Short Note

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First study on food habits of anteaters, *Myrmecophaga tridactyla* and *Tamandua tetradactyla*, at the southern limit of their distribution

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Abstract: This study provides data on the diet of two species of anteaters in Argentina. We worked with feces and the stomachs of road kill individuals. The feces were washed to separate the soil material consumed and 100 ml of the stomachs' content were taken and examined. The differences in diet between both species of anteaters are related to their habits and the availability of ants. Ants consumed by *Myrmecophaga tridactyla* have mainly soil habits, nesting and foraging in the leaf litter. Meanwhile, ants consumed by *Tamandua tetradactyla* are characterized by foraging both at the ground level and on vegetation.

Keywords: ants; Argentina; diet; myrmecophagy.

Ants are one of the most abundant and easy to find food sources due to their high concentration of individuals and strong chemical cues that they use for communication (Hölldobler and Wilson 1990). In fact, in many parts of the world these insects are a basic potential prey (Redford 1986). Argentina, due to its extension and particular geographical location, offers a wide range of niches that can be occupied by these insects, thus promoting species diversity (Cuezzo 1998, Vittar 2008). In this country, there are 71 known genera, representing 24% of worldwide ant genera and nearly 60% of the Neotropical myrmecofauna (Vittar 2008). In view of the apparent availability of ants and termites as food, it is surprising that few mammalian forms have evolved to exploit this food resource (Montgomery 1985b). A notable exception are the anteaters (Mammalia: Myrmecophagidae), whose main food source includes ants and termites. This is reflected in their morphology, like the shape of the jaw, tongue and palatal musculature, which severely limits the prey they can ingest (Redford and Dorea 1984, Reiss 2000). Although the anteaters are considered one of the mammals most specialized for feeding on termites and ants (Rodrigues et al. 2008) it has been reported to feed on other small arthropods (Montgomery 1985b, Redford 1985, Hayssen 2011).

The two species inhabiting Argentina have a restricted distribution in the northeast, with the giant anteater (*Myrmecophaga tridactyla* Linnaeus, 1758) mainly found in grassland areas, although it often ventures into forested areas, and the southern tamandua (*Tamandua tetradactyla* Linnaeus, 1758) that uses diverse habits like grasslands, transitional and rain forests (Hayssen 2011). The presence of a prehensile tail gives *T. tetradactyla* the ability to climb trees allowing it to exploit different food sources than *M. tridactyla* (Rodrigues et al. 2008).

The giant anteater is terrestrial, primarily nocturnal and feeds mainly on ants, and occassionally on termites (Montgomery 1985b). The southern tamandua is scansorial, moving, feeding and resting both on the ground and in trees. It feeds on a combination of ants and termites. In trees, they mainly use branches rather than lianas as a substrate for moving and feeding, but sometimes feed on ants or termites living inside liana stems (Montgomery 1985a). They sometimes feed on large nests of ants or termites, both while foraging on the ground and in trees, but

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more commonly they forage few ants or termites (Lubin et al. 1977). Both anteaters spend considerable energy and time in finding and consuming social insects. Certainly most of the time their foraging is spent in searching for a prey, rather than consuming it. In Argentina, there is a lack of research about the feeding habits of these myrmecophagous mammals. Hence this study provides the first data set on the diet of anteaters coming from the analysis of stomach contents and feces, and ant diversity.

The information on the diet of *Myrmecophaga tridactyla* was obtained from feces collected in two locations in the Salta province (23°57′S 62°44′W, 24°02′S 62°44′W) and five locations in the Chaco province (between 26°36′53″S 61°34′46″W and 26°13′44″S 61°4′27″W); both areas belong to the Chaco ecoregion, characterized by a semiarid climate with a forest matrix crossed by grasslands (Torrela 2005). The four stomach samples of *Tamandua tetradactyla* were obtained from road kill individuals, two in Misiones province (26°17′39″S 53°45′26″W, 25°40′09″S 54°07′43″W), one in Chaco (27°55′38″S 59°15′28″W), and one in Formosa province (25°45′70″S 58°57′25″W). The first two samples of *T. tetradactyla* belong to the Paranaense Forest ecoregion, which has a subtropical climate characterized by the presence of patches of dense forest (Plací 2005), and the last two belong to the Chaco ecoregion.

To process the feces, we washed them to remove soil material consumed with the ants. The samples were left for a week in containers with water to facilitate separation of materials and then the heads of individuals consumed were separated, which is the part of the exoskeleton best preserved, using a fine-mesh filter. For stomach samples, we obtained 100 ml of content, which presented entire individuals of ants. In this case, it was not necessary to wash the sample. All taxa were separated and determined under a binocular microscope, using taxonomic keys of families and genera, and subsequent corroboration of specialists.

For samples of giant anteater a total of 22 morphospecies were identified, which were grouped into 14 genera belonging to five subfamilies (Table 1). The subfamily Myrmicinae, a taxonomic group well represented in the Chaco region (Lutz and Godoy 2010), showed higher species richness. However, the genus *Camponotus* (subfamily Formicinae) was the most diverse. It is important to emphasize that most genera found in *Myrmecophaga tridactyla* were terrestrial. In addition, Blatodea eggs, fragments of Coleoptera and abundant Isoptera taxa were found.

For *Tamandua tetradactyla* a total of 21 morphospecies, grouped in 11 genera and four subfamilies were found (Table 1). The subfamily Myrmicinae showed higher species richness, followed by Fomicinae which, unlike *Myrmecophaga tridactyla*, presented higher diversity of genera. This is expected because both subfamilies predominate in the regions (Vittar 2008). Some of the genera found have terrestrial and/or arboreal habits. Besides ants, different taxa of Coleoptera, Isoptera and a particular genus of bee, *Melipona* sp. which build nest within living woody plants (Roubick 2006) were recorded.

Table 1: Ants consumed by anteaters of Argentina.

Ant genus	Number of ant species consumed		Habitat
	Myrmecophaga Tridactyla	*Tamandua tetradactyla*	
Eciton	1	–	Terrestrial
Labidus	1	–	Terrestrial
Camponotus	5	6	Terrestrial/arboreal
Brachymyrmex	–	1	Terrestrial
Nylanderia	–	1	Terrestrial
Acromyrmex	2	1	Terrestrial
Atta	1	–	Terrestrial
Crematogaster	–	2	Arboreal
Pheidole	3	4	Terrestrial/arboreal
Pogonomyrmex	1	–	Terrestrial
Solenopsis	1	2	Terrestrial
Trachymyrmex	–	1	Terrestrial
Xenomyrmex	1	–	Terrestrial/arboreal
Anochetus	1	–	Terrestrial
Odontomachus	1	–	Terrestrial
Pachycondyla	1	1	Terrestrial
Heteroponera	–	1	Terrestrial/arboreal
Ectatomma	2	–	Terrestrial
Gnamptogenys	1	1	Terrestrial/arboreal

The ants' diversity present in a given region depends on climate and almost exclusively on food supply (Silvestre et al. 2003), thus the availability of this prey for anteaters may vary geographically (Medri et al. 2003). This study observed that the differences in diet between both species of anteaters are related to the availability of ants and the different habits that these insects have. The ant genera *Camponotus* and *Pheidole* were the most consumed for the anteaters. *Camponotus* is a vast genus with 1000 species in the Neotropical region, generally considered omnivorous, with several species living on trees and nesting on wood, and with colonies of variable size (Fernández 2003).

Pheidole is another abundant genus present in the region, that nests and forages mainly in the soil surface, both on the ground or in leaf litter (Fernández 2003). Other genera found in both anteaters' diet were *Solenopsis*, *Pachycondyla*, *Acromyrmex* and *Ganmptogenys* that although they have different habits, their colonies and foraging areas are at ground level, which means they are an easily accessible prey for both *Myrmecophaga tridactyla* and *Tamandua tetradactyla*.

Ants mainly consumed by the giant anteater belong to genera inhabiting at the soil level, present in the leaf litter such as *Eciton* or *Labidus* which are characterized by nomadic habits, moving over vast distances. The consumption of these genera by *Myrmecophaga tridactyla* is probably associated with its larger home range compared to *Tamandua tetradactyla* (Rodrigues et al. 2001, Medri and Mourão 2005). The genera *Atta, Xenomyrmex* and *Pogonomyrmex,* inhabit vegetation (Lattke 2001), and were found only in giant anteater's diet. The ant's genus *Anochetus, Odontomachus, Ecatatomma* and *Gnamptogenys* inhabit dry forests with seasonal rains. Their nests are not only very common in decaying wood on soil and leaf litter, but also within the soil (Lattke 2001).

Within the ants consumed exclusively by *Tamandua tetradactyla*, the most abundant genus was *Crematogaster*, which is classified within the guild of "small arboreal and massive recruitment" as they nests in vegetation and have focal but massive activity on different species of trees (Silvestre et al. 2003). Other genus of main arboreal activity found in these anteaters was *Nylanderia,* classified within the guild "opportunistic of soil and vegetation" which is characterized by foraging both at ground level and on vegetation. And finally, the other genus consumed by Southern tamandua was *Heteroponera*, ants that are frequently found in tropical forest areas, which can nest on the ground, leaves or roots of epiphytes.

While *Myrmecophaga tridactyla* is known to have terrestrial habits and *Tamandua tetradactyla* both terrestrial and arboreal, recently certain arboreal behavior has been observed for giant anteaters (Young and Coelho 2003), which would explain the consumption of ants that usually nest or forage on forest vegetation.

Compared to similar studies on the diet of these species of anteaters in the Neotropical region, the present study found that *Tamandua tetradactyla* in Argentina has higher diversity of ant genera in its diet. We found 10 different ant genera, while in Brazil only two genera were found (Sousa and Messias 2012), only one genus in Colombia (Sandoval-Gomez et al. 2012) and four different genera in Venezuela (Montgomery 1985a). Likewise, the most abundant genera used as resource by this anteater, *Camponotus* and *Solenopsis* which are widely distributed in Neotropical region, were also found in the diet of *T. tetradactyla* in Brazil and Venezuela (Montgomery 1985a, Sousa and Messias 2012).

Concerning *Myrmecophaga tridactyla,* this study found similarities with results obtained in Colombia (Sandoval-Gomez et al. 2012) and Brazil (Medri et al. 2003, Braga 2010, Braga et al. 2014). However, the present study found more diversity of genera in the samples examined, adding *Xenomyrmex, Gnampotogenys* and *Pogonomyrmex* genera; therefore making a total of 13 genera consumed by these species of anteater. It is important to mention that termites (Isoptera) were present in both anteaters' diet for all the works mentioned, including this one, but always in fewer numbers than ants. Likewise, we can not specify if the difference in ant diversity of each work compared above is due to the region studied or to the number of samples taken in each case, because these data were not detailed in the reviewed studies.

This paper provides information about the diet of the two species of anteaters from Argentina, which until now was unknown. We also consider it necessary to expand the information obtained analyzing seasonal variations in diet as well as the effect of the human impact on ant communities and its impact on anteaters.

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