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Social behavior of *Euphractus sexcinctus* during a reproductive event in a protected forest of northeastern Argentina

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ABSTRACT

In this note we describe for the first time in Argentina, an event that involved social (tolerance, proximity and sniffing), reproductive (mounting and chasing) and exploratory (sniffing entrances, digging and filling) behaviors of five individuals of *Euphractus sexcinctus* Linnaeus, 1758 in a mesophile forest of Mburucuyá National Park, Corrientes Province. These behaviors were observed at five entrances of a possible common burrow, a new trait for this species. For this region, observations suggest a mating period from August to November. All these observations contribute with new knowledge to the natural history of the species in Argentina.

RESUMEN

Esta nota reporta, por primera vez en Argentina, un evento que involucra comportamientos sociales (tolerancia, proximidad y olfateo), reproductivos (intento de montura y de persecución) y exploratorios (olfateo de las entradas, excavación y relleno con arena) de cinco individuos de *E. sexcinctus* Linnaeus, 1758 en un bosque mesófilo del Parque Nacional Mburucuyá, provincia de Corrientes. Estos comportamientos fueron observados en cinco entradas de una posible madriguera común, un rasgo novedoso para esta especie. Para esta región, se sugiere un periodo de apareamiento de agosto a noviembre. Estas observaciones contribuyen con nuevos conocimientos sobre la historia natural de la especie en Argentina.

The Six-Banded Armadillo (*Euphractus sexcinctus* Linnaeus, 1758) is considered a common species, and is listed as Least Concern in both the IUCN Red List of Threatened Species (Abba et al. 2014) and the Red List of Threatened Mammals of Argentina (Superina et al. 2012). Nevertheless, the information on the species' reproductive behavior, particularly during the mating and pre-mating periods, is scarce (Tomas et al. 2013). As a general rule, armadillos are solitary and asocial (except in the breeding season); nonetheless, they present a wide range of social

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behaviors that have a low probability of observation (McDonough & Loughry 2008). Chasing behavior of a female by males of *E. sexcinctus* has been previously reported in Brazil (Desbiez et al. 2006; Tomas et al. 2013; Porfirio et al. 2015). During a seven-year study Tomas et al. (2013) observed only three instances of mounting, each associated with running or chasing. These authors also described a successful attempt of one male mounting one female, and the subsequent excavation by several individuals (presumably males) of a female occupied burrow, suggesting an explanation for the concentration of burrows in a certain area.

For the first time in Argentina, we describe seven types of behavior for *E. sexcinctus* that can be divided into reproductive (mounting and chasing), exploratory (sniffing entrances, digging and filling), and social (tolerance, visual contact and sniffing), in a mesophile protected forest (27° 59' 18.3" S, 58° 00' 54.7" W) of Mburucuya National Park, northwestern Corrientes province, northeastern Argentina. The park is included in the Humid Chaco ecoregion, in the Mesopotamian sector of grass savannas, *Butia yatay* and forested hills and plains of the Correntino subdistrict (Carnevali 1994), where floristic elements of the Paranaense and Espinal Phytogeographic regions converge (Cabrerá 1976). This park covers an area of 176.6 km² with a gently undulating relief, sandy hills and depressions including lagoons and floodplains. The climate is subtropical, with seven months of average, temperature above 20°C, and the remaining months with temperatures ranging between 10°C and 20°C (Koeppen 1948). Annual rainfall reaches 1,360 mm (Bagnouls & Gaussen 1957) with rains occurring mostly during summer, and with occasional summer droughts.

We recorded the behavior of five *E. sexcinctus* individuals at five entrances of a potential common burrow, where two non-residents (A and E, see Fig. 1) and three resident individuals (B, C and D, see Figs. 2-4) were identified. The term "resident" was used for individuals which, at the time of observation, were present at the burrow entrances regardless of whether they lived there or not. Observations were taken during November 22nd 2014 (6:30 pm) using a digital video camera (Nikon P530, 42 x optic zoom), which recorded for 12 minutes at a distance of 2.5 meters away from the first observed individual. During this event, an assumed non-resident adult female A, came out of the forest and moved towards one of the burrow entrances (e¹ Fig. 2). This female explored (exploratory behavior) the entrance, and then moved in to a second entrance (e²), at which point an adult resident male B came out. Male B tried mounting (reproductive behavior) female A for two seconds (Fig. 2). After this mounting attempt, he made another attempt (one second) after which, he left the burrow. Male B sniffed in three different entrances (e², e³ and e⁵), and repeatedly went in and out of e² from where it had initially emerged (exploratory behavior). Male B also dug and made a mound of sand around e².

One minute after the second mounting attempt, the resident armadillo C appeared from e¹. It dug into e¹ and explored three other entrances (e², e³ and e⁵). It then



returned to e^1 , where it made a mound and remained inside the burrow for 41 seconds. We identified resident armadillo D when it was initially observed within the burrow at e^5 , and as it fully emerged from a different entrance (e^2), eight seconds after male B. Armadillo D then dug into four different entrances (e^1 , e^2 , e^3 and e^5), making mounds of sand around e^1 , e^2 and e^3 . Even though the three resident armadillos were in proximity to one another, the interactions between them were neutral (no direct affiliative or aggressive interactions or mounting attempts) (Fig. 3). Seven minutes after armadillo D emerged from the burrow, we observed a fifth armadillo E, approaching from the forest at a distance of six meters from the burrow complex (Fig. 4). Armadillo E explored various entrances (e^1 , e^2 and e^5) and sniffed male B (exploratory and social behaviors), who was located at entrance e^2 , for four seconds before going back to the forest. Entrance e^4 was not used by any of the individuals during this event.

We found similarities between our observations and the behaviors reported by Tomas et al. (2013) in Brazil. The behaviors observed could be: (1) reproductive behaviors, events preceding or following the chasing behavior, as described by other authors (Desbiez et al. 2006; Tomas et al. 2013; Porfirio et al. 2015), and multiple individuals in proximity to a mounting attempt by a resident male with a non-resident female; or (2) exploratory behaviors, frenetic digging in three entrances (e^1 , e^2 and e^3) of the burrow by resident armadillos (B, C and D) among which there was very little or no physical interactions. Our assumption is that these individuals were male, coinciding with comments of Tomas et al. (2013), which they observed in the southern Brazilian Pantanal ($19^\circ 08' 36''$ S, $56^\circ 50' 50''$ W), when one female of *E. sexcinctus* entered a burrow and one male started digging and filled the entrance with sand, as well as the other males involved in the chasing event.

Tomas et al. (2013) suggested that the mating period for the species was from July to November in the Pantanal (Brazil). Barlow (1965) also reported two pregnant females in September – October in central Brazil, and in January in Uruguay. Similarly, we observed reproductive behaviors in late November, which falls into this period. Moreover, during the second week of December 2014 we observed 2 young *E. sexcinctus* individuals (approximately two or three months old) at the entrance of another burrow within the National Park, indicating an approximate time of impregnation during August 2014 (60 to 65 days gestation), followed by a period of 90 days when young individuals remain in the burrow (Noss et al. 2003; Medri 2008). These young armadillos showed affiliative behaviors such as coordinated foraging and feeding (McDonough & Loughry 2008).

Finally, our observations of juveniles and the mounting attempt suggest a mating period from August through November. These observations are consistent with those of Tomas et al. (2013). In addition, based on our observations of armadillos entering and exiting the burrows, we assume that residents were males and those just passing



by the site were females. This is supported by our observations of how males dug vigorously the burrow entrance and surrounding substrate, in an attempt to reach for the females, as described in the Brazilian Pantanal (Tomas et al. 2013). However, an alternative explanation for the second female is that it was a male that had picked up on her scent, and followed the first female.

One peculiarity of our observations is the possibility of multiple entrances to a common burrow. We assume that the burrow had several entrances, due to their clumped spatial distribution. The maximum distance between entrances was 1.50 m, and we think at least two entrances were connected, because armadillo D was seen entering one (e^5) and leaving another (e^2) within seconds. This characteristic contradicts Carter & Encarnação (1983), who describe that *E. sexcinctus* builds its burrows with a single inverted U-shape entrance.

Our field observation contributes to the knowledge of reproductive, exploratory and social behaviors of *E. sexcinctus*, all of which were not previously described in northeastern Argentina, in addition to a novel structural characteristic for the burrows of this species.

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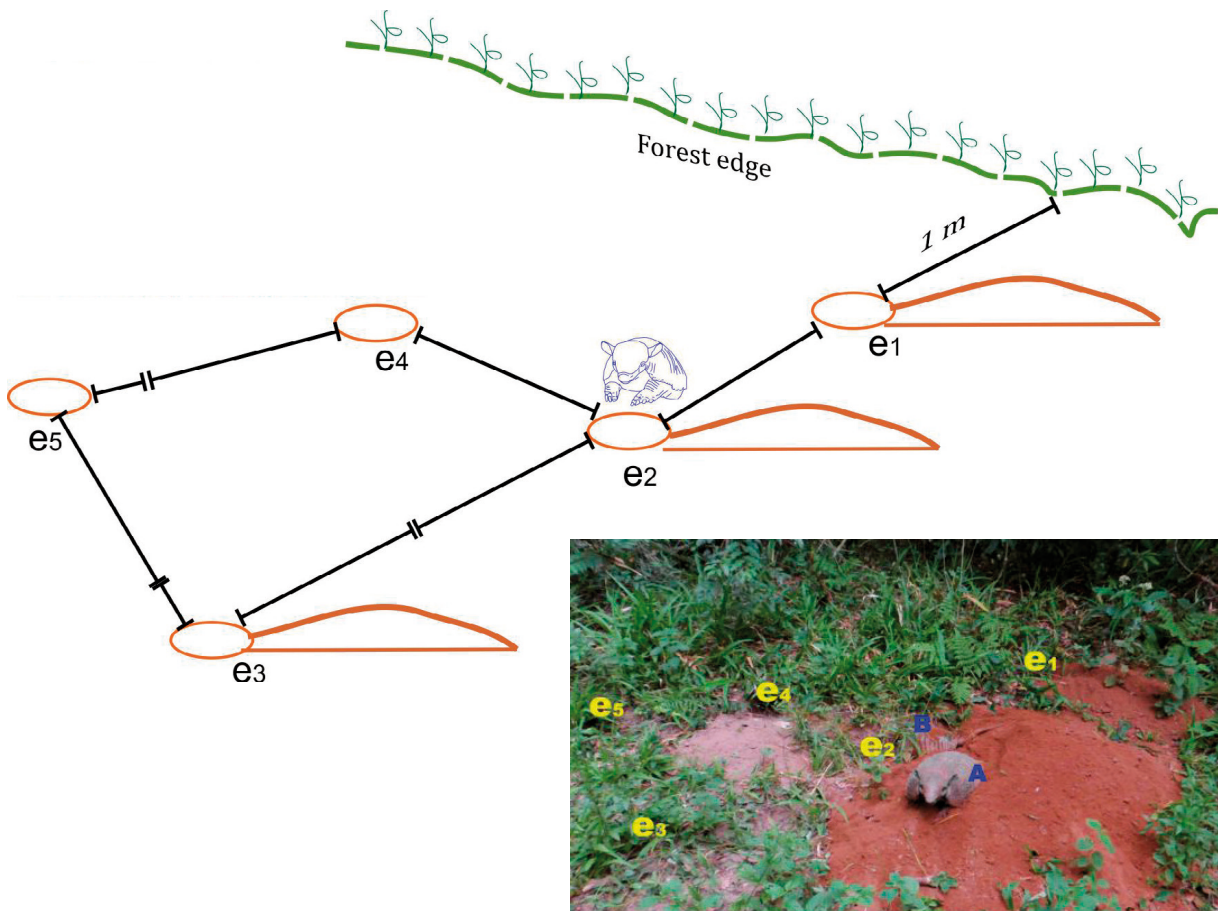


Figure 1. Schematic representation of common burrows of *Euphractus sexcinctus* with five potential entrances (e^1 , e^2 , e^3 , e^4 and e^5), where a resident male individual B and one non-resident female individual A are in proximity.



Figure 2. Two-second sequence of *Euphractus sexcinctus* in which a male (B) tried mounting a female (A).



Figure 3. Social behavior of *Euphractus sexcinctus* showing tolerance between resident individuals B, C, and D.



Figure 4. Social behavior of *Euphractus sexcinctus* showing non-resident individual E approaching the burrow complex, and resident individuals (B, D).

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