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Brown-nosed coati (*Nasua nasua vittata*) on the Roraima tepui (Carnivora: Procyonidae)

Výskyt nosála červeného (*Nasua nasua vittata*) na stolové hoře Roraima (Carnivora: Procyonidae)

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Abstract. Tepuis are geomorphologically (physically) isolated mountains in the northeastern area of South America. Their long-time isolation has promoted the evolution of a highly endemic fauna at the genus and species level. In general, the rare incidence is typical for all vertebrates, especially for mammals (there are no fishes on the tops of the tepuis). Herein we report of two independent observations of coatis (genus *Nasua*) in March 2002 and January 2003 on Roraima tepui (on the borders of Venezuela, Guyana and Brazil). The observed animals possess evident distinctive black and olive-brown coloration. Based on its distribution and published reports we suppose that these individuals belong to the subspecies of Brown-nosed coati (*Nasua nasua vittata*). Its distribution on Roraima tepui could be interpreted as a case of habitat and food source opportunism in coatis. The observation of January 2003 includes aggressive interaction between two individuals. Our observations could be added to other examples of mammal distribution on tepuis. The exact number of coatis on Roraima, their detailed feeding strategy and the potential dependence on human activity in this area remain unclear.

INTRODUCTION

The Guayana highlands are a complex of igneous and sedimentary formations in the northeastern part of South America. The sedimentary formations take the form of many isolated sandstone and quartzite mesas (tepuis). These tepuis are of archean and proterozoic age, making them one of the oldest massifs on Earth (e. g. Rosales & Huber 1996, Givnish et al. 2000, Kelloff & Funk 2004). Tepuis are typical with orthogonal hillsides that caused the long isolation of their plateaus from the surrounding landscape. Consequently, very specific habitats developed on top of tepuis with a high percentage of plant and animal endemism (e. g. Rosales & Huber 1996, Pérez-Zapata et al. 1992, Rull 2005). In spite of the high endemism, tepuis do not house some "Lost World fauna" sensu Sir A. I. Conan Doyle. In contrast, the Roraima tepui is disproportionately much more barren than the belletristic authors supposed. All tepuis are, in fact, a paradise for geologists (and recently for speleologists too) (e. g. Rosales & Huber 1996, Audy 2003), botanists and algologists (e. g. Rull 1991, Pokorný 1996, Givnish et al. 2000,

Kelloff & Funk 2004, Rull 2004a, Rull 2005), and entomologists, but vertebrate zoologists are partly unsatisfied (e. g. Rosales & Huber 1996). Vertebrates are poorly distributed on tepuis – represented by some endemic frogs (e. g. Rivero 1961, Zweifel 1986, Myers & Donnelly 2001), reptiles (e. g. Myers & Donnelly 2001, Macculloch & Lathrop 2004), birds (e. g. Barrowclough et al. 1997, Barber & Robbins 2002, Braun et al. 2003, Hilty 2003) and mammals (e. g. Pérez-Zapata et al. 1992). Mammals on tepuis are scarce and probably represent stray animals (e.g., *Panthera onca* in Auyán tepui) or extremely rare endemic taxa (e.g. *Podoxymys roraimae*) (Pérez-Zapata et al. 1992, Pokorný 1996). For a long time, the tepuis were considered as refugia for archaic forms ("living fossils") (the Lost World hypothesis – for details see Rull 2004a, b), but, in spite of high endemism new research shows that tepui biotas have many relatively young connections with other biogeographical areas (e.g., Andean region, Amazonia etc.) (e. g. Rivero 1964, Pérez-Zapata et al. 1992, Da Silva & Patton 1998, Kelloff & Funk 2004, Steiner & Catzeflis 2004) with vertical movements of biotas during the Pleistocene glacial cycles (the Vertical Displacement hypothesis – for details see Rull 2004a, b). Nowadays, the dispersal scenario (i.e., repeated dispersion and local speciation) in the combination with vicariant scenario is more considered than simply vicariant (refuge) scenario (for details see e. g., Rull 2004a, b, c, 2005) – in this context, many so-called living fossils (e. g., the toad *Oreophrynella*) are now unsupported illusions.

Mount Roraima (5° 12' N, 60° 44' W, 2810 m a. s. l.) represents one of the highest tepuis and is situated on the secondary deforested savanna (called Gran Sabana) on the borders of Venezuela, Brazil and Guyana. Roraima possesses a typical flora with high percentage of endemism (Pokorný 1996). It is also occupied by some typical birds (Barber & Robbins 2002, Braun et al. 2003, Hilty 2003), and other endemic herpetological fauna like e.g., Roraima Bush Toad (*Oreophrynella quelchii*) (Rivero 1961), *Colostethus roraima* (Barrio 2004) and the rattlesnake *Crotalus durissus ruruima* (Hoge 1966) and very rare example of mammalian endemism of tepuis – akodontine cricetid *Podoxymys roraimae* (Pérez-Zapata et al. 1992). We report here on the occurrence of Brown-nosed coati (*Nasua nasua*) on the Roraima tepui. Our observations are interesting for two main reasons: first, the occurrence of coatis has not been reported from the top of tepuis yet (Mondolfi 1997) – coatis inhabit mainly woodland areas (Nowak 1991). Second, the observed coatis were of a relatively unusual appearance in comparison with individuals of normal-colored *Nasua nasua* with reddish brown to black general coloration and yellowish to dark brown below (Nowak 1991).

RESULTS AND DISCUSSION

The first author (PH) observed and took a picture of one unusually colored adult specimen of Brown-nosed coati, *Nasua nasua* (Linnaeus, 1766) on the top of Roraima tepui in March 2002 (Fig. 1). In January 2003, M.A. repeatedly observed and photographed two individuals (Figs. 2, 3) of the same unusual coloration. During both these occasions (2002 and 2003), the observed individuals were not too shy. Good quality photographs were taken in January 2003, due to repeated visits of the camp by one (?) male of coati. All observations were made during daytime, which is congruent with the known diurnal activity of coatis (Nowak 1991).

The appearance of these coatis is relatively unusual in comparisons with the typical coloration of Brown-nosed coati with orange or reddish to dark brown pelage coloration and head with white spots around the eyes (for more details see Gompper & Decker 1998). However there is extensive variation known throughout the distribution range of *Nasua nasua* (Gompper

& Decker 1998). The individual on the Figs. 2 and 3 is probably an adult male with relatively slender snout and a yellow-black pattern of pelage. Its head is black without distinct facial light markings, only one small yellow spot is situated on the right side of left eye (for left lateral view see Fig. 2). The nose is suspiciously gray. Dorsal side of the ears and fur behind them is orange or orange-brown. The black color of the head continues over the dorsal side of the neck to the level of shoulders. Feet and distal parts of limbs are black. Dorsal side of the tail

Fig. 1. Our first observation of the distinct colored coati on the Roraima tepui (2002). Photo by Pavla Havelková.
Obr. 1. Naše první pozorování odlišně zbarveného nosála na Roraimě (2002). Snímek Pavly Havelkové.

Fig. 2. The male of coati near the speleologists' camp (2003). Photo by Marek Audy.
Obr. 2. Samec nosála při návštěvě speleologického tábora (2003). Snímek Marka Audyho.

is blackish melting to brown at the tip, ventral side is yellow. Approximately six black rings, which are about twice as wide as the light ones, and a black tip are well recognizable on the tail. The rest of the body (throat, trunk, proximal parts of limbs) are light – yellow or beige, but the underfur is probably black (Fig. 3). This individual was determined as *Nasua nasua vittata* Tschudi, 1844, based on published data (Allen 1904, Gompper & Decker 1998, Linares 1998) and consultations with the fourth author. Observed individuals correspond in almost all aspects with the description by J. A. Allen of *Nasua phaeocephala* (junior synonym of *N. n. vittata*). This form was originally described by J. J. von Tschudi as *Nasua vittata* from the region near Roraima tepui. In Venezuela, two subspecies of *Nasua nasua* occur – *N. n. dorsalis* Gray, 1866 in the Andean region and *N. n. vittata* that is distributed in the region south of the Orinoco River, but it is minimally reported from tepuis, although it was recorded from Auyán tepui (Linares 1998). It would be interesting to investigate using molecular methods how old and how much differentiated are the subspecies of *Nasua nasua* throughout their range.

The distribution of such a relatively big carnivore is quite unexpected in so barren habitat. The third author (M.A.) had the opportunity of repeated and long-lasting observations of this coati. His observations include an aggressive interaction (a tag) between two individuals. The stronger individual drove its rival by hardly defined bark to the edge of the tepui. These repeated observations were possible due to several visits of coatis to the expedition camp. It could

imply some exploitation of the human touristic activity by coatis at the top of Roraima tepui. Diet of the Brown-nosed coati consists mainly of forest floor invertebrates, fruits and carrions with a minor amount of vertebrates (fishes, snakes, infrequently chickens in urban environment, small mammals or eggs of caiman) (Bisbal 1986, Gompper & Decker 1998). Its ecology (e.g., the presence in secondary forests, etc.) implies ecological plasticity (Eisenberg 1989, Gompper & Decker 1998). In this point of view, the coati as an omnivorous opportunist is well predisposed for its distribution on tepuis. We can only estimate the diet of the Roraima coati – it may consist of rare fruits, vertebrates (e.g., the endemic frogs and akodontine rodents), invertebrates (e. g., endemic beetles and many other insects and spiders etc.), and theoretically birds or their eggs, plus finally some human foodrests. Recently Beisiegel & Mantovani (2006) showed relatively robust home range shifts of *Nasua nasua* in a period of three years in a pluvial tropical Atlantic forest area. These shifts could be connected to resource availability. The same authors also described coatis foraging for food (invertebrates and vertebrates) inside bromeliads as part of

Fig. 3. Portrait of the coati from Roraima tepui with its remarcable distinct coloration (2003). Photo by Marek Audy.
Obr. 3. Portrét neobvykle zbarveného nosála z Roraimy (2003). Snímek Marka Audyho.

their typical behavior. The bromeliads are relatively abundant on top of the Roraima tepui, and this behavior could thus facilitate the survival of coatis in this relatively inhospitable habitat.

There are two different points of view for this coati's distribution. It could either be caused by a stray of a few individuals, or be a regular distribution, either seasonal or permanent (stable). The following conditions could be of importance: First, the slopes of Roraima and Kukenán (the tepui in near neighborhood of Roraima) are covered by tropical rain forest which could represent a suitable and stable habitat for coatis, in contrast to the secondary deforested dry and grassy savanna. Second, the top of Roraima is relatively well accessible – a touristic activity could facilitate the access for coatis and moreover, the climb on the top should be no problem for such agile animals. It could be interesting that both our observations happened in the end of the dry season. At least four other expeditions in different seasons did not observe any coatis. It could imply some seasonal distribution of coatis on the top of Roraima (related to possible seasonal specific behavior – e.g., higher male's exploration activity for females, higher density of individuals in forest, decrease of food sources in surrounding areas etc.).

In conclusion, we have reported a rare observation of the omnivorous opportunistic Brown-nosed coati on Roraima tepui. The exact number of coatis on Roraima, their detailed feeding strategy and potential dependence on human visiting activity in such area remain unclear. We will be deeply indebted for any additional information about coatis (or some other mammals) on whichever tepui.

SOUHRN

Stolové hory venezuelské Guayany (tzv. tepui) jsou izolovanými horami či pohořími, u kterých jejich dlouhodobá samostatnost snížila výskyt řady živočichů a rostlin, ale na druhou stranu přispěla k vysokému podílu místního endemismu. K velmi vzácným zvířatům vrcholových partií stolových hor patří savci. Náš příspěvek zmiňuje opakované pozorování poddruhu nosála červeného (*Nasua nasua vittata*) na stolové hoře Roraima (hranice Venezuely, Guyany a Brazílie) v letech 2002 a 2003. Výskyt této středně velké šelmy v tomto relativně nehostinném prostředí spojujeme s všeobecným oportunismem nosálů (ve vztahu k potravě i biotopu). V roce 2003 se dokonce podařilo pozorovat agresivní střet dvou jedinců. Vzhledem k tomuto sledování se zdá, že nejde pouze o zatoulané jednotlivce, ale možná o výskyt více zvířat trvalejšího rázu. Nelze také vyloučit, že přežívání nosála červeného na Roraimě je v určité míře umožněno také přiživováním na turistech.

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