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*Sociedad Argentina para el Estudio de los Mamíferos*



## **Fight club: *Dasypus novemcinctus* agonistic behavior in an island area of the Brazilian Atlantic Forest**

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### **ABSTRACT**

*Dasypus novemcinctus* has a large geographical distribution and can occur in a wide range of habitat types. There are few studies about their ecology within the Neotropical region. Studying the mammal community using camera traps in an island of Rio de Janeiro state, Brazil, we recorded an agonistic behavior between two individuals of *D. novemcinctus*. This kind of social interaction is part of the species' behavioral repertoire, but this is the first record in the wild in the Neotropical region. The use of camera traps in field work enables observing species behaviors, allowing the establishment of appropriate conservation strategies.

### **RESUMO**

*Dasypus novemcinctus* tem uma grande distribuição geográfica, e pode ocorrer em uma ampla variedade de tipos de habitats. Há poucos estudos disponíveis sobre sua ecologia na região neotropical. Estudando a comunidade de mamíferos com armadilhas fotográficas em uma ilha, no estado do Rio de Janeiro, Brasil, foi registrado um comportamento agonístico entre dois indivíduos de *D. novemcinctus*. Este tipo de interação social faz parte do repertório comportamental da espécie, no entanto, este é o primeiro registro em vida livre na região neotropical. O uso de armadilhas fotográficas no trabalho de campo possibilita a observação do comportamento das espécies, permitindo o estabelecimento de estratégias apropriadas de conservação.

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Popularly known as nine-banded armadillo, *Dasypus novemcinctus* Linnaeus, 1758 is the species with the largest geographical distribution among all xenarthrans (Loughry et al. 2014), it is found in South, Central and North America (Arteaga et al. 2020). It is the fourth largest of all *Dasypus* species (Feijó & Cordeiro-Estrela 2016) and has crepuscular and/or nocturnal habits (McDonough & Loughry 2005). The nine-banded armadillo most commonly occurs in forested areas, but it can also occupy modified habitats, such as pastures, plantations and urban areas (Abba & Superina 2010). Although *D. novemcinctus* is the most studied armadillo species, only few ecological studies have been made in the Neotropical region (Loughry & McDonough 1998; Silva et al. 2015); most research on this species has been carried out in the United States (Superina et al. 2014; e.g., Taber 1945; Clark 1951; Fitch et al. 1952; Layne & Glover 1977; Taulman 1994; Taulman & Robbins 1996, 2014; McDonough 1997).

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This is a region recently colonized (approximately in the last 170 years) by *D. novemcinctus* (Taulman & Robbins 1996), therefore it is inappropriate to assume that the observations made in this environment are representative of other regions (McDonough & Loughry 2006). Despite the agonistic behavior of *D. novemcinctus* is well known, there have been no reports of this kind of behavior in the Neotropical region so far. Accordingly, even for the best-known species, describing the occurrence of new observation is essential (McDonough & Loughry 2006).

The record reported in this paper is part of a larger study on the mammal community at Ilha Grande State Park (Fig. 1). Ilha Grande is an island in the Atlantic Forest hotspot, located in Angra dos Reis municipality, southwestern Rio de Janeiro state, Brazil. This ongoing study was initiated in March 2019 and extends to the current period (October 2020). Bushnell® camera traps were installed in 18 plots of 250 m each, in the East Module of Ilha Grande (-23,153433; -44,188983), following RAPELD methodology (see Magnusson et al. 2005). The East Module consists of 10 uniformly distributed plots arranged every 1 km in two parallel transects 1 km apart of 5 km each, and 8 riparian plots located in the streams that run the module. Each plot has 1 ha (250 m by 40 m) and the module has a total of 5 km<sup>2</sup>. Of the 18 plots surveyed, ten plots are uniformly distributed and eight are riparian. The 250 m of the uniformly distributed plots follow the contour, while the riparian plots follow the river course. In each plot, a camera trap was installed inside the line of the plot, about 30 cm from the floor, and programmed to take videos and photos when activated by the motion/heat sensor. Camera traps were set to operate for 24 hours/day the entire sampling period, with a minimum interval between records of 10 seconds. Between March and August 2019, we captured 189 images of *D. novemcinctus* at six sampling sites. As it was not possible to differentiate individuals through the records, we considered that the images captured by the same camera, less than an hour apart, were of the same individuals. Thus, images taken less than one hour apart by the same camera were discarded, finally totaling 83 records.

On 2019 May 14th at 02:54 a.m., we registered an agonistic behavior between two adult *D. novemcinctus* individuals (Figure 2) at one of our uniformly distributed plot (latituded -23,136306; longituded -44,188773). One of the armadillos was walking when the other approached it from behind. The first turned and attacked the second with his head, knocking over the individual, who fell with his back to the ground. The attacked individual got up and went towards the attacker, tried to fight back, but ended up being attacked again. In the next record, the attacked armadillo seems to run away. The behavior can be viewed at: <[https://youtu.be/Q\\_41P-HI8XA](https://youtu.be/Q_41P-HI8XA)>. We emphasize that the interpretation of the encounter was made by putting the video in slow motion, thus there is an ambiguity about this. The interaction occurred in the left edge of the frame, and partly outside of the camera range. Then, it is possible that what we observed and describe might have a different interpretation.

According to Costa et al. (2011), this kind of social interaction is part of the behavioral repertoire of *D. novemcinctus*. However, this is the first record of an agonistic encounter of wild *D. novemcinctus* in the Neotropics. McDonough (1994)



analyzed the possible motivations for the agonistic behavior among *D. novemcinctus* and found that males and females are equally likely to initiate and receive aggression. Both directed their aggression more significantly towards individuals of the same sex (male-male and female-female interactions; McDonough 1994). It is not possible to identify the sexes of the individuals of *D. novemcinctus* in our observations.

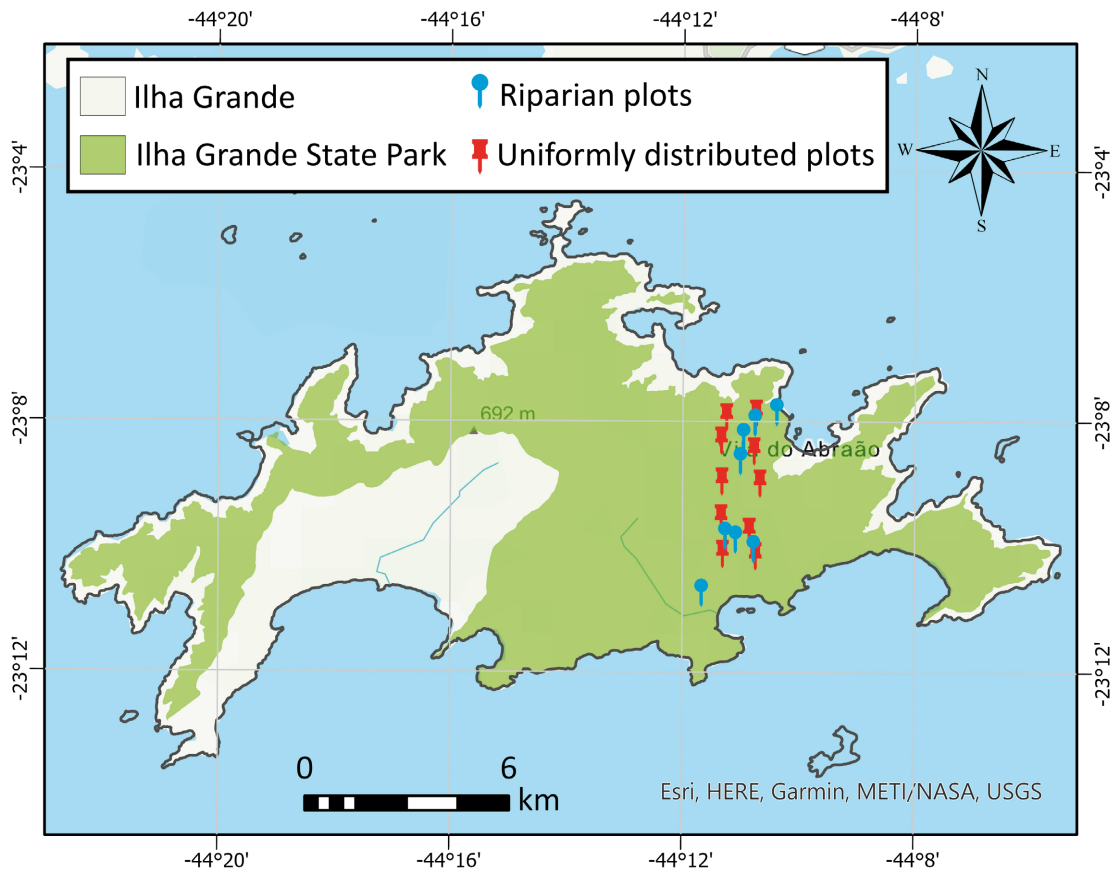
The most likely explanation for nine-banded armadillo aggression in males may be competition for females, whereas in females it is possible that aggression is a defensive behavior of the litter. However, the functions of aggressive behavior in females are less clear (McDonough 1994). Co-specific aggression has also been observed in different mammal species (see Greene 1989; Korytko & Vessey 1991; Kreutz et al. 2009; Crawford et al. 2015). The explanations for this type of behavior and the intensity of aggression according to sex vary widely depending on the species. For instance, in *Peromyscus leucopus* the aggression between males is more common than between females, and the authors concluded that the level of aggression is more strongly related to mate competition (Korytko & Vessey 1991). In *Castor canadensis* both males and females have the same incidence in agonistic encounters, such encounters are caused by territorial defense (Crawford et al. 2015).

In an armadillo literature review (Superina et al. 2014), authors found less than 20% of the publications on armadillos were from field research. This reinforces the importance of our record and demonstrates the need for further studies based on field work; Camera traps are an important tool in the study of animal behavior and reduces the possible bias caused by the presence of an observer (Caravaggi et al. 2017). The encounter reported here occurred in the early hours of the day, so probably would not have been witnessed if it had depended on human observation. A disadvantage of camera traps is that they do not have the ability to move towards the animal when activated, which sometimes may difficult complete description of a registered behavior. Besides that, the sounds and flashes (in those cameras with flashes) emitted by the camera can also cause some changes in behavior. However, the disturbance is probably much smaller than the presence of an observer (Alexy et al. 2003; Bridges & Noss 2011). Finally, camera trapping is a good way to record and understand animal behavior and thereby allow the establishment of appropriate conservation strategies.

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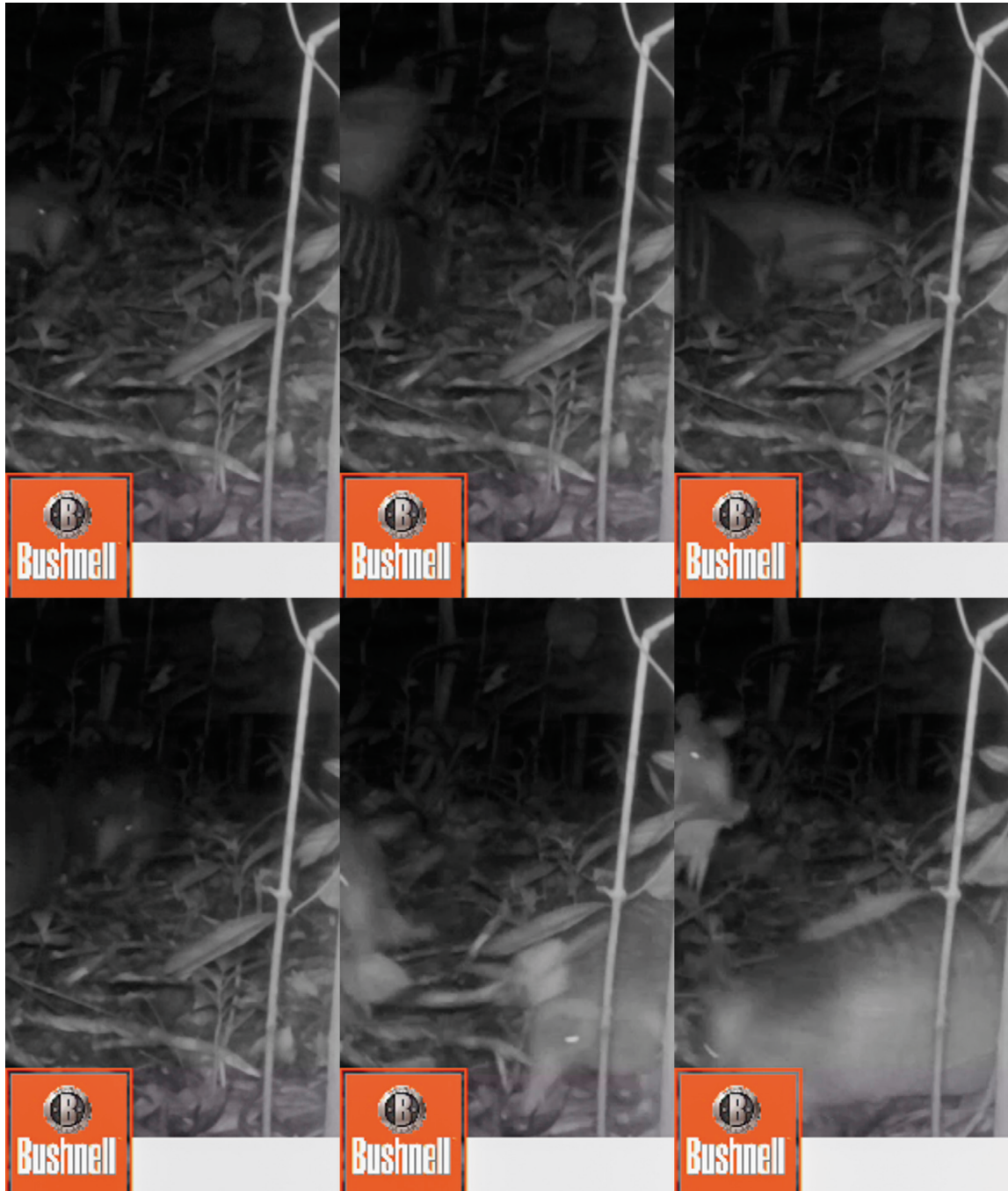




**Figure 1.** The Ilha Grande State Park, located in Angra dos Reis municipality, southwestern Rio de Janeiro state, Brazil.







**Figure 2.** Frames of the video of the showing behavior between two individuals of *Dasypus novemcinctus* in the Ilha Grande State Park, Angra dos Reis municipality, Rio de Janeiro State, Brazil.

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