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## Scientific Note

# First record of bird and spider species preying on dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) in the Amazon Forest

**Renato P. Salomão[1], Cleiton Valentim[2], André F. A. Lira[3]**

*[1]Universidad Nacional Autónoma de México, Tlalnepantla de Baz, Mexico. [2]Instituto Nacional de Pesquisas da Amazônia, Manaus, AM, Brazil. [3]Universidade Federal Rural de Pernambuco, Recife, PE, Brazil.*
*Corresponding author: andref.lira@gmail.com*

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**Abstract.** Predator-prey relationships are critical for establishing trophic networks, but our understanding of these interactions is hindered by a lack of records in tropical rainforest ecosystems. Although literature indicates that dung beetles may be preyed by a wide range of animal species, surprisingly, there are no such antagonistic records between dung beetles and other species in the Amazon forest. The objective of this study is to present two records of such interactions in the Amazon, involving a bird and a spider species preying on dung beetles. The bird *Galbula albirostris* Latham, 1790 (Aves: Galbulidae) was observed feeding on a Deltochilini dung beetle (Coleoptera: Scarabaeidae) in a *terra firme* forest, while a *Canthidium* sp. was captured in a *Trichonephila* sp. (Araneae: Nephilidae) spider web on an artificial island also located in a *terra firme* forest. While birds are the most commonly recorded predators of dung beetles in the literature, there are few records of such predation events with spider species. The scarcity of data regarding predatory behavior on dung beetles in the Amazon forest underscores the need to assess these interactions to establish their importance in maintaining food webs.

**Keywords:** Aves, Arachnida, antagonistic interaction, natural history.

Predator-prey interactions are a crucial aspect of population and community dynamics, and understanding them is essential for comprehending biodiversity responses to natural and non-natural environmental fluctuations (Schmitz 2008; Thompson 2009; Ripple et al. 2014). The assessment of predator-prey interactions allows the establishment of complex food-web interactions (McDonald-Madden et al. 2016; Draper & Weissburg 2019). However, the lack of records of predator-prey interactions in many ecosystems is a significant limitation in understanding ecological dynamics (Thompson et al. 2012; Gray et al. 2014), as species specific or generalist interactions. With the increasing anthropogenic pressure on natural and semi-natural landscapes, it is important to identify gaps in interaction networks, as environmental disruptions caused by human activities that challenge species coexistence (Daugaard et al. 2019; Del-Claro & Dirzo 2021).

Dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) are preyed upon by a wide range of animals, including birds, lizards, marsupials, and other invertebrates (e.g., Bornemissza 1976; Duncan et al. 2009; Young 2015; Noriega 2016). While most dung beetle predators are generalist, some species have specialized in preying on them (Bornemissza 1976; Duncan et al. 2009; Young 2015). Predatory behavior is often associated with the search for dung beetles in dung pad surfaces or below them, as well as by excavating dung beetle tunnels to feed on the individuals (Young 2015). Dung beetles have also been observed being predated after falling into spider webs (Noriega 2016). Despite the widespread occurrence of predation on dung beetles, most studies have been conducted in Europe and North America, with few records from other regions (Young 2015). In South America, there are almost no records, except for a recent report of *Latrodectus geometricus* Koch, 1841 (Theridiidae) preying on exotic species *Digitonthophagus gazella* (Fabricius, 1787) in a desertic region of Colombia (Noriega 2016). Surprisingly, there are no records of antagonistic interactions with dung beetles in the Amazon forest, despite its high species diversity and complex ecological interactions. Therefore, the aim of this study was to provide new records of antagonistic interactions with dung beetles in the Amazon. Here, we describe and discuss two new records of birds and an arachnid capturing two species of dung beetles.

In April 2022, during a field experiment conducted in the artificial archipelago of Balbina, situated in Presidente Figueiredo, Brazil (01°46'S, 59°42'W), we made an observation of a dung beetle caught in a spider web. The observation was carried out on a sunny day at about 10:00 a.m., during the rainy season of the region, which has an average monthly rainfall of 416 mm in April (Climate-Data 2023). The spider orb weaver was found about 130 cm above the ground level, in a forest clearing close to the edge of the island. The spider responsible for trapping the dung beetle belongs to the genus *Trichonephila* Dahl, 1911 (Araneae: Nephilidae) (Fig. 1B), while the dung beetle was identified as a *Canthidium* sp. (Fig. 1C), by comparing the collected specimens with the Entomological Collection of the *Instituto Nacional de Pesquisas da Amazônia*, Manaus, AM. Species of *Canthidium* Erichson, 1847 genus are not easily identified (see Cupello 2018). During our observation of this spider-dung beetle interaction, which lasted for about five minutes, both the *Trichonephila* spider and the *C. bicolor* beetle remained motionless. Upon collecting the dung beetle, we noticed that the individual was already dead.

The predation of dung beetles by a bird was observed in a *terra firme* forest located in the municipality of Presidente Figueiredo, Amazonas state, Brazil (01°45'S, 60°08'W). The observation was done in June 2022, during the beginning of the dry season (mean monthly rainfall: 220 mm, Climate-Data 2023), and it took place at approximately 11:00 a.m. on a sunny day. The bird involved in the predation event was a female *Galbula albirostris* Latham, 1790 (Fig. 1A) and was found perching at around 80 cm of height in a tangle of vines, with the dung beetle already in its beak. During the observation, the dung beetle was motionless, and after a few seconds, the bird swallowed it. Based solely on the photograph, the dung beetle can be tentatively assigned to the tribe Deltochilini. However, since the specimen was not collected, this identification should be considered only a preliminary assumption. It may correspond to species of *Scybalocanthon* Martínez, 1948 [*Scybalocanthon pygidialis* (Schmidt, 1922) or *Scybalocanthon sexpilotus* (Guérin, 1855)] or *Canthon* Hoffmannsegg, 1817 [*Canthon*

*triangularis* (Drury, 1770)], genera known to occur in the region (Ratcliffe 2013; Silva & Valois 2019).

Birds are known to be the primary predators of dung beetles (Young 2015). Some owls and hawks often preys arthropods, including dung beetles (Sick 1997; Smith & Conway 2007). Typically, bird predation on dung beetles occurs when the birds actively search for them in the excrement of large mammals, particularly in pasture environments (Seibt & Wickler 1978; Young 2015). Additionally, birds from open environments are more commonly reported to prey on beetles, as they can capture them during flight (Johnston 1967; Keith et al. 1992), such as birds of the Tyrannidae family (Sick 1997). Considering the behavioral patterns of Deltochilini, we hypothesize that *G. albirostris* could have captured dung beetles in three possible situations: (1) during flight activity of the dung beetle; (2) at the perching sites of the dung beetle (e.g., leaves or sticks) or (3) near a dung pad. The scarcity of literature on predation of dung beetles in tropical forests (see Young 2015), and the lack of clarity regarding the diet of Galbulidae [reports indicate that small beetles are a part of their diet, *see* Sick (1997)], presents a challenge for obtaining more detailed information on this interaction.

In contrast to birds, spiders have been rarely recorded as predators of dung beetles. This antagonistic interaction has only been reported for spiders of Theriididae and Thomisidae (Jennings 1974; Carrel & Deyrup 2014; Noriega 2016), and to our knowledge this is the first record for Araneidae. According to Carrel & Deyrup (2014), dung beetles are the principal prey item for the red widow spider *Latrodectus bishopi* Kaston, 1938, in Florida scrublands. However, this does not seem to be the case for the predation event reported in this study. *Trichonephila* spiders are considered generalist predators that capture small to medium flying prey with their orb-weaver webs (Shimazaki & Miyashita 2005; Ripp et al. 2018). In addition, these spiders capture most of their prey during the day (Higgins 1987; Herberstein & Elgar 1994), which is a similar period when most *Canthidium* spp. forage (Feer & Pincebourde 2005), which may facilitate the encounter between the two taxa. Therefore, the predation of *C. bicolor* by *Trichonephila* may be frequent, although this hypothesis needs to be tested in future studies.

Antagonistic interactions between predators and dung beetles vary from sporadic and occasional records to more common occurrences. The new records presented in this study broaden our understanding of predator-prey interactions in the Amazon region, providing insight into the potential use of dung beetles as a food resource for other animals. The scarcity of records for the Amazon forest may suggest that such events are uncommon. However, it is important to consider that ecological fieldwork may be biased towards exploring the environment for other aspects, rather than focusing on predatory interactions with dung beetles.

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## Author's Contributions

RPS: Investigation, data curation, resources, writing – original draft. CV: Investigation, data curation, writing – original draft. AFAL: conceptualization, investigation, visualization, writing – review and editing.

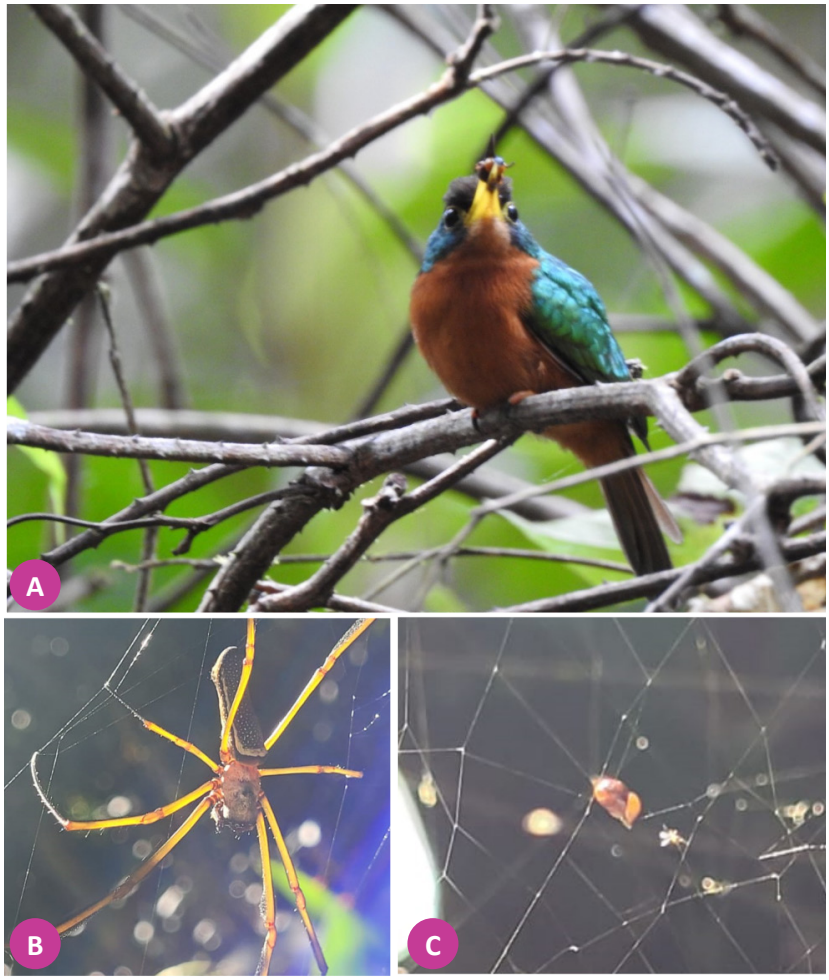


**Figure. 1.** *Galbula albirostris* Latham, 1790 (Aves: Galbulidae) (A) preying Delthochilini dung beetle, and *Trichonephila* sp. (Araneae: Araneidae) (B) preying *Canthidium* sp. (Coleoptera: Scarabaeidae) (C) in Amazon forest fragment located at Amazonas state, Brazil.

## Conflict of Interest Statement

The authors declare no have competing interests.

## Ethical Approval

Not applicable.

## Data Availability

Not applicable, all data used is disponible on manuscript.

## Generative AI Statement

Authors declare that any AI was used during manuscript preparation.

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