

A CASE OF KYPHOSCOLIOSIS FOUND IN A WILD VIPER *BOTHROPS AMMODYTOIDES* (SERPENTES: VIPERIDAE) FROM THE CENTRAL ANDES OF ARGENTINA

UN CASO DE CIFOESCOLIOSIS ENCONTRADO EN UNA VÍBORA SILVESTRE *BOTHROPS AMMODYTOIDES* (SERPENTES: VIPERIDAE) DE LOS ANDES CENTRALES DE ARGENTINA

Martina Feldman^{1*}, Franco Valdez Ovallez^{1,2}, Yamila Méndez Osorio^{1,2}, Jeremías Luis Villafañe¹, Nicolás Emmanuel Damiani¹, Paola A. Carrasco³ & Rodrigo Gómez Alés^{1,2}

¹Gabinete de Diversidad y Biología de Vertebrados del Árido (DIBIOVA), Departamento de Biología, Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de San Juan, Av. José Ignacio de la Roza 590 (Oeste), Rivadavia, San Juan, Argentina.

²Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina.

³Universidad Nacional de Córdoba, Facultad de Ciencias Exactas, Físicas y Naturales, Centro de Zoología Aplicada, Córdoba, Argentina.

*Correspondence: marti.feldman2@gmail.com

Received: 2024-09-10. Accepted: 2025-01-22. Published: 2025-05-21.

Editor: Nicolas Pelegrin, Brasil.

Resumen. – Son varias las osteopatologías frecuentemente reportadas en lagartos y tortugas, pero pocos son los casos registrados en serpientes, mucho menos en vida silvestre. Aquí reportamos por primera vez un caso de cifoescoliosis encontrado en un ejemplar de *Bothrops ammodytoides*, especie de víbora endémica de Argentina, encontrada en una quebrada de los Andes Centrales de San Juan, Argentina. La patología fue confirmada mediante placas radiográficas y podría tratarse de una malformación de origen congénito.

Palabras clave. – Escoliosis, cifosis, columna vertebral, malformación, serpiente.

Abstract. – Several osteopathologies are frequently reported in lizards and turtles; however, few cases have been recorded in snakes, and even fewer in wildlife. Here, we report for the first time a case of kyphoscoliosis found in a specimen of *Bothrops ammodytoides*, a viper species endemic to Argentina, found in a ravine in the Central Andes of San Juan, Argentina. The pathology was confirmed through radiographic imaging, and it could be a malformation with a congenital origin.

Keywords. – Kyphosis, malformation, scoliosis, snake, spinal column

Bone malformations are common among reptiles, particularly in lizards (Avila et al., 2013; Castillo-Juárez et al., 2020; Bateman et al., 2022; Mata-Silva et al., 2023) and Testudines (Rothschild et al., 2012, 2013). However, there is limited information about these types of anomalies occurring in snakes (Sant'Anna et al., 2013). Rarely described spine malformations in serpents include scoliosis (sideways curvature of the spine), kyphosis (dorsal/convex curvature of the spine), kyphoscoliosis (a combination of kyphosis and scoliosis), and lordosis (ventral/concave curvature of the spine) (Garin-Barrio et al., 2011). These malformations may have a genetic, environmental or idiopathic origin (Rothschild et al., 2012). Generally, these types of spinal deformities are associated with anomalies of the scales surrounding the

malformation. If ventral scales are affected, locomotion, digestion or reproduction could be compromised (De Carvalho et al., 2020).

In this study, we report for the first time a malformation found in the snake locally known as 'Yarará ñata', *Bothrops ammodytoides* (Serpentes: Viperidae), a viper species endemic to Argentina with the southernmost distribution in the world, reaching elevations of up to 3,000 m a.s.l. (Carrasco et al., 2010; Scrocchi et al., 2023). *Bothrops ammodytoides* is found across a large portion of the country, inhabiting the Altoandina, Puna, Monte, Chaco Árido and Estepa Patagónica ecoregions (Acosta et al., 2018; Williams & Vera, 2023), primarily in areas with rocky,

sandy, and saline soils (Carrasco et al., 2010; Acosta et al., 2018). It is a viviparous species that feeds on small lizards (Gómez Alés et al., 2013; Zaldúa et al., 2020; Tettamanti et al., 2024), rodents, anurans and birds (Scolaro, 2006; Carrasco et al., 2010; Williams & Vera, 2023).

On December 29, 2023, at 13:20 h, we found a juvenile male of *B. ammodytoides* resting under a rock. We discovered this specimen during a herpetological survey conducted in the Iglesia Department, Province of San Juan, Argentina (30.66886° S, 69.55023° W; WGS 84; 3,122 m a.s.l.) (Fig. 1A). The habitat where the encounter occurred is a ravine in the Andes Mountains, which belongs to the Puna ecoregion. This environment is characterized by a cold and dry climate, with a great daily and seasonal thermal amplitude (−20 to 30 °C throughout the year),

prolonged periods of drought with average annual precipitation between 100 and 200 mm, low partial pressure of oxygen, strong winds, great solar radiation, and frozen soil and thawing depending on the time of year (Márquez et al., 2016; Gómez Alés et al., 2021; Valdez Ovallez et al., 2023, 2024).

Upon discovery, we observed a malformation in the posterior portion of the body with the naked eye (Fig. 1B). We captured the specimen and recorded microhabitat data, including the surface temperature of the rock in contact with the substrate (22.5 °C) and the substrate temperature (27.5 °C), along with body measurements: snout-vent length (161 mm), and tail length (25 mm). We transported the specimen to the laboratory of the Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de San Juan (FCEFN-UNSJ) and deposited it in the



Figura 1. Ambiente y especie. A) Cordillera de los Andes, San Juan, Argentina. B) Juvenil macho de la especie *Bothrops ammodytoides*, flecha negra indicando cifoescoliosis. Foto: Martina Feldman.

Figure 1. Environment and species. A) Andes Mountains, San Juan, Argentina. B) Male juvenile of *Bothrops ammodytoides* species, black arrow indicating kyphoscoliosis. Photo: Martina Feldman.

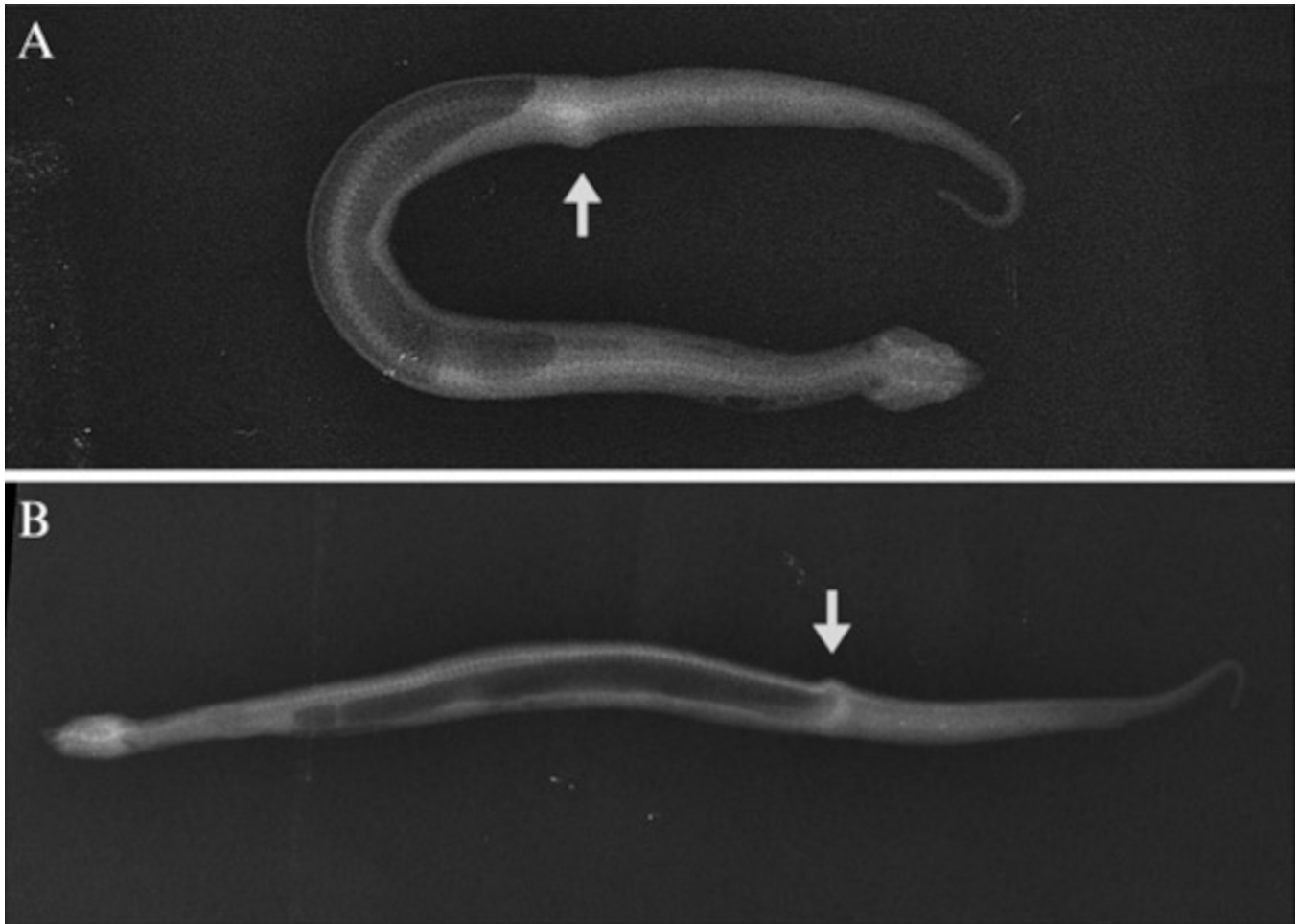


Figura 2. Placas radiográficas de *Bothrops ammodytoides*. A) Radiografía dorsal, flecha blanca indicando escoliosis. B) Radiografía lateral, flecha blanca indicando cifosis. Foto: Martina Feldman.

Figure 2. X-ray plates of *Bothrops ammodytoides*. A) Dorsal radiograph with white arrow indicating scoliosis. B) Lateral radiograph, with white arrow indicating kyphosis. Photo: Martina Feldman.

Herpetological Scientific Collection of FCFN-UNSJ (UNSJ-3705) (Collectors: Feldman M., Gómez Alés R., Méndez Osorio Y., Valdez Ovallez F.). Capture was authorized by the Secretaría de Medio Ambiente, Dirección de Conservación y Áreas Protegidas, Provincia de San Juan (SAyDS N° 1300-000131-2020). For pathology confirmation, dorsal and lateral X-rays were taken, which showed a dorso-ventral and lateral curvature, indicating kyphoscoliosis, located at 42 mm from the cloaca (Fig. 2)

Reports of wild snakes with these types of spinal bone anomalies are scarce (Table 1), and many documented cases involve neonates born in captivity, which are either alive but dying shortly after birth or stillborn (Gray et al., 2003; Sant'Anna et al., 2013; Najbar et al., 2022). This scarcity may explain the low prevalence of scoliosis or kyphosis in wild snakes, as affected

individuals often die before reaching adulthood. The presence of these malformations can compromise aspects such as locomotion, feeding (ingestion of prey and its passage through the digestive system), reproduction, and ecdysis/shedding process (Mulder, 1995). The specimen found in this study appeared healthy and active, with no locomotor difficulties; this may be because malformations located in the caudal segment do not always interfere with the normal development of the individual (also noted by Sant'Anna et al., 2013 and Álvarez et al., 2021).

In conclusion, we report the first case of kyphoscoliosis in *B. ammodytoides*. Given that we found the specimen in a potentially contaminant-free environment and with minimal anthropogenic influence, the malformation is most likely congenital, with

Tabla 1. Casos de escoliosis y cifosis registrados en serpientes.**Table 1.** Scoliosis and kyphosis cases recorded in snakes.

Snakes	Bone malformation type	Sex	Age	Snake status	Health condition	Malformation position in the body	Possible or observed difficulties	Malformation origin	Reference
Viperidae									
<i>Bothrops ammodytoides</i>	Kyphoscoliosis	Male	Juvenile	Wild snake	Healthy	Posterior quarter	No locomotion difficulties	Probably congenital	This record
<i>Bothrops jararaca</i> and <i>Crotalus durissus</i>	Simple and multiple kyphosis, scoliosis and lordosis	Both	Neonates	Born in captivity	Healthy and stillborn	Throughout the body and near the cloaca	Abnormal locomotion	Since they are neonates, origin was probably congenital	Sant'Anna et al. (2013)
<i>Agkistrodon contortrix cantortrix</i>	Scoliosis	Male	Adult	Kept in captivity	Healthy	Anterior third and midbody	Abnormal locomotion	Sequelae produced by septicemic disease	Kiel (1977)
Colubridae									
<i>Arizona elegans occidentalis</i>	Multiple kyphosis and scoliosis	Female	Adult	Wild snake	Healthy	Posterior quarter	Little to no effect on movement and foraging	Congenital origin is suspected	Álvarez et al. (2021)
<i>Natrix natrix</i>	Kyphosis and scoliosis	Both	Neonates	Born in captivity	Stillborn and early neonatal death	Throughout the body	Early death	Exposed to extreme high temperature during incubation	Idrisova & Khairutdinov (2018)
<i>Coronella austriaca</i>	Lordosis	-	Neonates	Born in captivity	Early neonatal death	Tail	Caused early death	Since they are neonates, origin was probably congenital	Najbar et al. (2022)
<i>Thamnophis sirtalis</i>	Multiple scoliosis	-	Neonates	Born in captivity	Stillborn	Throughout the body, especially posteriorly	Caused death before birth	High probability of toxic pollution, also congenital origin is suspected	Gray et al. (2003)

either a genetic or environmental origin (Sant'Anna et al., 2013). Living in a hostile environment, as the Puna, abnormal values or variations of the extreme environmental factors mentioned above may have influenced the development of malformations during the embryonic stage, although this requires further investigation (Bellairs, 1981; Wallach, 2007; Sant'Anna et al., 2013; Idrisova & Khairutdinov, 2018). This appears to be a rare condition and is currently classified as an idiopathic pathology due to its unknown origin. In any case, data on developmental anomalies in wild snakes are limited and need to be increased, including documenting new cases of kyphosis or scoliosis in reptiles, primarily in snakes. Understanding pathologies present in wild populations is a significant contribution to their conservation, as diseases can reduce survival and reproductive success of individuals, while also enhancing our understanding of the biology and ecology of species.

Acknowledgments.– We would like to express our gratitude to Graciela Vega and Ana Romina Cortez Vega for their generosity and hospitality during our field studies. In addition, we thank Enrique Morales for taking the x-rays. We also acknowledge the Environment and Sustainable Development Secretariat of the Province of San Juan for granting the capture permits. This research received support from the National Council for Scientific and Technical Research (CONICET doctoral fellowship, Res. 2262/18, FMVO).

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