

SHORT COMMUNICATION

Frugivory by *Tropidurus hispidus* (Squamata: Tropiduridae) on the cactus *Pilosocereus pachycladus* in the Brazilian Caatinga

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The lizard *Tropidurus hispidus* (Spix, 1825) occurs in several types of open habitats in South America (Carvalho 2013). It has a continuous distribution, mainly in areas of Caatinga and in coastal areas of northeastern Brazil, where it extends across a large part of the Espinhaço mountain range and occurs in sympatry with several congeners (Carvalho 2013). *Tropidurus hispidus* is omnivorous and consumes small arthropods, vertebrates, and plant material (e.g., leaves, flowers, and fruits) (Vitt 1995, Ribeiro *et al.* 2011). In their generalist diet, plant material has been reported as one of the three most important food items for Caatinga populations

(Albuquerque *et al.* 2018); however, data concerning the identity of the plant species consumed are scarce.

Pilosocereus pachycladus subsp. *pernambucoensis* (Ritter) Zappi is an arboreal, columnar cactus that attains a height of 6 m, and is endemic to the Brazilian semiarid region, occurring mainly in rupicolous environments (Zappi *et al.* 2015, Batista *et al.* 2018). It is distributed in the Caatinga ecosystem in the states of Alagoas, Bahia, Ceará, Paraíba, Pernambuco, Piauí, and Rio Grande do Norte (Zappi *et al.* 2015). Its dehiscent fleshy fruits (3.81 ± 0.45 cm in length and 5.05 ± 0.50 cm in width) are produced at the top of the cactus branch, with purplish pericarp (Figure 1 A, B). The fruits have many small, black seeds embedded in an intense magenta funicular pulp (Abud *et al.* 2010). Typically, this cactus is ornithochoric, as are other *Pilosocereus*

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spp. (Zappi 1994). Frugivory and seed dispersal studies focusing on *Pilosocereus* have recorded birds, lizards, ants, and bats as seed dispersers (Munguía-Rosas *et al.* 2009, Gomes *et al.* 2016, 2017, Santos *et al.* 2019, Vazquez-Castillo *et al.* 2019).

The Serra do Jatobá is a rocky outcrop located in the municipality of Serra Branca in the state of Paraíba (07°29'49" S, 36°44'32" W); this part of the Caatinga has a seasonal climate and a dry period that extends from May–December. Seven cacti species occur in this area: *Pilosocereus pachycladus* subsp. *pernambucoensis*, *Xiquexique gounellei* (F.A.C. Weber) Lavor and Calvente (= *P. gounellei*), *P. chrysolepis* (Vaupel) Byles and G.D. Rowley, *Cereus jamacaru* D.C., *Melocactus ernestii* Vaupel, *M. zehntneri* (Britton and Rose) Luetzelb., and *Tacinga inamoena* (K. Schum.) N.P. Taylor and Stuppy; all of which produce attractive fleshy fruits consumed by a diversity of animals (Leal *et al.* 2017).

We undertook systematic focal observations of bird-seed dispersers on specimens of *Pilosocereus pachycladus* subsp. *pernambucoensis* fruiting in Serra do Jatobá, and recorded individuals of *Tropidurus hispidus* consuming pulp and seeds for 3–5 minutes around 10:15 h in May 2019 (Figure 1C). The lizard climbed the cactus in seconds, ascending 6 m from the ground to reach the fruit. During the visits, the lizard inserted its head multiple times into the fruit until it reached and removed portions of pulp and seeds. The lizard ingested the seeds entirely without chewing them.

Herpetochory or saurochory on members of the genus *Melocactus* is classified as a positive evolutionary interaction (Guerrero *et al.* 2012). Records of seed dispersal by lizards from cacti usually are associated with globular species *Melocactus*. These plants rarely reach 0.50 m in height (Taylor and Zappi 2004), which facilitates access to fruits and flowers on the cephalium structure by the lizards (Figueira *et al.* 1994, Gomes *et al.* 2014). However, other studies have shown that interactions between lizards and




Figure 1. (A) *Pilosocereus pachycladus* subsp. *pernambucoensis* in the Serra do Jatobá, in the municipality of Serra Branca, state of Paraíba in northeastern Brazil. (B) Fruit showing black seeds embedded in the funicular pulp. (C) *Tropidurus hispidus* consuming fruits of *P. pachycladus* subsp. *pernambucoensis*.

cactus are not restricted to globular cacti, and that *Tropidurus* frequently disperses seeds of columnar cacti. For example, in the Caatinga area of the “Cariri Paraibano” fruit consumption of *Pilosocereus chrysostele* (6 m high) by *Tropidurus semitaeniatus* (Spix, 1825) and *Pilosocereus gounellei* (4 m high) by *T. semitaeniatus* and *T. hispidus* (Gomes *et al.* 2016, 2017) was recorded, whereas, on rock outcrops in the Atlantic Forest, individuals of *T. torquatus* (Wied-Neuwiedi, 1820) consume fruits of *Coleocephalocereus fluminensis* (Miq.) Backeb. (Koski *et al.* 2018).

Fleshy cactus fruits have a high caloric value, as well as high water content, making them an important food resource for lizards in seasonal environments such as the Caatinga (Fonseca *et al.* 2008, Gomes *et al.* 2014, 2017). Our results report a new and important interaction between lizards and columnar cacti, demonstrating how much these animals expose themselves in their search for resources (e.g., thorn damage, predation risks by predatory birds). Guerrero *et al.* (2012) pointed out that seed dispersal by lizards is considered an infrequent dispersal system for Cactaceae and other angiosperms, specially because studies focusing on other tribes that produce attractive fruits for reptiles within Cactaceae are still missing. The Caatinga biota includes more than 16 species of *Pilosocereus* (Zappi *et al.* 2015) and nine species of *Tropidurus* (Mesquita *et al.* 2017). We think that lizards in the Caatinga disperse columnar cacti seeds frequently and expect new examples to be reported soon for this seasonal ecosystem.

Meiado (2012) found that the presence of the funicular pulp inhibits seed germination for *Pilosocereus gounellei* subsp. *gounellei* and *P. pachycladus* subsp. *pernambucoensis*. Such data reinforce the importance of dispersers in increasing the germination rates of seeds of *Pilosocereus*. In fact, seeds of *P. gounellei* subsp. *gounellei* ingested and defecated by *Tropidurus semitaeniatus* have better germination rates than do undigested seeds (Gomes *et al.*

2016). We collected 30 fecal samples of *T. hispidus* containing intact cactus seeds. To confirm the role of *T. hispidus* as an effective seed disperser of *P. pachycladus* subsp. *pernambucoensis*, studies evaluating the effects of passing seeds through the digestive tract of the lizard are necessary.

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