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First record of blackbuck *Antilope cervicapra* (Linnaeus, 1758) in Brazil

Paulo G. C. Wagner (1,2*), Laura Berger (2), Fábio Dias Mazim (3) and Walter Nisa-Castro-Neto (4)

(1) Centro de Triagem de Animais Silvestres da Superintendência do IBAMA no Rio Grande do Sul, Porto Alegre, RS, Brazil. (2) Laboratório de Protozoologia e Rickettsioses Vetoriais, Faculdade de Veterinária, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Rio Grande do Sul, Brazil. (3) Instituto Pró-Carnivoros e Ka'aguy Consultoria Ambiental, Rio Grande do Sul, Brazil. (4) Organização para a Pesquisa e a Conservação de Esqualos no Brasil (PRÓ-SQUALUS), Torres, Rio Grande do Sul, Brazil. [*correspondence: paulo.wagner@ibama.gov.br]

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ABSTRACT
This study is the first report of the exotic blackbuck (*Antilope cervicapra*) in Brazil. The record was obtained through observation and videotape in a grassland area of Pampa Biome of the South region. The camera records are of female and juvenile individuals in an area adjacent to the riparian forest of the Quaraí River. In this region, there is also records of the exotic Chital deer (*Axis axis*), which underscore for the necessity for studies of the impact of the presence of these species on the Brazilian Pampa ecosystem.
Keywords: blackbuck, conservation, exotic species, Pampa Biome, Southern Brazil

RESUMEN- Primer registro de antílope negro *Antilope cervicapra* (Linnaeus, 1758) en Brasil.
Este es el primer registro de un antílope negro (*Antilope cervicapra*) en Brasil. El registro fue obtenido a través de observación y grabación en vídeo en una zona de pastizales del Bioma Pampa de la región Sur. Los registros de la cámara son de individuos hembras y juveniles en un área adyacente al bosque ribereño del río Quaraí. En esta región, también hay registros del ciervo exótico Chital (*Axis axis*), lo que subraya la necesidad de estudios sobre el impacto de la presencia de estas especies en el ecosistema pampeano brasileño.
Palabras clave: antílope negro, bioma Pampa, conservación, especies exóticas, sur de Brasil

The Blackbuck (*Antilope cervicapra*) (Linnaeus, 1758) is an artiodactyl found mainly in India, and locally extinct in Pakistan, Afghanistan, and Bangladesh (Wilson & Reeder 2005; IUCN-SSC 2017). This species was once the most abundant ungulate in India and Pakistan, however overhunting and habitat loss for agriculture led to an intense reduction in its populations (Jha & Isvaran 2022). Blackbucks inhabit diverse environments, from open forest and semi-desert areas to thorny areas and dry deciduous forests (Ranjitsinh 1989). Additionally, they alter feeding resources and

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living areas according to seasonality, which demonstrate a striking adaptation (Jhala 1997; Isvaran 2005a).

This species is gregarious and lives in herds composed of a dominant adult male, females and juveniles, occasionally containing 1 or 2 subordinate adult males (Jarman 1974). Group sizes vary depending on the availability of food and environmental conditions, with a range of 5 to 50 animals (Isavaran 2007). Additionally, blackbucks are sexually dimorphic, with a bitonal coloration pattern (Jarman 1974). Males have dark brown to black coloration on the upper body to the outer sides of the legs, females and juveniles are yellowish in these same areas, with a whitish horizontal lateral stripe on the shoulders to the croups, and all have white lower body and circular spot around the eyes (Fig. 1). Both sexes have spiral horns, however, males' horn are more developed and may reach 70 cm or more in length. Males are heavier than females, whereas the weight range are of 20-57 kg and 20-33 kg respectively.

In winter this species shows a diurnal behavior while in summer due to high temperatures, it is more active at dawn and dusk. In addition, in summer, flocks decrease in size (Vats & Bhardwaj 2009). There is no marked breeding season, and mating occurs all year round (Vats & Bhardwaj 2009). The gestation period lasts 6 months, with the birth of a single cub. Territorial breeding areas for males are defined by the composition of females in the groups (Jarman 1974). The dominant male establishes an area of 25-100 hectares and defends it aggressively, driving out other competing males and making the territories with pre-orbital and interdigital glands secretion, feces, and urine (Isavaran 2005b).

The blackbuck was introduced into Argentina in 1906, in the grassland region of La Pampa Province for recreational hunting (Lever 1985). During 1912, this species was released in Santa Fe, Cordoba and Buenos Aires (Navas 1987; Novillo & Ojeda 2008). Nowadays, groups of specimens can also be found in the provinces of Chaco, Corrientes, Entre Rios, Mendoza and San Luis (Navas 1987; Chebez 2008; Chebez & Rodríguez 2014). According to Novillo & Ojeda (2008), the blackbuck has no ecological equivalent in its new distribution areas (allochthonous) and its potential impacts are unknown. However, in other countries where this species was also introduced, such as Mexico and the United States, struggle for population control, competition for resources with native deer, and changes in native vegetation were reported (Traweek 1989; Medellin et al. 2005).

This study describes the first record of *A. cervicapra* in Brazilian territory in the south region frontier with Argentina areas where the species have been reported. In addition, the presence of the exotic Chital deer *Axis axis* (Erxleben, 1777) has been documented in the same spot (unpublished), highlighting the importance of constant monitoring of the presence and population dynamic of exotic species in the area and the necessity of further studies on the impact on native deer species and the landscape.

The observation of the specimens took place on October 15, 2021, on a rural property devoted exclusively to extensive livestock farming in the municipality of Santana do Livramento, state of Rio Grande do Sul, Brazil (latitude -30.542000; longitude -56.274611; Fig. 2). The landscape is shaped with the original configuration of the

Pampa Biome, with areas of grassland and thorny vegetation. The record occurred next to a riparian forest of the Quaraí River, a frontier location with Uruguay, and is close to the border of the province of Corrientes, Argentina. The team was doing search and monitoring activities of the invasive exotic species, the Chital deer (*A. axis*), in Brazil when came across the blackbuck group.

The team came across a group of three individuals, one adult female and two juveniles (sex undefined) of smaller size (Video S1). As soon as they sensed the presence of the team, the individuals quickly fled, heading into the savannah formation bordering the riparian forest of the Quaraí River. The size of the group, the typical coat spotted with prominent lateral stripes of females, and the body size showed that they were neither individuals of *A. axis*, which are commonly seen in the area, nor of the native deer common brown brocket *Subulo gouazoubira* (Fischer, 1814) typical of the region and which is much smaller. Their size can be estimated from the attached video, where they can be seen moving along the dividing fence of 1.6 m. The owners of the study area also reported meeting individuals in the property whose description correlates directly with the morphological features of blackbucks. In addition, the team interviewed rural landowners of the region to verify the possible acquisition of individuals and a hypothetical escape event, however, there was no evidence of this hypothesis.

The most logical way of entrance of the blackbuck in RS is throw Argentina, from where the border is 150 km away from the study area. Also, the closest location where this species has been spotted in Uruguay, in the Department of Treinta y Tres, is 350 km. The Quaraí River, borders flows into the Uruguay River, which in turn serves as the dividing line between Brazil and Argentina to the north and, later, to the south, between Uruguay and Argentina, therefore its course and riparian forests may serve as a path for the individuals to translocate between these countries. This same fluvial border and its features enabled the invasion processes of the wild boar *Sus scrofa scrofa* Linnaeus, 1758 (Suidae) and the *A. axis*, both species widely distributed throughout the geographical border strip between Brazil and Uruguay.

It should be noted that the southern region of the state of Rio Grande do Sul is currently home to only two (perhaps three) species of native deer: common brown brocket (*S. gouazoubira*), which has an expanding population, and Pampas deer *Ozotoceros bezoarticus* (Linnaeus, 1758), a regionally critically endangered species. In Argentina and Mexico, studies indicate that the blackbuck presence modifies native vegetation arrangements, which could result in competition for feeding resources between native herbivorous species and modification of predator population dynamics (Medellin et al. 2005). Another risk is the flow of pathogens and ectoparasites to native deer species and cattle (Mertins et al. 1992). A higher problem reported in these countries is the difficulty of population control. Even though pumas *Puma concolor* (Linnaeus, 1771) have become its only predator in Argentina, as there are no canids or other potential predators large enough to carry out culls, this feline is critically endangered in South Brazil. Blackbucks are susceptible to intense climatic events like droughts and extreme cold, as was recorded in La Pampa province, Argentina, where hundreds of animals died after a heavy snowfall in 2013 (Sánchez 2015), however, climate events similar to these are scarce in Brazil.

The blackbuck is an exotic species with high hunting value and is present in several provinces of Argentina. Its presence in border areas and this first report in the southern region should inevitably and immediately alert the Brazilian environmental authorities. Its expansion may not only impact the dynamics of the region's ecosystem but also put to risk the sanitary condition of the native deer population. In addition, we highlight the relevance of the landscape features and the use of riparian forests for the invasion process of exotic species in Brazil.

Figure 1. Sexual dimorphism among of the blackbuck (*Antilope cervicapra*). Adult male specimen (Left); Adult female (Right). Source: https://www.biodiversity4all.org/taxa/42416-Antilope-cervicapra.

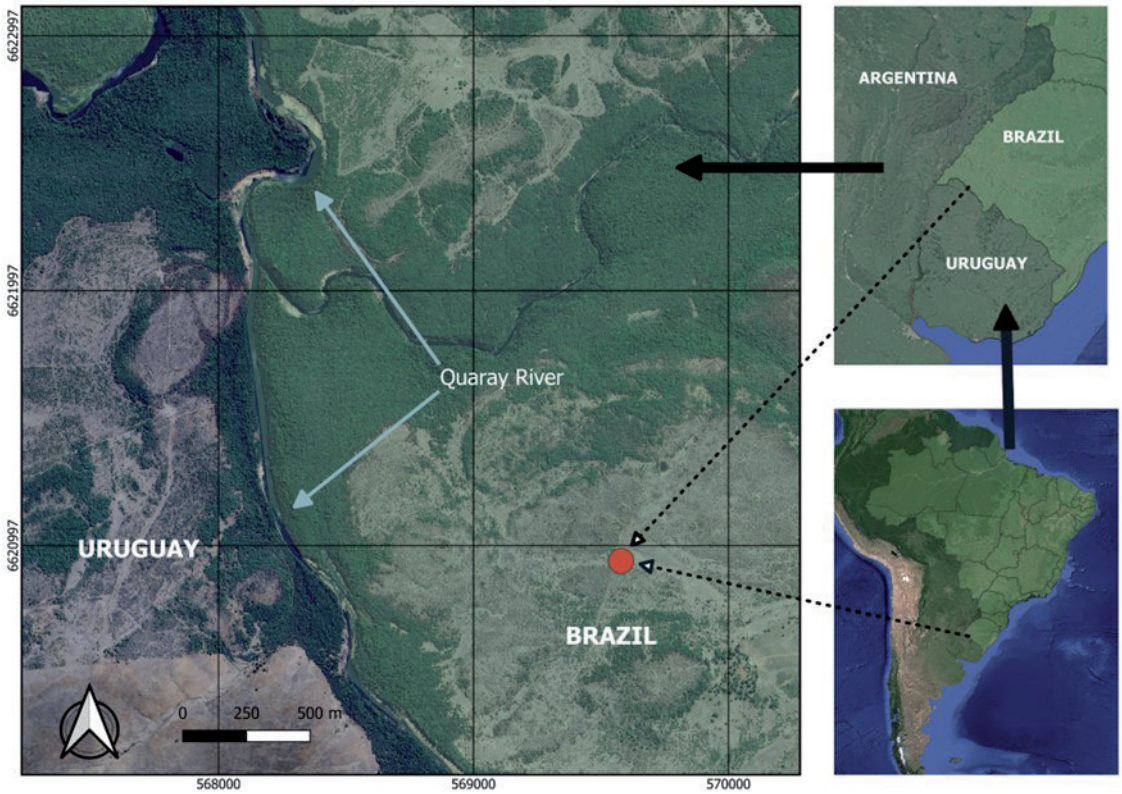

Figure 2. Detail of the location (coordinates) where the blackbuck (*Antilope cervicapra*) specimens were sighted (red dot); see text for more details. The light gray arrows represent the length of the Quaraí River, which is the boundary between Brazil (Rio Grande do Sul) and Uruguay in the Pampa Biome.

SUPPLEMENTARY ONLINE MATERIAL

Supplement 1:
Video S1. Family group of blackbuck (*Antilope cervicapra*) that were spotted on the farm next to a riparian forest of the Quaraí River, municipality of Santana do Livramento, state of Rio Grande do Sul, Brazil on October 15, 2021.

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