An opportunist predator hidden in the vegetation: on the predation of birds by Philodryas olfersii (Serpentes: Dipsadidae)

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ABSTRACT
Snakes are common predators of birds. However, reported cases of snake predation on Troglodytes musculus are scarce. Here, we report a predation attempt of a Troglodytes musculus nesting by the dipsadid snake Philodryas olfersii. We also present a list with bird species recorded as prey of this snake species. We found 25 predation events of P. olfersii on adult, juvenile, and nestling birds. A total of 19 bird species from 14 families have been reported as prey of P. olfersii. Most predation events occurred on the vegetation, while some others were observed on the ground, cage, and artificial nest.

Serpentes são predadores comuns de aves. No entanto, casos relatados de predação de Troglodytes musculus por serpentes são escassos. Aqui, relatamos uma tentativa de predação de um filhote de Troglodytes musculus pela serpente Philodryas olfersii. Também apresentamos uma lista de espécies de aves registradas como presas dessa espécie de serpente. Encontramos 25 eventos de predação de P. olfersii sobre aves adultas, juvenis e filhotes. Um total de 19 espécies de aves pertencentes a 14 famílias foram relatadas como presas de P. olfersii. A maioria dos eventos de predação ocorreu na vegetação, enquanto alguns outros foram observados no solo, gaiola e ninho artificial.

The Neotropical dipsadid Philodryas olfersii (Lichtenstein 1823) is a medium-sized venomous, semi-arboreal and diurnal snake widely distributed throughout South America, where it occurs in Argentina, Bolivia, Brazil, Colombia, French Guiana, Guyana, Paraguay, Peru, Uruguay, and Venezuela [1,2]. It inhabits mainly forest and forest edge habitats [3], but can also be found in swampy and agricultural areas as well as in the vicinity of human habitations [4–7]. As a generalist predator, P. olfersii preys on a wide variety of small vertebrates such as frogs, lizards, snakes, birds, rodents and bats [8–11].

Snakes employ two foraging strategies to hunt prey – active searching and ambush [12,13]. They are common predators of birds, with their predation on nestlings being one of the main causes of nest failure for most birds [14,15]. However, reported cases of snake predation on adults and nestlings of passeriform Troglodytes musculus Naumann, 1823, are scarce [16,17].

Troglodytes musculus is recognized as a species distinct from Troglodytes aedon Vieillot, 1809, by the Brazilian Ornithological Records Committee [18], although BirdLife International [19] does not acknowledge this distinction and treats T. aedon as a single species living throughout the Americas. Troglodytes musculus often builds nests in natural cavities or among human construction, such as on walls and under tiles [20]. It uses grass and/or roots to install nests, depending on the place they have chosen, and incubates 3 to 7 eggs, which hatch after 15 days [20,21]. Here we reported a predation attempt of a Troglodytes musculus nesting by the dipsadid snake Philodryas olfersii, and provide a list of bird species recorded as prey of this snake.

Field observation was performed in the rural zone of the municipality of Assai, northern Paraná State, southern Brazil (−23.4709°S, −50.8926°W, Datum WGS 84). A bibliographic search was conducted using Google Scholar to summarize the records of P. olfersii predating individuals of other bird species. The search terms used were: “Philodryas olfersii”, “diet”, “feeding behavior” and “birds”. Natural history notes published in Atualidades Ornitológicas, Herpetological Bulletin, Herpetology Notes, and Herpetological Review were also searched for predation records. Photos and videos of predation records were also obtained from WikiAves (https://www.wikiaves.com.br/) and YouTube (www.youtube.com).

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Table 1. Bird species reported as prey of Philodryas olfersii.

| Bird species                        | Prey age | Predation microhabitat | Locality (all in Brazil)                          | Source |
|-------------------------------------|----------|------------------------|--------------------------------------------------|--------|
| Cardinalidae                        |          |                        |                                                  |        |
| Cyanoloxia brissonii (Ultramarine Grosbeak) | ?        | Cage                   | Montenegro, RS [30]                              |        |
| Columbidae                          |          |                        |                                                  |        |
| Columbina picui (Picui Ground-Dove) | ?        | ?                      | Carlos Chagas, MG [31]                           |        |
| Columbina talpacoti (Ruddy Ground-Dove) | ?        | ?                      | Pentecoste, CE [6]                               |        |
| Dendrocolaptidae                    |          |                        |                                                  |        |
| Lepidocolaptes angustirostris (Narrow-billed Woodcreeper) | Adult    | Vegetation             | Três Rios, RJ [33]                              |        |
| Fringillidae                        |          |                        |                                                  |        |
| Spinus magellanicus (Hooded Siskin) | ?        | Vegetation             | Baependi, MG [34]                               |        |
| Icteridae                           |          |                        |                                                  |        |
| Gnorimopsar chopi (Chopi Blackbird) | ?        | ?                      | Distrito Federal, DF [35]                        |        |
| Passerellidae                       |          |                        |                                                  |        |
| Zonotrichia capensis (Rufous-collared Sparrow) | ?        | ?                      |                                                  |        |
| Passer domesticus (House Sparrow)   | Adult    | Vegetation             | Campinas, SP [4]                                |        |
| Adult                               |          | Vegetation             | Nazaré da Mata, PE [39]                         |        |
| Pipridae                            |          |                        |                                                  |        |
| Chiroxiphia caudata (Swallow-tailed Manakin) | Nestling | Vegetation             | Nova Lima, MG [40]                              |        |
| Pittacidae                          |          |                        |                                                  |        |
| Melopsittacus undulatus (Budgerigar) | ?        | Cage                   | Lavras, MG [41]                                 |        |
| Rhynchocyclidae                     |          |                        |                                                  |        |
| Tolmomyias sulphurescens (Yellow-olive Flycatcher) | Nestling | Vegetation             | Cuiabá, MT [42]                                |        |
| Thraupidae                          |          |                        |                                                  |        |
| Coereba flaveola (Bananaquit)       | Juvenile | Vegetation             | Campinas, SP [4]                                |        |
|                                     |          | ?                      | Campinas, SP [24]                               |        |
|                                     |          | ?                      | Gurupi, TO [43]                                 |        |
| Sicalis flaveola (Saffron Finch)    | Adult    | Vegetation             | Carlos Chagas, MG [44]                          |        |
| Thamnophilus pallatus (Chestnut-backed Antshrike) | Adult   | ?                      | Bossoroca, RS [30]                              |        |
| Tangara sayaca (Sayaca Tanager)     | Adult    | Vegetation             | Campinas, SP [4]                                |        |
|                                     |          | ?                      | Sabinópolis, MG [45]                            |        |
| Thamnophilidae                      |          |                        |                                                  |        |
| Thamnophilus pallescens             | ?        | ?                      | Carlos Chagas, MG [31]                          |        |
| Troglodytidae                       |          |                        |                                                  |        |
| Troglodytes musculus (Southern House Wren) | Nestling | Artificial nest        | Assai, PR [This study]                          |        |
| Turdidae                            |          |                        |                                                  |        |
| Turdus leucomelas (Pale-breasted Thrush) | Nestling | Vegetation             | Carlos Chagas, MG [46]                          |        |
| Turdus rufiventris (Rufous-bellied Thrush) | Nestling | Ground                | Santa Margarida do Sul, RS [47]                 |        |

Brazilian states: CE, Ceará; DF, Distrito Federal; MG, Minas Gerais; MT, Mato Grosso; PE, Pernambuco; PR, Paraná; RJ, Rio de Janeiro; RS, Rio Grande do Sul; SP, São Paulo; TO, Tocantins

? – data not available.

Figure 1. Nestlings of Troglodytes musculus.
At 14:30 h on 28 December 2018 an adult *P. olfersii* was observed trying to reach a nest of *T. musculus* containing three nestlings in the backyard of a house in the rural zone of the municipality of Assai (Figure 1). The nest was located inside a cylindrical cardboard container on top of a short wall. While unsuccessfully trying to climb the wall, the snake was mobbed by an adult *T. musculus* (https://www.youtube.com/watch?v=AyRA_wsYh9Q&feature=youtu.be). The adult bird uttered alarm calls, displayed approaches and attacked three times by pecking the snake in the head (Figure 2). Disturbed by the mobbing behavior, the snake took shelter on a roll of barbed wire below a table near the wall. The snake remained motionless with its head directed towards the cardboard container (Figure 3). After some minutes, the snake then climbed the table, reached the wall and entered into the cardboard container with the nest. While was holding one of the
three nestlings, it was mobbed by the adult bird, at which point the property owner removed the snake from the cardboard container and killed it.

Our review of the literature and photos and videos of predation records uncovered 25 events of *P. ofersii* preying upon adult, juvenile and nestling birds (Table 1). These 25 records reveal that 19 bird species belong to 14 families have been reported as prey of *P. ofersii*. Thraupidae was the family with the greatest number of reported predation events with seven records. Most of the predation events occurred on vegetation, although some cases occurred on the ground, in a cage or in an artificial nest (Table 1).

Among snakes of the genus *Philodrys*, only *Philodrys chamissonis*, *P. nattereri* and *P. patagoniensis* have been reported as predating nestlings of *Troglodytes aedon* and *T. musculus* [17,22,23]. There were no reports of *T. musculus* as prey of *P. ofersii* among the 25 predation events obtained from the literature and photos and videos of predation records. Therefore, this reported case adds *P. ofersii* to the list of predators of *T. musculus*.

*Philodrys ofersii* is a green snake that actively forages both on the ground and among vegetation [2]. In southern Brazil, *P. ofersii* has been reported to prey mainly on nestlings [2]. The present study, however, found adults and nestlings to account for most records of predation by *P. ofersii* (see Table 1), which seems to reflect its generalist feeding strategy and the availability of these prey items in the habitats where this snake species is found [2,4,24]. Furthermore, the higher number of bird predation events that occurred in vegetation is associated with foraging strategies and camouflage of *P. ofersii* in this type of microhabitat, which favors hunting for prey and avoiding visually oriented predators [2].

Potential prey employ mobbing behavior in an attempt to confound, distract or physically attack the predator [25,26]. In southeastern Brazil, attempts by *P. ofersii* to prey on birds were hindered by a group of mockingbirds (*Mimus saturninus*) that displayed mobbing behavior towards the snake [24]. Although mobbing by a group increases the chances of hindering predation [24], the mobbing behavior displayed by the single adult *T. musculus* did not prevent *P. ofersii* from trying to prey one of the nestlings.

*Philodrys ofersii* occasionally preys on adult and nestling birds living in cages and artificial nests in human habitations near native vegetation [27,28, this study]. As observed in the present study, individuals of *P. ofersii* can be killed by humans while actively searching for prey in human habitations, while in other cases humans can be envenomed by the snake [27–29].

**Disclosure statement**

No potential conflict of interest was reported by the authors.

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