

Report of a protozoan of the phylum Ciliophora compatible with *Balantioides coli* in feces of white-lipped peccaries in Brazil

Relato de protozoário do filo Ciliophora compatível com *Balantioides coli* em fezes de queixadas no Brasil

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Abstract: *Balantioides coli* is a ciliated protozoan with worldwide distribution, which parasites several species, especially the pig. In this work, it was presented the first possible case of parasitism by *B. coli* in white-lipped peccaries in Brazil. The 13 fecal samples were collected from white-lipped peccaries kept in the *Zoológico Municipal de Curitiba*, Brazil. The feces were processed using flotation and spontaneous sedimentation techniques. All of them were positive for parasites of the phylum Ciliophora similar to *B. coli*. As the animals did not show clinical signs of balantidiasis, they may be acting as reservoirs, which is worrying because of the proximity of white-lipped peccaries created as a means of subsistence by human population. Thus, we emphasize the importance of documenting these reports in order to understand the expansion of the parasite, mainly due to zoonotic potential of *B. coli* and implications for public health.

Keywords: Balantidiasis. *Tayassu pecari*. Zoonoses.

Resumo: *Balantioides coli* é um protozoário ciliado de distribuição mundial que parasita várias espécies, principalmente o suíno. Neste trabalho, apresentamos o primeiro possível caso de parasitismo por *B. coli* em queixadas no Brasil. Foram coletadas 13 amostras fecais de queixadas mantidas no Zoológico Municipal de Curitiba, Brasil. As fezes foram processadas por meio de técnicas de flutuação e sedimentação espontânea. Todas as amostras foram positivas para parasitos do filo Ciliophora similares a *B. coli*. Como os animais não apresentavam sinais clínicos de balantidíase, podem estar atuando como reservatórios, o que é preocupante devido à proximidade de queixadas criados como forma de subsistência por populações humanas. Assim, destacamos a importância de documentar esses relatos para entendermos a expansão do parasito, principalmente devido ao seu potencial zoonótico de *B. coli* e as implicações em saúde pública.

Palavras-chave: Balantidíase. *Tayassu pecari*. Zoonoses.

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White-lipped peccaries (*Tayassu pecari* Link, 1795) are wild pigs native to the Neotropical region and closely related to the pig (Beck et al., 2017). Despite the proximity to humans due to the increase in the subsistence hunting of the species (Altrichter, 2005), the record of ecto- and endoparasites is still scarce (Beck et al., 2017). Helminths have been described for white-lipped peccaries (Carlos et al., 2008; Romero-Castañon et al., 2008), but there are few reports of parasitic protozoa (Farret et al., 2010; Limachi-Quiñajo et al., 2014). The lack of knowledge and records is worrying, especially since contact with the species is maintained by rural and indigenous groups (Altrichter, 2005), who may be naturally more susceptible to contamination when they have malnutrition or comorbidities and associated pre-existing infections (R. Silva et al., 2021).

One of the protozoa with a wide geographic distribution that infects several domestic and wild species, as well as humans (Koopowitz et al., 2010; Bellanger et al., 2013), is *Balantioides coli* (Malmsten, 1857). The fact that pig is the main species infected with *B. coli* (Nakauchi, 1999; Barbosa et al., 2015b; Mendoza-Gómez et al., 2015; Yaghoobi et al., 2016), together with the close relationship with white-lipped peccaries (Beck et al., 2017), makes this wild pig a species potentially affected by the parasite (Ponce-Gordo & Jirků-Pomajbíková, 2017). However, there are few records of infection (Morales, 2006), and in Brazil, there is only one record of the genus *Balantioides* in white-lipped peccaries (Farret et al., 2010), but the identification of the species is not made.

The infection caused by *B. coli*, called balantidiasis, is asymptomatic in domestic pig (*Sus scrofa domestica* Erxleben, 1777), a species very susceptible to parasitic diseases and which can also transmit parasites to others (Ponce-Gordo & Jirků-Pomajbíková, 2017; Condemayta et al., 2018; Ahmed et al., 2020). Humans, who keep a physical proximity with domestic pigs, may or may not have symptoms similar to the amoebiasis caused by *Entamoeba histolytica* (Shaudinn, 1903) (R. Silva et al., 2021).

The fact that *B. coli* has a zoonotic feature is extremely important for public health, as well as knowing the other hosts and/or reservoirs besides to *Sus scrofa* (Nakauchi, 1999) and the geographic regions where they were identified (Lores et al., 1994) to introduce preventive measures in transmission. Thus, in this work we reported the first possible case of parasitism by *B. coli* in white-lipped peccaries (*Tayassu pecari*) captives of a zoo in Brazil.

This study was performed according to the Ethical Principles of Animal Experimentation, adopted by the *Conselho Nacional de Controle de Experimentação Animal* (CONCEA) and was approved by the *Comissão de Ética no Uso de Animais* (CEUA) under protocol No. 31/2017 (*Universidade Federal do Paraná – UFPR*, Palotina) and with license of the *Sistema de Autorização e Informação em Biodiversidade/Instituto Chico Mendes de Conservação da Biodiversidade* (SISBIO/ICMBio) under protocol 59628-1.

Feces collections were performed with male white-lipped peccaries (n = 7) from the *Zoológico Municipal de Curitiba*, from Curitiba, Paraná, Brazil, from March to August 2018. The animals' enclosure was made of dirt floor and without temperature control (Figure 1). The water was supplied *ad libitum*, from the *Companhia de Saneamento do Paraná*, and without any communication with the other enclosures. The animals were fed once a day, with pig feed, grains and fruits, totaling 45 kg of food.

The animals were anesthetized for routine zoo procedures. The feces were collected from the rectum, packed under refrigeration in 50 mL plastic tubes until they were transported to the *Laboratório de Parasitologia Animal* at the *Universidade Federal do Paraná*. The samples were processed by the flotation method in saturated sodium chloride solution (d = 1.20 g/mL) (Willis, 1921), with one reading of slide per sample; and spontaneous sedimentation method (Hoffman et al., 1934; Lutz, 1919) with three readings of slides per sample. Readings were performed at 100X and 400X magnifications under a white light optical microscope.



Figure 1. Enclosure of the white-lipped peccaries at the Zoológico Municipal de Curitiba, Paraná, Brazil. Photos: L. Grossel (2022)

Were obtained thirteen fecal samples ($n = 13$) from seven individuals in three collections. All samples were positive for *B. coli* according to the spontaneous sedimentation method (Figure 2), while by the flotation method no protozoan cysts were observed. However, the feces showed normal consistency and color, and the animals did not show clinical signs related to parasitosis.

The present study recorded the first possible report of *B. coli* parasite in white-lipped peccaries in Brazil. The occurrence of the *Balantioides* genus in this host species had been recorded only once in Brazil, in the State of Rio Grande do Sul (Farret et al., 2010). We present this record as possibly being *B. coli* because we do not employ molecular identification techniques or ultrastructural characterization (Barbosa et al., 2018). Even so, flotation and sedimentation methods used in the present work are still being applied in the morphological identification of this parasite (Ahmed et al., 2020; R. Silva et al., 2021).

As in domestic pigs (Schuster & Ramirez-Avila, 2008; Condemayta et al., 2018), the white-lipped peccaries did not show clinical signs compatible with balantidiasis, as they may be acting as reservoirs (J. Silva & Pereira, 1967). Reservoir animals are those that host a pathogen without manifesting clinical signs, perhaps due to prolonged adaptation to it, but can transmit it to other animals and to humans, when zoonotic (J. Silva & Pereira, 1967;

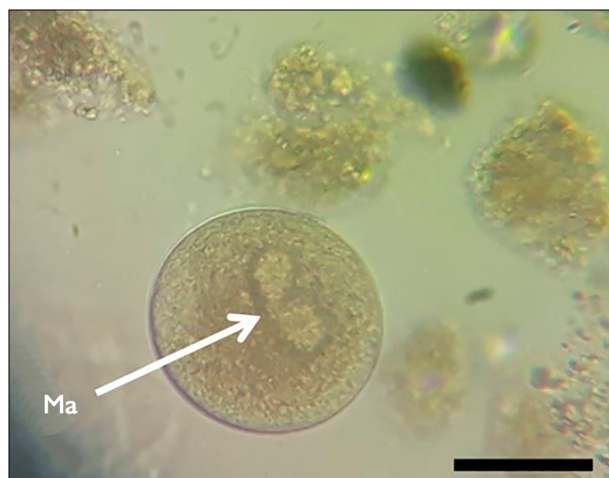


Figure 2. *Balantioides coli* cyst found in the feces of white-lipped peccaries by the spontaneous sedimentation method (Ma: macronucleus, Bar: 25 μm).

Barbosa et al., 2016). Although the records of white-lipped peccaries parasitized by *B. coli* are from captive animals in zoos and conservation breeding sites (Morales, 2006), this species is part of the subsistence of rural and traditional populations (Altrichter, 2005) or is raised in intensive meat production systems (Figueira et al., 2003; Le Pendu et al., 2011). This coexistence with humans and domesticated animals increases the possibility of their contamination, both because the parasite is zoonotic and because of the possibility that reservoir animals are completely asymptomatic (J. Silva & Pereira, 1967).

In fact, there are several records of infected humans in Brazil, represented by risk groups and with low natural immunity, and therefore more susceptible to parasitic infections: indigenous (Lawrence et al., 1983; Coimbra Jr. & Santos, 1991), hospitalized children (Vasconcelos, 1981) and disabled people (De Oliveira Albuquerque & Andrade de Souza, 2017). There are estimates that, between 1980 and 2005, a thousand cases were recorded in humans worldwide (Solaymani-Mohammadi et al., 2005). These cases vary from dysentery (Bellanger et al., 2013) and peritonitis (Ferry et al., 2004), to pulmonary involvement (Koopowitz et al., 2010) and death (Pinheiro & Lima, 1991). These records are in line with the worrying claim that *B. coli* is a neglected and understudied protozoan, but one that can be considered emergent (Schuster & Ramirez-Avila, 2008).

In this study, was recorded the first possible occurrence of parasitism by *Balantioides coli* in white-lipped peccaries in Brazil. It highlights the importance of documenting similar reports, even if punctual, as for the hosts, origin and location of parasitism. These records allow us to understand the expansion of the parasite, mainly due to its zoonotic potential, in which it can affect species where the disease does not develop, although they continue to act as transmission sources.

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AUTHORS' CONTRIBUTIONS

L. A. Grossel contributed to project administration, formal analysis, funding acquisition, conceptualization, data curation, research, methodology, resources and writing (original draft, review and editing); M. L. Javorouski to methodology, resources and writing (review and editing); M. K. Shimada to formal analysis, conceptualization, data curation, research, methodology, resources, supervision and writing (review and editing).

