


# Interspecific association between brown-nosed coatis and capybaras in an urban area of Brazil

## Associação interespecífica entre quatis e capivaras em uma área urbana do Brasil

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**Abstract:** This study aimed to report an interspecific association between brown-nosed coatis (*Nasua nasua*) and capybaras (*Hydrochoerus hydrochaeris*) in an urban area of Brazil. We recorded *N. nasua* feeding on ectoparasites (ticks) attached to *H. hydrochaeris*, which in turns, did not show any reaction of discomfort with the situation. Thus, we report an unprecedented case of proto-cooperation between apparently unrelated species. Moreover, the interspecies interaction reveals other interesting scenarios as the inclusion of ticks in the diet of *N. nasua* and the possibility of parasite transmission and adaptation to a new host species, a phenomenon known as 'host switching'. We associate these new records as adaptations of wildlife to urbanization, and their effects should be further investigated from both wildlife conservation and 'One Health' approach.

**Keywords:** Carnivora. Proto-cooperation. Rodentia. Urban ecology.

**Resumo:** O objetivo deste estudo foi relatar uma associação interespecífica entre quatis (*Nasua nasua*) e capivaras (*Hydrochoerus hydrochaeris*) em uma área urbana do Brasil. Registramos *N. nasua* se alimentando de ectoparasitas (carrapatos) aderidos em *H. hydrochaeris*, que, por sua vez, não mostrou nenhuma reação de desconforto com a situação. Logo, relatamos um caso de proto-cooperação entre espécies aparentemente não relacionadas. Além disso, a interação interespecífica revela outros cenários interessantes, como a inclusão de carrapatos na dieta de *N. nasua* e a possibilidade de transmissão e adaptação de parasitas a uma nova espécie hospedeira, fenômeno conhecido como 'troca de hospedeiro'. Associamos esses novos registros como adaptações da vida selvagem à urbanização, e seus efeitos devem ser investigados a partir da perspectiva da conservação da vida selvagem e da abordagem de Saúde Única.

**Palavras-chave:** Carnívora. Proto-cooperação. Rodentia. Ecologia urbana.

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It is well documented that some wild animals inhabit, and therefore benefit from, remnant forest fragments found in urban and peri-urban areas worldwide. In South America, a widely distributed mesocarnivore, the brown-nosed coati *Nasua nasua* (Linnaeus, 1766), and the largest extant rodent species, the capybara *Hydrochoerus hydrochaeris* (Linnaeus, 1766), are both known to inhabit several urban areas of Brazil (Costa *et al.*, 2009; Ferreira, G. *et al.*, 2013; Tonin *et al.*, 2016). Notably, the city of Campo Grande, Mato Grosso do Sul state, in the western Brazilian Cerrado, has a diverse array of wild fauna utilizing the urban environment (Ferreira, C. *et al.*, 2010). From the human perspective, interacting with wildlife is positive for the wellbeing of people, and has the added benefit of attracting tourism to the area, particularly if wildlife has become used to human presence (Mamede & Benites, 2018; Calderan *et al.*, 2019). However, wild animals in urban areas can provide other scenarios as they can pose risk of traffic accidents, invade residences, and even maintain zoonotic parasites (Soulsbury & White, 2016). *Hydrochoerus hydrochaeris*, for example, play a primary role in the transmission cycle of *Rickettsia rickettsii* (Ricketts, 1909), which is the etiological

agent of Brazilian spotted fever, considered the most deadly rickettsiosis worldwide (Labruna, 2013). Furthermore, from an ecological viewpoint, urbanization can change population parameters and the behavioral dynamics of animal species in these areas, revealing previously undescribed, or seemingly unlikely, relationships among species (Soulsbury & White, 2016).

Here we report on an interspecific association between *N. nasua* and *H. hydrochaeris* at *Parque das Nações Indígenas* (PNI), regarded as one of the most important urban parks of Campo Grande city, Mato Grosso do Sul state, Brazil (Figure 1). The PNI is an urban secondary forest fragment with an area of 119 hectares; the forest formations and wildlife species assemblages of the park are typical of the Cerrado biome. The connectivity of PNI with other forest fragments allows several species of wild animals to use the park, for example *Didelphis albiventris* Lund, 1840, *Dasyprocta azarae* Lichtenstein, 1823, *Ara ararauna* (Linnaeus, 1758), *Dasyurus novemcinctus* Linnaeus, 1758, and *Ramphastos toco* Müller, 1776, besides *N. nasua* and *H. hydrochaeris* (G. Porfirio, personal observation, 2017).

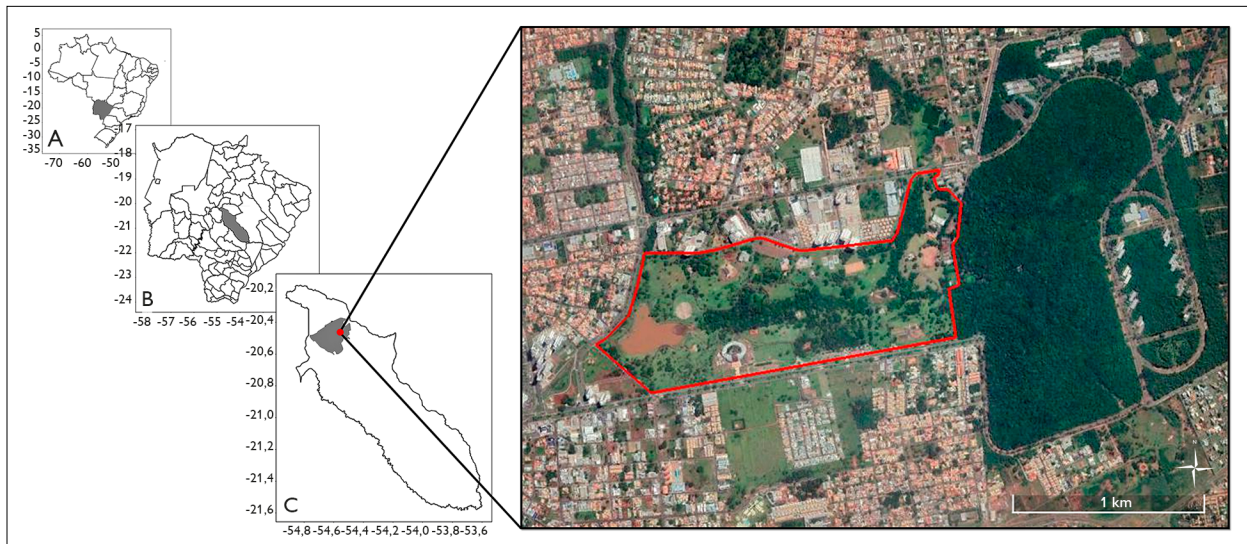


Figure 1. A) Mato Grosso do Sul state in Brazil (pale gray); B) location of the municipality of Campo Grande in Mato Grosso do Sul state (pale gray); and C) location of *Parque das Nações Indígenas* in the city of Campo Grande (pale gray), and its land use in the enlarged image. Map: Filipe Martins Santos (2020).

Interspecific associations between *N. nasua* and *H. hydrochaeris* in the PNI were recorded on two occasions, in January (rainy season) and August (dry season) 2019, respectively. Individuals of *N. nasua* were observed feeding on ectoparasites (ticks) attached to *H. hydrochaeris* (Figures 2A and 2B). *Nasua nasua* group composition consisted of adult females and their cubs, and juveniles. Animals were classified according to their age and sex, based on Barros & Frenedo (2010): (i) adult males: animals with large body and head size, in addition to the presence of the scrotal sac; (ii) adult females: smaller than adult males, rarely seen alone; (iii) young: smaller than adult females or of similar proportions; (iv) cubs: smaller than the young, with similar head/body proportions.

Cubs were the first individuals of the group to be observed foraging on ticks attached to *H. hydrochaeris*, just prior to sunset (approximately 17:00 pm in both occasions). Initially, adult females foraged on fruit in the surrounding area; adult females and the rest of the group were later observed alternating between foraging on ticks attached to *H. hydrochaeris*. Interactions were interrupted when casual human observers approached the site resulting in the dispersal of both wildlife species involved in the interaction. During both observation periods, *H. hydrochaeris* did not

show any avoidance behavior toward *N. nasua*, instead individuals remained immobile, in the ventral position, while *N. nasua* foraged for ticks.

Although there are other reported cases of mammalian interspecies associations (McClean, 1992; Haugaasen & Peres, 2008; Desbiez *et al.*, 2010), this is the first time an interspecies association between *N. nasua* and *H. hydrochaeris* has been described. Moreover, we consider this species interaction particularly interesting because, although *N. nasua* and *H. hydrochaeris* coexist in several tropical ecosystems (see Paglia *et al.*, 2012), they are thought to rarely interact in natural areas due to their contrasting habits (H. Herrera and G. Porfirio, personal observations, 2020). While, *H. hydrochaeris* is a herbivorous and semi-aquatic species (Mones & Ojasti, 1986; Desbiez *et al.*, 2011), *N. nasua* (although classified as a carnivore taxonomically) is ecologically classified as an omnivore (Gompper & Decker, 1998; Desbiez *et al.*, 2010), consuming mainly fruits and invertebrates (insects and other arthropods) (Bianchi *et al.*, 2013).

Accordingly, we report here on three interesting ecological scenarios associated with the described interspecies interaction. The first is protocoooperation between *N. nasua* and *H. hydrochaeris* in an urban forest fragment.



Figure 2. Groups of brown-nosed coatis (*Nasua nasua*) foraging on capybara (*Hydrochoerus hydrochaeris*) (A and B) in the Parque das Nações Indígenas, urban area of Campo Grande, Mato Grosso do Sul state, Brazil. Photos: Andreza Castro Rucco (2019) (A) and Gabriel Tirintan de Lima (2019) (B).



Protocooperation is defined as a harmonic interspecific relationship whereby both species benefit from the interaction but neither species require the interaction to survive (Odum & Barrett, 2011). *Nasua nasua* gained a novel food source, while the *H. hydrochaeris* had its ectoparasite load reduced. Interestingly, this type of association has been described on multiple occasions for herbivorous African mammals and birds (Mikula *et al.*, 2018). For *H. hydrochaeris*, association with birds is commonly reported in Brazil, especially involving two bird species, the cattle tyrant *Machetornis rixosa* (Vieillot, 1819) and the yellow-headed caracara *Milvago chimachima* (Vieillot, 1816) (Sazima *et al.*, 2012; D'Angelo *et al.*, 2016). However, this is the first record of *H. hydrochaeris* in a harmonic interspecific relationship with *N. nasua*. For *N. nasua*, in turns, interspecific association with other mammals is not a novelty. *Nasua nasua* is known to associate with squirrel monkeys *Saimiri ustus* I. Geoffroy, 1843 in Amazonian dry forest, but the association was limited to foraging in the same place, in different strata (Haugaasen & Peres, 2008). According to the Haugaasen & Peres (2008), no interspecific interference or aggression was observed in any occasion of such observations. In the same study site, these authors reported two events of associations between *N. nasua* and brown-capuchins *Cebus (Sapajus) apella* (Linnaeus, 1758), but unlike the previous association described, *N. nasua* and *C. (S.) apella* foraged side by side. Again, no interspecific interference or aggression was recorded (Haugaasen & Peres, 2008). In the Brazilian Pantanal, *N. nasua* was observed associating with *Dicotyles tajacu* (Linnaeus, 1758), also to forage together on fruits (Desbiez *et al.*, 2010).

The second point of interest is the inclusion of ticks as a food item in the diet of *N. nasua*. Although invertebrates are a known part of the species' diet (Gompper & Decker, 1998; Bianchi *et al.*, 2013; Ferreira, G. *et al.*, 2013), the consumption of ticks has not been observed before. On the other hand, *Nasua narica* (Linnaeus, 1766), another procyonid species occurring from south United States,

Central America up to northern South America (Cuarón *et al.*, 2016), was recorded grooming and ingesting ticks attached to *Tapirus bairdii* (Gill, 1865) in Barro Colorado Island, Panamá (McClean, 1992). On these occasions, both individuals were habituated to humans, and McClean (1992) suggested that the association was probably a learned phenomenon occurring in a small subset of both populations. According to McClean (1992) humans and their behavior favor this kind of association.

Finally, we highlight the possibility of parasite transmission and adaptation to a new host species, in this case *Nasua nasua*, in a phenomenon known as 'host switching' (Araujo *et al.*, 2015). This scenario can happen because some parasites have arthropods as intermediate hosts (Avancini & Ueta, 1990; Bennett *et al.*, 1992; Labruna *et al.*, 2004), and it may be that certain parasite species that co-evolved with ticks attached to *H. hydrochaeris* (the host species), such as *Rickettsia* spp. (Queirogas *et al.*, 2012) and *Mycoplasma* spp. (Cubilla *et al.*, 2017) could be transmitted to a new mammalian host, in this case, *N. nasua*. Additionally, as some of the same microorganisms infect animals and humans, possible transmission of parasites to urban inhabiting *N. nasua* could potentially impact human populations occupying the same environment. Therefore, tick consumption by *N. nasua* in urban areas should be investigated further from both wildlife conservation and human health perspectives (i.e., 'One Health' approach) (Dantas-Torres *et al.*, 2012).

In conclusion, urban parks in Campo Grande city, appear to provide an environment that can support interspecific interactions between apparently disparate wildlife species. *Nasua nasua* and *H. hydrochaeris* were found to have a previously undescribed, interspecific association. Based on our observations, we propose that ticks (from *H. hydrochaeris*) appear to be a new food item in the diet of urban inhabiting *N. nasua*. Additionally, we consider the possibility of a new parasitic adaptation associated with tick consumption by *N. nasua*, and possible concerns for the conservation of *N. nasua* in urban forest

fragments associated with this. Accordingly, research into this interspecies association warrants further investigation.

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