DEATH OF AN ADULT *CROTALUS CERASTES* (VIPERIDAE) DUE TO INGESTION OF *DIPSOSAURUS DORSALIS* (IGUANIDAE)

MUERTE DE UN ADULTO DE *CROTALUS CERASTES* (VIPERIDAE) POR INGESTA DE *DIPSOSAURUS DORSALIS* (IGUANIDAE)

Leonardo Ponce-Rosales^{1,3*}, Gabriel Suárez-Varón^{1,2,3}, Oswaldo Hernández-Gallegos¹, Leonardo Fernández-Badillo^{4,5} & Karime G. Gómez-Moreno⁶

¹Laboratorio de Herpetología, Facultad de Ciencias, Universidad Autónoma del Estado de México, Instituto Literario #100 Centro, 5000 Toluca, Estado de México, México.

²Laboratorio de Morfofisiología de la Reproducción, Facultad de Ciencias, Universidad Autónoma del Estado de México, Instituto Literario #100 Centro, 5000 Toluca, Estado de México, México.

³Red de Investigación y Divulgación de Anfibios y Reptiles MX, Guadalupe Victoria #33, Ozumba de Alzate, 56800 Estado de México, México. ⁴Predio Intensivo de Manejo de Vida Silvestre X-Plora Reptilia, km 65 carretera México-Tampico, Pilas y Granadas, Metztitlán, Hidalgo, 43350, México.

⁵Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo. Km 4.5 carretera Pachuca-Tulancingo, s/n, Mineral de la Reforma, Hidalgo, 42184, México.

⁶Laboratorio de Aracnología y Entomología, Centro de Investigaciones Biológicas del Noroeste S.C., La Paz, 23096, Baja California Sur, México. *Correspondence: <u>lponce.biocienciasb@gmail.com</u>

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Resumen.– Registramos la mortalidad de la Cascabel Cornuda del Noroeste (*Crotalus cerastes*) por la ingesta de la Iguana del Desierto (*Dipsosaurus dorsalis*) en Los Algodones, Mexicali, Baja California, México. Encontramos un individuo muerto en un hábitat compuesto por dunas y sin alguna lesión física aparente que le hayan causado la muerte; sin embargo, se observó la ingesta de una presa de gran tamaño, la cual determinamos como *D. dorsalis*. Es necesario continuar documentando estos casos en serpientes, para comprender las fuerzas ecológico-evolutivas en la selección del tamaño de presa.

Palabras clave. – Dieta, ingesta, mortalidad, serpiente.

Abstract. – We report the mortality of a Sidewinder (*Crotalus cerastes*) by ingestion of a Desert Iguana (*Dipsosaurus dorsalis*) in Los Algodones, Mexicali, Baja California, Mexico. We found a dead individual of *C. cerastes* in a habitat composed of dunes, without any apparent physical injury that caused its death; however, we observed a large prey item recently ingested, which we identified as a *D. dorsalis*. The continual documentation of these cases in snakes helps identify ecological-evolutionary forces in prey size selection.

Keywords.- Diet, intake, mortality, snake.

Feeding is one of the fundamental factors for the survival and reproduction of animals. This process provides the energy requirements for development and maintenance; however, the composition of the diet varies depending on the biotic and abiotic factors that determine the acquisition of certain types and sizes of prey (Kornilev et al., 2023). Such variation in prey selection can be attributed to sexual, ontogenetic, morphological differences, and seasonal aspects of the habitat (Cappellari et al., 2007; Verrastro & Ely, 2015). Particularly in snakes, optimal foraging is related to prey size selection; that has been associated with morphological limitations of the oral apparatus during feeding, specifically the maximum jaw distention (Hampton, 2017), as well as both width and length of the head, or bite force (Vincent et al., 2006).

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Optimal foraging implies the selection of prey that maximizes the energy gained relative to the foraging time, characteristics that involve a cost-benefit relationship (Arnold, 1993), in this way, in many snake species, individuals tend to consume larger prey instead of smaller prey (Shine, 1991), not only due to the low energy contribution of smaller prey, but also because they can be more difficult to capture or handle for consumption (Cundall & Greene, 2000). In diverse families of snakes: Acrochordidae, Boidae, Colubridae, Elapidae, Psammophiidae, Pseudoxyrhophiidae, Pythonidae, and Viperidae (see Table 1 in Kornilev et al., 2023), it has been suggested that the size of prey is related with the size of the snake, assuming that as larger the snake (head or oral opening), the larger the prey it can consume (Shine, 1991), with some cases representing up to 150 % of the snake's weight (Greene, 1992). However, some species also regularly consume smaller prey, regardless of the snake's body size (Shine, 1991).

The morphological and physiological adaptive mechanisms that allowed for the diversification of snakes and the exploitation of large prey have also promoted ontogenetic changes in their diet. Thus, these predators can eliminate small prey from their diet and shift for larger prey, or increase food niche that includes the consumption of both small and large prey (Hampton, 2017).

In general, snakes exhibit anatomical and physiological adaptations that allow them to feed on large prey. There are many documented cases of snakes that have attempted to consume excessively large prey, resulting in fatal consequences for the snake (Gatica & Córdova, 2012; Bucio & Badillo, 2023; Kornilev et al., 2023).

Crotalus cerastes Hallowell 1854, it is a relatively small rattlesnake (50-60 cm snout-vent length [SVL]; Ernst & Ernst 2003; Webber et al., 2016) that inhabits sandy environments, dunes, and plains of the warm deserts of northwestern Mexico and the southern United States (Campbell & Lamar, 2004; Webber et al., 2016).

The species primarily feeds on lizards and small mammals, rarely on snakes and birds (Funk, 1965). It has also been documented that *C. cerastes* undergoes an ontogenetic change (correlated with size) regarding its feeding habits, such that as individuals increase in body size, the size of the prey in their diets also increases (Webber et al., 2016).

On September 6, 2023, at 14:00 h, in the locality of Los Algodones, Mexicali, Baja California, Mexico (32.70974° N, 114.77557°W, datum WGS84, 54 m a.s.l.), we found a dead adult *C. cerastes*, 450 mm in SVL. The organism was exposed in a habitat composed by dunes, alongside a cyclone fence, and was in good condition, showing no apparent physical injuries that could have caused its death; however, it was evident that it had ingested a large prey item. To determine the dietary item, a ventral incision was made on the snake (Fig. 1a), and an adult *Dipsosaurus dorsalis* Baird & Girard, 1852 was found inside, which had been ingested



serpiente *Crotalus cerastes* donde se observa la ingesta de *Dipsosaurus dorsalis.* B) Relación de la proporción de tamaño corporal en ambas especies. Fotos: Rafael Sánchez-Villagrana.

Figura 1. A) Corte ventral en la

Figure 1. A) Ventral cut in the snake Crotalus cerastes ...where an ingested Dipsosaurus dorsalis was observed. B) Relationship of body size ratio in both species. Photos: Rafael Sánchez-Villagrana.

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from head to tail and measured a total length of 350 mm, representing 77.8 % of the size of *C. cerastes* (Fig. 1b). Since it was a chance encounter, we did not have the necessary materials for preserving the organisms, so they were left at the same location where they were found.

According to the available evidence, it is possible that the snake died due to the large size of the prey, which may have caused breathing difficulties by compressing the lungs or as a result of a failed regurgitation, as has been observed in other snake species (Kornilev et al., 2023). Our observation is not isolated, as Coupe & Dawson (2007) documented a failed feeding attempt and mortality in a female *C. cerastes* for partially consuming a specimen of White-tailed Antelope Squirrel (*Ammospermophilus leucurus*).

As previously described, the complexity of the factors involved during foraging, capturing, and ingesting prey makes it difficult to demonstrate the probable causes of why a snake attempts to feed on prey larger than it can consume. However, it is important to continue documenting these cases to better understand why these animals seemingly err in prey size selection and attempt to capture and ingest prey much larger than they can consume.

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