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YOUNG DIDELPHID CONSUMPTION BY *Micoureus paraguayanus* (DIDELPHIMORPHIA: DIDELPHIDAE) IN SOUTHEASTERN BRAZIL

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ABSTRACT: In a study aiming to describe the diet of *Micoureus paraguayanus* in a southeastern Brazilian Cerrado (savannah-like) remnant, we found young didelphid remains in fecal samples from live-trapped adults. These findings uncovered either events of scavenging on dead young didelphids or infanticide adding to the knowledge on the dietary breadth and behavioral ecology of *M. paraguayanus*.

RESUMEN: Consumo de crías de didélfidos por *Micoureus paraguayanus* (Didelphimorphia: Didelphidae) en el sudeste de Brasil. En un estudio con el objetivo de describir la dieta de *Micoureus paraguayanus* en un remanente de Cerrado en el sudeste de Brasil, encontramos vestigios de didélfidos jóvenes en muestras de heces de adultos capturados. Estos resultados sugieren el consumo de individuos ya muertos o infanticidio. Nuestros hallazgos añaden un nuevo conocimiento acerca de la dieta y ecología conductual de *M. paraguayanus*.

Key words. Cannibalism. Cerrado. Didelphid. Infanticide.

Palabras clave. Canibalismo. Cerrado. Didélfidos. Infanticidio,

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The family Didelphidae includes 95 species widely distributed throughout the Neotropical region (Gardner, 2007). Dietary studies have revealed a wide variety of food resources consumed by didelphids, such as fruits, nectar, small vertebrates and arthropods (Vieira and Astúa de Moraes, 2003; Carvalho et al., 2005). Fruits and arthropods, for example, are frequent in the diets of *Gracilinanus*, *Micoureus*, *Metachirus*, *Marmosa* and *Caluromys*, whereas small vertebrates are frequently consumed by *Didelphis*, *Chironectes*, *Philander*, *Monodelphis* and *Lutreolina* (Santori et al., 1997; Cáceres et al., 2002; Vieira and Astúa de Moraes, 2003; Casella and Cáceres, 2006; Ceotto et al., 2009). The frequency and relative proportions with which different food resources are consumed vary widely among didelphid species and have led to their placement along a continuum from frugivory to carnivory (Astúa de Moraes et al., 2003; Vieira and Astúa de Moraes, 2003). The woolly mouse opossum *Micoureus paraguayanus* Tate, 1931, falls in the middle of this continuum, consuming a wide variety of arthropods such as hymenopterans, coleopterans, and hemipterans, and fruits from different taxa such as Cecropiaceae, Piperaceae and Moraceae (Leite et al., 1996; Carvalho et al., 1999; Cáceres et al., 2002; Casella and Cáceres, 2006). The consumption of birds was also reported for *M. paraguayanus*, suggesting that vertebrates may play an important role in the diet of some populations (Cáceres et al., 2002; Casella and Cáceres, 2006). Despite the dietary diversity uncovered for *M. paraguayanus*, the consumption of any mammal species has not been reported so far. In this note we communicate the first record of the consumption of didelphid marsupials by *M. paraguayanus*. This information is relevant not only because it contributes towards the goal of a more complete specification of the dietary breadth of *M. paraguayanus*, but also as a way of probing into the behavior of such secretive mammals as didelphids.

Our data was gathered during a study aiming to evaluate the endogenous and exogenous factors influencing the diet of two small marsupials, *M. paraguayanus* and *Gracilinanus microtarsus*, which coexist in a south-eastern Brazilian Cerrado (savannah-like) remnant (Reserva Biológica de Mogi Guaçu, São Paulo, 22° 15'/22° 18' S; 47° 08'/47° 13' W). Feces were collected from individuals captured in an 11 x 11 trapping grid with 121 trapping-stations located 15 m from each other. We captured 20 adult individuals of which seven were females and 13 were males. This strongly male-biased sampling is expected since there is evidence for male biased dispersion in *M. paraguayanus* (Pires and Fernandez, 1999). We collected 165 fecal samples (mean number of fecal samples and range: males 5.15, 1-23; females 14.0, 1-41) and analyzed each sample in the laboratory with a stereoscope. Four of those samples contained vertebrate remains. Vertebrate items collected from the feces of *M. paraguayanus*, were air dried, mounted in metal stubs, coated with gold in a Sputter Coater Balzers SCD050, and examined in a Jeol JSM 5800LV scanning electron microscope (SEM).

None of the males had evidence of vertebrate consumption, whereas the four samples containing vertebrate remains were found in feces from three of the seven captured females. One sample of one female contained a fragmented toothrow and bone fragments not completely ossified, a second sample from another female contained only a fragmented bone, and two samples from a third female contained one vertebrate claw each. The toothrow (**Fig. 1**) contained only three teeth, a long and curved canine and two premolars differing in size, with P2 being larger than P1; a dental morphology which unambiguously refers to a didelphid upper toothrow (Gardner and Creighton, 2007). Although the claws and the bone found in other fecal samples clearly represent vertebrate consumption events, their morphology is not enough to reliably identify the species consumed; therefore we focused on the toothrow and bones found in the same sample for the discussion below. Hair could not help in the identification of fragments since all fecal samples contained a large amount of hair most likely from the sampled individuals

themselves. The comparison of the toothrow and bones found in the feces with those of museum specimens of *M. paraguayanus* and *G. microtarsus*, established that the toothrow and bones were much smaller in size than those of adults of both species. Moreover the sample which contained the toothrow dates from December, when we expect only adults and newborns of *M. paraguayanus* compose the population, since juveniles seem to appear only after January (Barros et al., 2008). This observation, coupled with the fact that the bones and maxilla detected were not completely ossified and the feces containing vertebrate remains were collected during the reproductive season (December and March) of both species (Quental et al., 2001; Martins et al., 2006; Barros et al., 2008), suggests that our finding uncovered either an event of scavenging on a dead young didelphid, or infanticide (intra or interspecific).

Among didelphids, scavenging behavior has been deduced based on the detection of dipteran pupae remains in feces of species of the genera *Monodelphis, Philander, Caluromys* and also *Micoureus*, but no further information on the identity and quantity of the carrion consumed has been obtained (Santori et al., 1997; Vieira and Astúa de Moraes, 2003; Carvalho et al., 2005). Scavenging on carrion, including conspecific, has been shown to be an important food source to the diet of species of the genus *Didelphis* (Hopkins and Forbes, 1980). In particular, Hopkins and Forbes (1980) results show that especially on winter, in an urban environment, the most frequent mammal on the diet of *Didelphis virginiana* were conspecifics.

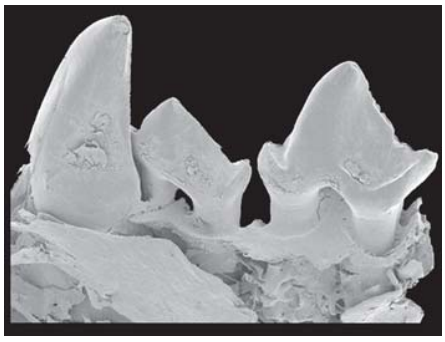

Fig. 1. Scanning electron microscope photograph of a fragmented young didelphid upper toothrow, containing one canine and two premolars found in a female *M. paraguayanus* fecal sample.

Intraspecific infanticide is the killing of immature by parents (also defined as filial cannibalism; Klug and Bonsall, 2007) or nonparental conspecifics. Among didelphids, filial cannibalism has been reported for captive opossums (genus *Didelphis*) in response to stress (Raven, 1929), but also seems to occur under the absence of stressors (Hopkins and Forbes, 1980). Similarly to filial cannibalism, nonparental infanticide behavior may provide individuals with nutritional benefits. In addition to that, territorial females that perform infanticide benefit from the abandonment of nest sites and territories by those mothers that had lost their offspring (Wolff, 1993, 1997). Since female *M. paraguayanus* seem to be territorial, because their home ranges show little overlap (Pires and Fernandez, 1999; Quental et al., 2001; Moraes and Chiarello 2005), and *M. paraguayanus* offspring pass through a nidiculous life, in which they may be vulnerable (Delciellos et al., 2006), nonparental infanticide behavior could also be included in this catalogue of possibilities.

Another possibility to be considered is that the maxilla and bones found in the samples are remains of a young of another didelphid species occurring in the study area such as *G. microtarsus*. Preying upon other marsupials is not unusual among didelphid species (Vieira and Astúa de Moraes, 2003). Interspecific predation on young could have an important role if sympatric didelphid species compete for nesting sites and would also provide an alternative source of food. Finally, we cannot exclude the possibility that young carried around by the female *M. paraguayanus* could have been consumed while inside the trap as a response to capture stress. Such a female could have been captured soon after we had set the traps and stayed there all night long, so that feces could contain remains of young consumed while inside the traps. This cata-

logue of possibilities reveals the potential behavioral complexity of the species and other didelphids. Detailed studies are needed to investigate the occurrence, prevalence, and ecological relevance of scavenging and infanticide behavior in *M. paraguayanus* and in other tropical mammalian species. Such information is important for us to better understand the unique ways in which each species experiences the environment and interfaces with the community and the implications of these behaviors for population and community dynamics.

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