos nucifera* inflorescence and arthropods in the urban area of the city of Porto Velho, Rondônia, Brazil. Photos: Raul Afonso Pommer-Barbosa.

This is the first record of *Calliandra brevipes*, *Cocos nucifera,* and *Eugenia uniflora* consumption for the genus *Aotus*, and the first record of the consumption of introduced species in the diet of *A. nigriceps* in a peri-urban and urban area in Brazil. *Aotus* spp. are generally highly adaptable to conditions in anthropogenic landscapes, probably in part due to their dietary plasticity, and have been observed living near human settlements in several areas (Bustamante-Manrique et al. 2021). Thus, there is the potential for exploitation of exotic species as food sources.

Calliandra brevipes is an ornamental shrub native to southeastern Brazil, Uruguay, and northern Argentina. The species has a high tolerance to flooded environments, flowering at different times of the year (Köhler et al. 2016). *Eugenia uniflora* is a native species of Brazil, but it has no natural occurrence in the state of Rondônia, but due to its high adaptability, it was introduced and cultivated in different Brazilian states. It grows well in hot and humid climates, besides having a sweet and highly nutritious fruit (Demattê 1997). *Cocos nucifera* is a species native to Southeast Asia and was introduced to Brazil in 1553 in the state of Bahia. Due to its tolerance to sandy soils, it adapted well to the Brazilian coast. It is a commonly cultivated tree throughout the tropics and is common in urban and rural areas across Brazil (Ferreira et al. 1998). Arthropods, such as species of Curculionidae (Coleoptera) and Aphididae (Hemiptera) are known to inhabit *Cocos nucifera* inflorescences (Comério & Benassi 2012, 2013), possibly increasing their importance as feeding trees. The abundance of these exotic species in anthropogenic landscapes makes them especially important resources for primates that show sufficient ecological and dietary flexibility to persist in these areas.

The observed individual caught arthropods in *Cocos nucifera* directly with the hands, taking them directly to the mouth, a behavior also observed in *Aotus lemurinus* (Castaño et al. (2010). The constant presence of arthropods, especially insects, in the inflorescences of *Cocos nucifera* suggests it is an important foraging and feeding site.

Castaño et al. (2010) suggest that *Aotus lemurinus* is not selective about the plant species consumed, taking advantage of the available resources in different habitat types in which they live. Another important aspect of *Aotus* feeding ecology is that, although primarily frugivorous, they also consume large amounts of other food types, including arthropods (Castaño et al. 2010; Shanee et al. 2013; Montilla et al. 2022). Henao-Isaza et al. (2020) reported consumption of mango (*Mangifera indica*) fruits, another exotic species, by *Aotus lemurinus* in Colombia, besides observing the group's tolerance to human presence. Similarly, Bustamante-Manrique et al. (2021) reported the consumption of avocado (*Persea americana*) and banana (*Musa paradisiaca*) in a peri-urban forest patch, also by *Aotus lemurinus* in Colombia. These studies demonstrate the dietary plasticity of night monkeys in the exploitation of different resources according to local availability, and the potential importance of exotic species as a source of resources for these primates surviving in small fragments.

Other primate species have shown preferences for, or dependence on, exotic plant species in their diet. McKinney (2011) recorded the use of fruits and shoots of *Cocos nucifera* by a group of *Cebus capucinus*, this being the third most important plant species for the group. Thus, the exploitation of exotic species could be an adaptation to altered environments, and a response to anthropogenic changes. Martins et al. (2022) studying *Sapajus robustus* recorded the use of six cultivated exotic species, which may have favored the maintenance of a smaller home range when compared to other conspecifics and congenerics. This consumption of exotic cultivated food sources can lead to conflicts between humans and wildlife, as losses in harvest could be attributed to primates or other species. In some cases, this has led to persecution and killing of the animals (Spagnoletti et al. 2017; Loría et al. 2021).

The exploitation of peri-urban environments and isolation in urban environments can expose primates to different risks, such as electrocution, attack by domestic animals, vehicle collision, zoonosis and anthropozoonosis, and abuse/conflict with humans (Montilla et al. 2020; Chaves et al. 2022). In the city of Porto Velho, attempted predation of the primate *Mico rondoni* by a domestic cat was recorded (Oliveira & Fernandes 2021), demonstrating the potential threat to primates, including *Aotus nigriceps*. Our record of the solitary adult individual may be an attempted migration from the natal group or may represent a floater (Fernandez-Duque & Huntington 2002). Dispersal in urban and peri-urban environments may increase the primates' vulnerability to the risk of being run over or attacked by domestic animals, thus decreasing successful dispersal events.

Information on the diet and feeding ecology of *A. nigriceps* is scarce, particularly from Brazil. This is in part due to the difficulties in studying strictly nocturnal species in rainforest environments. Our report confirms the presence of *Aotus nigriceps* in the peri-urban and urban area of Porto Velho, Rondônia, and its use of introduced species as feeding resources, thus adding to our knowledge of the species dietary plasticity.

ACKNOWLEDGEMENTS

We thank the support of Projeto Sagui-de-Rondônia and OSCIP Kanindé in the execution of the activities. To Rúbia Luz da Silva for making the registry available. To Adelciano Soares

Alves for the identification of *Calliandra brevipes*.To the anonymous reviewers for the suggestions to improve the manuscript.

REFERENCES

Bustamante-Manrique S, Botero-Henao N, Castaño JH, Link A. 2021. Activity budget, home range and diet of the Colombian night monkey (*Aotus lemurinus*) in peri-urban forest fragments. Primates. 62:529-536. https://doi.org/10.1007/s10329-021-00895-w

Castaño JH, Ramirez DC, Botero JE. 2010. Ecologia del mono nocturno Andino (*Aotus lemurinus*) en fragmentos de bosque subandinos de Colombia. In: Pereira-Bengoa V, Stevenson PR, Bueno ML, Nassar-Montoya F, editors. Primatologia en Colombia: Avances al principio del milenio. Bogota, Fundacion Universitaria San Martin. p. 67-90.

Chaves ÓM, Júnior JS, Buss G, Hirano ZM, Jardim MMA, Amaral ELS, Godoy JC, Peruchi AR, Michel T, Bicca-Marques JC. 2022. Wildlife is imperiled in peri-urban landscapes: threats to arboreal mammals. Science of The Total Environment 821:152883. https://doi.org/10.1016/j.scitotenv.2021.152883

Comério EF, Benassi VLRM. 2012. Espécies de Curculionidae (Insecta, Coleoptera) em cultura de coqueiro anão verde, em Linhares, ES, Brasil. Revista de Agricultura 87(1):54-58.

Comério EF, Benassi VLRM. 2013. Aphididae (Hemiptera) em cultivo de *Cocos nucifera* L. cv. anã verde no estado do Espírito Santo, Brasil. Revista de Agricultura 88(2):82-86.

Demattê MERP. 1997. Ornamental use of Brazilian Myrtaceae. Acta Horticulturae 452:143-179.

Fernandez-Duque E, Huntington C. 2002. Disappearances of individuals from social groups have implications for understanding natal dispersal in monogamous owl monkeys (*Aotus azarai*). American Journal of Primatology 57(4):219-225. https://doi.org/10.1002/ajp.10045

Fernandez-Duque E, Corley M, Spence-Aizenberg A. 2013. The Aotidae. In: Mittermeier RA, Rylands AB, Wilson DE, editors. The handbook of the mammals of the world (Primates), volume 3. Barcelona: Lynx Ediciones. p. 414-431.

Ferreira JMS, Lima MF, Santana DLQ, Moura JIL. 1998. Pragas do coqueiro. In: Sobrinho RB, Cardoso JE, Freire FCO, editors, Pragas de fruteiras tropicais de importância agroindustrial. Fortaleza, Brazil: Embrapa-CNPAT. p. 81-118.

Guzmán A, Link A, Castillo JA, Botero JE. 2016. Agroecosystems and primate conservation: shade coffee as potential habitat for the conservation of Andean night monkeys in the northern Andes. Agriculture, Ecosystems & Environment 215:57-67. https://doi.org/10.1016/j.agee.2015.09.002

Guimarães SCP, Silva HRO. 2015. Monitoramento da área urbana de Porto Velho-RO ao longo de 27 anos, utilizando imagens de satélite. Terr@ Plural 9(2):140-156.

Helenbrook W, Wilkinson ML, Suarez JA. 2020. Habitat use, fruit consumption, and population density of the black-headed night monkey, *Aotus nigriceps*, in southeastern Peru. Acta Amazonica 50(1): 37-43. https://doi.org/10.1590/1809-4392201900172

Helenbrook WD, Valdez JW. 2021. Species distribution and conservation assessment of the black-headed night monkey (*Aotus nigriceps*): a species of Least Concern that faces widespread anthropogenic threats. Primates 62:817-825. https://doi.org/10.1007/s10329-021-00922-w

Henao-Isaza JR, Payán-Montoya JE, López-Barrera AM, Grajales-Suaza E, Villa-Ramírez JJ, Betancourt-Torres JM. 2020. Inventario de mamíferos no voladores en remanentes de bosque seco tropical en el valle del río Cauca, Cartago, Colombia. Mammalogy Notes 6(2):144. https://doi.org/10.47603/mano.v6n2.144

Köhler M, Bernardes MG, Brack P. 2016. Espécies reófitas. In: Rolim RG, Köhler M, Reis CRM, Brack P, editors. Flora da Bacia do Rio Pelotas: uso e conservação de espécies RS-Brasil. Porto Alegre: Universidade Federal do Rio Grande do Sul. p. 145-170.

Loría LI, Gallina S, Silva JCS, Riley EP. 2021. Farmers' Perceptions of White-Faced Capuchins (*Cebus imitator*) and Human–Primate Coexistence in Rural Communities of Renacimiento District, Chiriquí Province, Panama. International Journal of Primatology 42:859-875. https://doi.org/10.1007/s10764-021-00244-0

Martins WP, Izar P, Araujo WS, Rodrigues FH, Lynch JW. 2022. Diet, activity patterns, and home range use in forest and cultivated areas for one wild group of endangered crested capuchin monkeys (*Sapajus robustus*) in Reserva Natural Vale, Espírito Santo, Brazil. American Journal of Primatology 84(8):e23413. https://doi.org/10.1002/ajp.23413

Mckinney T. 2011. The effects of provisioning and crop-raiding on the diet and foraging activities of human-commensal white-faced capuchins (*Cebus capucinus*). American Journal of Primatology 73(5): 439-448. https://doi.org/10.1002/ajp.20919

Montilla SO, Rios-Soto JA, Mantilla-Castaño JC, Patiño-Siro D, Bustamante-Manrique S, Botero-Henao N, Ruiz S, Arias-Monsalve HF, Link A, Ramírez-Chaves HE. 2020. Eventos de electrocución de *Aotus lemurinus* (Primates: Aotidae) en los Andes Centrales de Colombia. Mammalogy Notes 6(2):183. https://doi.org/10.47603/mano.v6n2.183

Montilla SO, Mopán-Chilito AM, Murcia LNS, Triana JDM, Ruiz OMC, Montoya-Cepeda J, Gutierres-Barreto DA, Holguín-Vivas JA, Agámez CJ, Pérez-Grisale LJ, Cruz-Moncada, M, Corredor-Durango NJ, Díaz EAC, Cardona-Cardona AH, Franco-Pérez E, Rivera-Ospina AM, Link A. 2021. Activity atterns, diet and home range of night monkeys (*Aotus griseimembra* and *Aotus lemurinus*) in tropical lowland and mountain forests of central Colombia. International Journal of Primatology 42:130-153. https://doi.org/10.1007/s10764-020-00192-1

Montilla SO, Arcila-Pérez LF, Fonseca ML, Link A. 2022. Arthropofauna consumed by the Andean night monkey (*Aotus lemurinus*) in a forest fragment at the Cordillera Central Colombia. Therya Notes 3:137-142. https://doi.org/10.12933/therya_notes-22-85

Oliveira MA, Calouro AM. 2020. Medium-sized and large mammals of the Cazumbá-Iracema Extractivist Reserve, Acre, Brazil. Check List 16(1):127-136. https://doi.org/10.15560/16.1.127

Oliveira MA, Fernandes M. 2021. Predation attempt by domestic cats (*Felis catus*) on a Rondon's marmoset (*Mico rondoni*) infant in an urban forest reserve in Porto Velho, Rondônia, Brazil. Neotropical Primates 27(1):48-50.

Shanee S, Allgas N, Shanee N. 2013. Preliminary observations on the behavior and ecology of the Peruvian night monkey (*Aotus miconax*: Primates) in a remnant cloud forest patch, north eastern Peru. Tropical Conservation Science 6(1):138-148. https://doi.org/10.1177/19400829130060010

Shanee S, Alves SL, Calouro AM, Lynch Alfaro JW, Romero-Valenzuela D, Messias MR, Röhe F, Ravetta, AL. 2021. *Aotus nigriceps* (amended version of 2018 assessment). The IUCN Red List of Threatened Species 2021: e.T41542A190455194. https://dx.doi.org/10.2305/IUCN.UK.2021-1.RLTS.T41542A190455194.en. Accessed on 29 July 2021.

Silva HRO, Guimarães SCP, Oliveira LBO. 2017. O uso do geoprocessamento na espacialização e avaliação das Áreas de Preservação Permanente: cidade de Porto Velho-RO. Confins 30:1-7. https://doi.org/10.4000/confins.11764

Silva FG, Gondim TMS, Borges LHM, Oliveira MA. 2021. Medium and large-sized mammals in a remnant forest in the state of Rondônia, Brazil. Mammalogy Notes 7(2):259. https://doi.org/10.47603/mano.v7n2.259

Spagnoletti N, Cardoso TCM, Fragaszy D, Izar P. 2017. Coexistence between humans and capuchins (*Sapajus libidinosus*): comparing observational data with farmers' perceptions of crop losses. International Journal of Primatology 38:243-262. https://doi.org/10.1007/s10764-016-9926-9

Veloso HP, Rangel-Filho ALR, Lima JC. 1991. Classificação da vegetação brasileira, adaptada a um sistema universal. Brasília, Brazil: IBGE.

Wright PC. 2011. Feeding in the night (*Aotus nigriceps* and *A. azarae*). In: Norconk M, Rosenberger AL, Garber PA, editors. Adaptive Radiations of Neotropical Primates. New York: Plenum Press. p. 369-382.

Editor: Diego J. Lizcano
Recibido: 2021-08-03
Revisado: 2021-09-115
Aceptado: 2022-09-23
Publicado: 2021-09-023