REPTILES & AMPHIBIANS

Anophthalmia in a Juvenile Pine Toad, *Incilius occidentalis* (Anura: Bufonidae), from Laguna de Tixtla, Guerrero, Mexico

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Amphibian anomalies have been observed and reported from all continents and from more than 400 species, with the majority of reports from Europe and North America. Among non-skeletal morphological anomalies, anophthalmia along with cysts, edema, and bloatedness are most frequently detected in anurans (Henle et al. 2017). Possible causes of anophthalmia, the absence of one or both eyes (Meteyer 2000), include ultraviolet radiation (Blaustein and Johnson 2003; Ankley et al. 2004), parasites (Johnson et al. 2002; Johnson and Lunde 2005; Rajakaruna et al. 2008), depredation (Lannoo 2008; Reeves et al. 2008), hybridization (Berger and Uzzel 1977; Haddad et al. 1990; Mable and Rye 1992), inbreeding caused by founder effects (Williams et al. 2008; Toledo and Ribeiro 2009), environmental contaminants such as metals and petroleum hydrocarbons (Bacon et al. 2013), and pesticides (Hayes 2005; Robles-Mendoza et al. 2009). However, causative relationships remain poorly understood because different factors or combinations thereof appear to be responsible for different patterns of anomalies (Henle et al. 2017).

During a field survey of aquatic birds at 1830 h on 19 July 2020, we found a juvenile Pine Toad (*Incilius occidentalis*) with only one (left) eye (Fig. 1) at Laguna de Tixtla, Guerrero, Mexico (17°33'38.83"N, 99°23'09.29"W; WGS 84; elev. 1,335 m). The toad was in a hole with a depth of 15 cm. The skin over the missing eye lacked any traces of a supraocular bulge or an eyelid and showed no visible signs of injury. The absence of any traumatic morphological aberrations suggested that the right eye had not developed or had been injured during early larval development. We found no other malformed toads in the area.

Laguna de Tixtla is surrounded by agricultural fields, which are potential sources of pesticides that have been used intensively in the area for decades, and the city's wastewater is

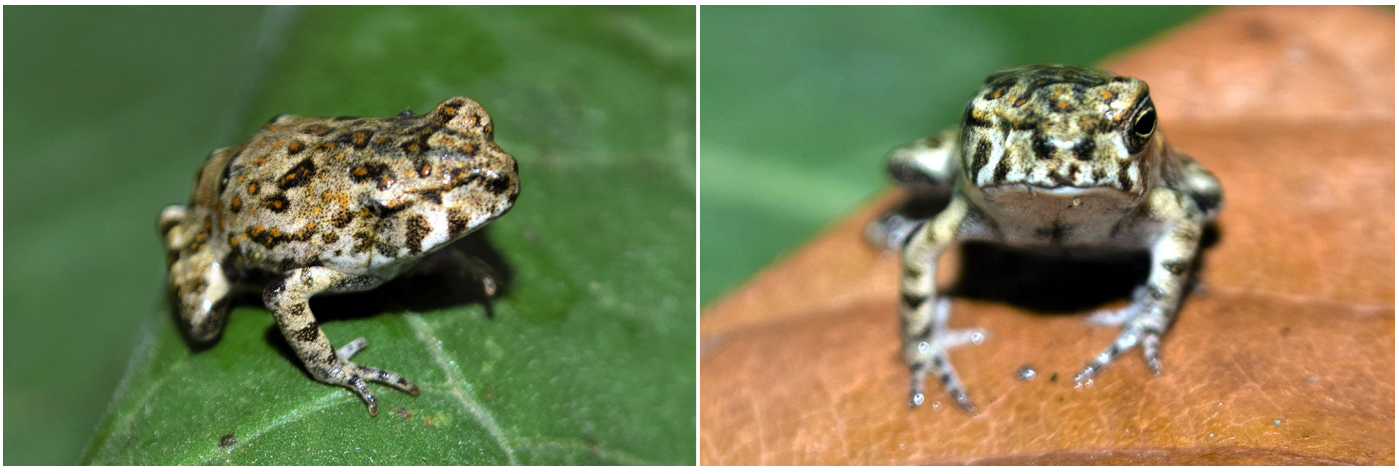

Fig. 1. Lateral (left) and frontal (right) views of a juvenile of Pine Toad (*Incilius occidentalis*) from Laguna de Tixtla, Guerrero, Mexico, with anophthalmia of the right eye. Photographs by Marisol Castro-Torreblanca.

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discharged into the water. Although we could not determine the cause of the deformity in this anuran, agrochemicals, which are known to affect the development of amphibians (Hayes 2005), are most likely responsible. Similar anuran eye deformities have been reported in agricultural areas in South America (Carezzano et al. 2016; Cortés-Suárez 2018) although the causes of those abnormalities have not been confirmed.

This report of anophthalmia is the first from Mexico and the first in *Incilius occidentalis*. Further studies of the frequency and magnitude of such observations at this site are required to assess which factors have the potential to cause anomalies in amphibians, could become a possible threat to this species, and are potential indicators of environmental degradation.

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