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Acerola fruit: An unusual food item for the Cururu toad *Rhinella diptycha* (Cope, 1862) (Anura: Bufonidae)

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Adult anurans may be generalists, feeding upon a wide diversity of prey, ranging from arthropods to even other amphibians, or specialists feeding mainly on ants or termites (Parmelee, 1999; Toledo et al., 2007). However, adult anurans diet is constrained mainly by body size and head width (Emerson, 1985). Furthermore, resource availability and environmental conditions play a key role in determining diet composition of anurans (Toft, 1985; Duellman and Trueb, 1994). Bufonids are terrestrial predators whose diet is usually reported to be composed of arthropods such as ants, beetles, termites, scorpions, among others (Sabagh and Carvalho-e-Silva, 2008; Quiroga et al., 2009; Batista et al., 2011; Maragno and Souza, 2011), but there is evidence that their diet can be influenced by prey availability in the environment (Giux, 1993; Leite Filho et al., 2015).

Rhinella diptycha (Cope, 1862) is a large, terrestrial bufonid, widely distributed in South America, occurring in natural open areas and even urbanized environments (Pramuk, 2006; Frost, 2019). *Rhinella diptycha* was previously a junior synonym of *Rhinella schneideri*, but recently Lavilla and Brusquetti (2018) have synonymized *R. schneideri* with *Bufo diptychus* based on morphological characters of the original description of *B. diptychus* by Cope (1862), which match the characteristics of juveniles of *R. schneideri*. Therefore, the name diptycha has precedence over schneideri and authors proposed removing *Bufo diptychus* from the synonym list of *Rhinella schneideri* as a new combination *Rhinella diptycha*.

The diet of this species is mainly composed of insects, such as beetles (Coleoptera) and ants (Formicidae; Lajmanovich, 1994; Batista et al., 2011). Besides these categories, other types of items have been found in the stomach of this species, such as Diplopoda, Araneae, Isopoda, as well as leaves and plant material (Lajmanovich, 1994; Batista et al., 2011). Therefore, *R. diptycha* can be considered generalist and opportunistic, because it feeds on what is available in the environment (Batista et al., 2011). However, describing the unusual

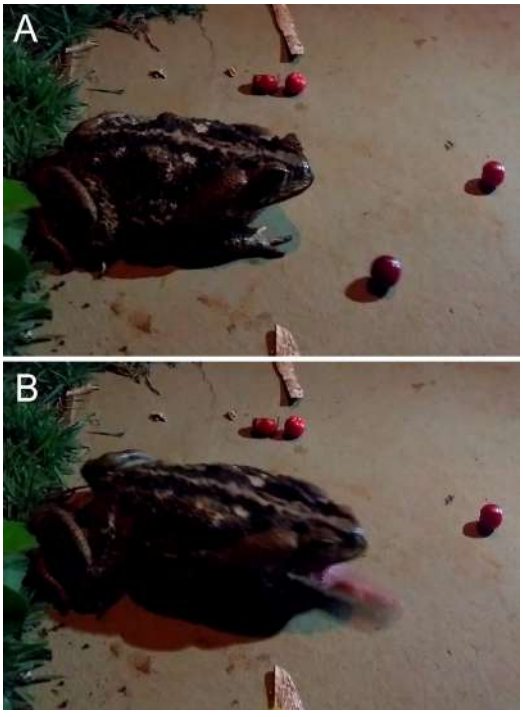

Figure 1. *Rhinella diptycha* ingesting some acerola fruits from the floor. (A) Before catching acerola fruits. (B) Catching acerola fruits. Photo by Matheus de Toledo Moroti.

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diet of this species may provide key information that may contribute to this classification.

During a walk at an urban area in the Municipality of Campo Grande, State of Mato Grosso do Sul (-20.498784, -54.622950, WGS-84), in January 2018, MTM and MP found occasionally one individual female of *R. diptycha*, ingesting some acerola fruits from the floor (Fig. 1). We observed the individual during three minutes before we collected it. During that time span we observed the toad ingest two more acerola fruits. The specimen was killed using topical anaesthetic (Xylocaine 5%), fixed with 10% formaldehyde and then preserved in 70% ethanol before analysing the stomach content. We removed the stomach through a small abdominal incision and stored the contents in separate vials. The collected specimen is housed at the Coleção Zoológica de Referência da Universidade Federal de Mato Grosso do Sul (ZUFMS AMP 09021).

We analysed the stomach content under a stereomicroscope and identified each item to order level. After measuring the length and width of each prey, we estimated their volumes using the formula of the ellipsoid: $V = 4/3\pi*2(W/2)2*L/2$, where, V = volume, W = width, and L = length (Griffiths and Mylotte, 1987). For each item (prey category), we calculated the number, volume, and frequency of occurrence in both absolute and percentage values. This individual had 147 prey items in its stomach that we divided into 10 categories, of which mango seed and acerola fruit mesocarp (Fig. 2) were the categories with higher volume (V = 39.1%, V = 25.83%, respectively). Formicidae was the most representative prey category (N = 83.67%; Table 1).

Table 1. Items consumed by *Rhinella diptycha* and the representativeness of each item in the stomach. Number of prey (N), numerical proportion (N%), volumetric proportion (V%), volume [V (mm^3)].

Category	V (mm^3)	V%	N	N%
Acerola fruit (mesocarp)	12823.56	25.83	6.00	4.08
Coleoptera	716.86	1.44	5.00	3.40
Dermaptera	46.28	0.09	1.00	0.68
Diplopoda	529.69	1.07	2.00	1.36
Formicidae	5562.66	11.20	123.00	83.67
Hemiptera	367.56	0.74	1.00	0.68
Mango seed	19563.41	39.40	1.00	0.68
Pulmonata	2580.07	5.20	4.00	2.72
Scorpionida	5828.96	11.74	1.00	0.68
Undetermined seed	1630.92	3.28	3.00	2.04

Other anuran species are known to feed on fruits, such as *Xenohyla truncata* (Izecksohn, 1959) (Da Silva and De Britto-Pereira, 2006), or on seeds, such as *Dendropsophus branneri* (Cochran, 1948) and *D. minutus* (Peters, 1872) (Oliveira et al., 2017). Interestingly, a few bufonid species are known to feed on flowers, such as *Anaxyrus americanus* (Holbrook, 1836), *A. houstonensis* (Sanders, 1953) (Oliveira et al., 2017), and *R. icterica* (Spix, 1824) (Benício et al., 2011). Nonetheless, of the 5,971 anuran species whose diet was compiled by Oliveira et al. (2017) in the AmphiBIO database, only *X. truncata* appears as fruit eater. Additionally, other studies have reported the consumption of plant material in the diet of anurans, including *R. diptycha* (e.g., leaves, grasses; Lajmanovich, 1994; Batista et al., 2011; Benício et al., 2011; Maragno and Souza, 2011). The consumption of plant material in anurans is reported as accidental while they feed on other prey (Anderson and Mathis, 1999; Teixeira et al., 1999; Sabagh and Carvalho-e-Silva, 2008). However, Anderson et al. (1999) suggest that anurans may actively do this and the consumption of these items may aid in digestion and nutrition and act as an extra source of water against dehydration.

Rhinella diptycha is considered omnivorous, basically insectivorous (Lajmanovich, 1994), generalist and opportunist (Batista et al., 2011), due to the wide variety of food items present in the diet. However, the fact that many anurans present a broad selection of food items does not mean that they show no preferences (Anderson and Mathis, 1999). Indeed, *R. diptycha* feeds mainly on beetles and ants (Lajmanovich, 1994; Batista et al., 2011). However, urban environments can constrain both foraging and prey availability (Hunter, 2007; Coleman and Barclay, 2013), which could favour the incorporation of unusual food items into their diet. A recent study with other anuran species reported differences on diet composition in urban and natural environments, indicating that anuran feeding is likely to be affected by urbanization (Santana et al., 2019). Therefore, our results add an important, previously unreported record of a bufonid species eating fruit seeds and mesocarp. The consumption of these items by *R. diptycha* may have occurred occasionally or intentionally. Nonetheless, anurans that feed on fruit seeds can play a key role in seed dispersal (Da Silva and De Britto-Pereira, 2006), especially in xeric or highly seasonal environments, such as *restingas* or the Cerrado, where our observation took place.

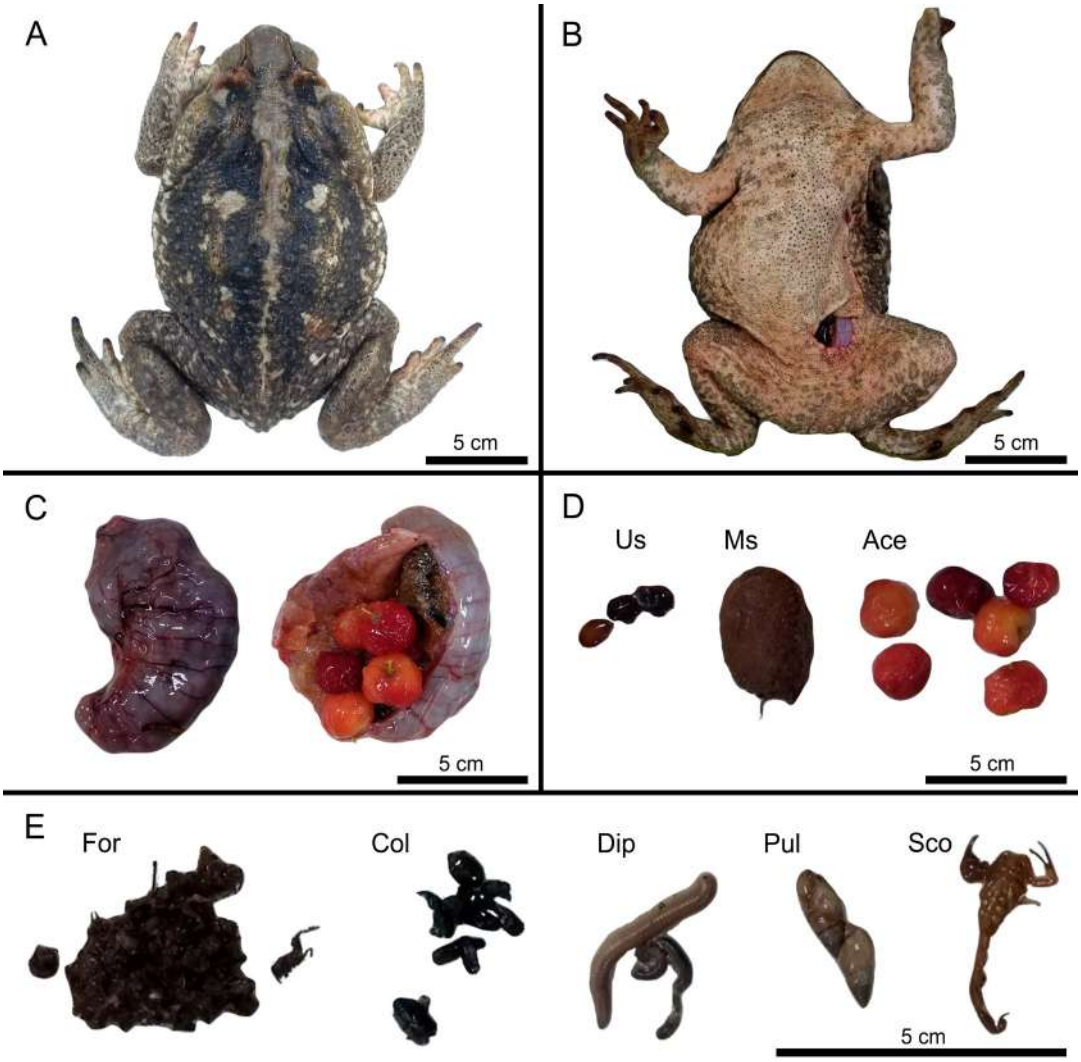

Figure 2. *Rhinella diptycha* under two views and items present in the stomach. (A) Dorsal view; (B) Ventral view; (C) Stomach; (D) Vegetable content analysis (Us = Undetermined seed; Ms = Mango seed; Ace = Acerola fruit mesocarp); (E) Animal content analysis (For = Formicidae; Col = Coleoptera; Dip = Diplopoda; Pul = Pulmonata; Sco = Scorpionida). Photos by Matheus de Toledo Moroti.

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