



# Anomalies and Parasite Infestation in the Canyon Treefrog, *Dryophytes arenicolor* (Cope 1866) (Anura: Hylidae), in Mexico

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Malformations are structures with a permanent defect resulting from abnormal development, whereas deformities are alterations in an organ or structure that was originally formed correctly (Meteyer 2000). Such anomalies in amphibians may be caused by mutations or failures or trauma during embryonic development; causes include predator attacks, parasitic infections, viruses, and exposure to chemical contaminants or ultraviolet radiation (Aguillón-Gutiérrez 2018). In Mexico, such cases have been recorded for 18 species of amphibians, most of them in the family Hylidae (Morales-Lugo et al. 2022; Venerozo-Tlazalo et al. 2022).

The Canyon Treefrog (*Dryophytes arenicolor*) (Snout-vent length = 32–57 mm) has a thick, rough skin that resists desiccation (Hernández-Herrera and Pérez-Mendoza 2020). Dorsal coloration is highly variable and can be green, brown, or gray (Stebbins 2003). The species, which ranges from southern Utah in the USA to Oaxaca in Mexico (Duellman 2001; Frost 2021), is listed by the IUCN as Least Concern (LC) (IUCN SSC Amphibian Specialist Group 2020) and is not included in any risk category in Mexico (NOM-059-SEMARNAT 2010).

We herein report three Canyon Treefrogs with five different morphological anomalies encountered during two field surveys in the Sierra Madre Occidental in Sinaloa, Mexico. The first individual was a subadult (SVL = 29 mm) found at 1100 h on 17 November 2022 on rocks in a slow-flowing stream surrounded by pine vegetation in the Sierra de Badiraguato in Surutato (25.833969 N, -107.565814 W; WGS84; elev. 1,528 m asl). It had an incomplete right forelimb, a condition known as humeral ectromelia, in which only the proximal part of the humerus is present, and a distorted right mandible corresponding to brachygnathia (Fig. 1) (Meteyer 2000). The specimen was collected and deposited

in the Biological Collection of the Centro de Investigación y Jardín Etnobiológico of the Universidad Autónoma de Coahuila (Mexico) (UAdeC-CIJE-CVH-An-0007).

The second individual was a small adult male (SVL = 35 mm) found at 1230 h on 17 November 2022 on a wet trail surrounded by mixed pine-oak forest and cattle pastures in the Sierra de Badiraguato in Surutato (25.830308 N, -107.567892 W; WGS84; elev. 1,488 m asl). It was unable to jump properly, presumably due to swellings and cavities infected with externally visible arthropodan larvae (Fig. 2). The specimen also was collected and deposited in the Biological Collection of the Centro de Investigación y Jardín Etnobiológico of the Universidad Autónoma de Coahuila (Mexico) (UAdeC-CIJE-CVH-An-0008). The larvae were not identified but likely were dipteran, which are common amphibian ectoparasites (Herczeg et al. 2021; da Cunha-Martins et al. 2022).



**Figure 1.** A Canyon Treefrog (*Dryophytes arenicolor*) with ectromelia of the right humerus and superior brachygnathia of the right margin of the mandible. Photograph by Walfredo Avila Chancellor.

The third individual was a subadult (SVL = 28 mm) found at 1208 h on 1 December 2022 on rocks in a stream surrounded by pine vegetation in Sierra de Concordia in El Palmito (23.56493 N, -105.84483 W; WGS84; elev. 1,913 m asl). Only two poorly developed fingers of the right manus were present (Fig. 3), corresponding to ectrodactyly (reduction in the number of digits) and brachydactyly (reduction in the length of digits) (Meteyer 2000). This frog was photographed and released where initially encountered. Photographs were deposited in the Museo de Zoología “Alfonso L. Herrera” of the Universidad Nacional Autónoma de México (MZFC-IMG72–3).

The only previous report of an anomaly in a Mexican Canyon Treefrog was a case of polyphalangy in central Mexico (Monroy-Vilchis et al. 2015). However, three instances of anomalies have recently been reported in Sinaloa for a Mesoamerican Giant Toad (*Rhinella horribilis*), Forrer’s Leopard Frog (*Lithobates forreri*), and Mexican Leaf Frog (*Agalychnis dacnicolor*) (Castro-Bastidas et al. 2022a, 2022b; Morales-Lugo et al. 2022).

Morphological anomalies in amphibians can affect the survival and fitness by increasing the probability of preda-



**Figure 3.** A Canyon Treefrog (*Dryophytes arenicolor*) with ectrodactyly and brachydactyly of the right manus. Photograph by Elías Méndez.



**Figure 2.** A Canyon Treefrog (*Dryophytes arenicolor*) with externally visible cavities containing arthropodan (probably dipteran) larvae. Photographs by Walfredo Ávila Chancellor.

tion and reducing foraging efficiency and mate acquisition (Johnson et al. 2006) and might be indicative of environmental conditions that could affect other organisms (Roy 2002). Most cases recorded in Mexico were from anthropized environments (Venerozo-Tlazalo et al. 2022), whereas those reported herein were in mature pine-oak forests. A recent *Ranavirus* outbreak in northwestern Sinaloa (Saucedo et al. 2019) might have been a factor but more field research in the region is critical for identifying factors that can cause anomalies and define with greater certainty the incidence rate and effects on amphibian populations in both natural and altered habitats in Sinaloa.

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