

## Albinism in larvae of the Chacoan frog *Leptodactylus chaquensis* (Anura, Leptodactylidae) from an urban lake from Argentina

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### ABSTRACT

We report complete albinism in *Leptodactylus chaquensis* (Ce, 1950; Amphibia, Anura) larvae. Two foam nests were collected from an urban lake and maintained in outdoor tanks during metamorphosis. Different proportions of albino larvae and metamorphs occurred. This is the first observation of several larvae of *L. chaquensis* with albinisms from an urban lake with continuous artificial and natural luminosity.

Albinism is a hereditary disorder that occurs due to a recessive gene (*alb*) in the homozygous condition, leading to an absence of melanin or alteration of development and distribution of chromatophores in the skin of animals (Brame, 1962; Browder, 2005, Jablonski *et al.*, 2014). This anomaly is expressed phenotypically by the white coloration of the skin and by the red iris (Bechtel, 1995). Albinism has been widely reported among vertebrates worldwide (McCardle, 2012), and amphibians present different examples (Childs, 1953; Bosch, 1991; Benavides *et al.*, 2000; Pearl *et al.*, 2002; Wojnowski *et al.*, 2010; Toledo *et al.*, 2011). However, for Argentinean albinism are scarce for amphibian species (caecilians: Cacivio and Céspedes, 1998, anurans: Barg and Canepuccia, 2003; Sanabria and Laspiur, 2010; López and Ghirardi, 2011) and generally most of them are described on adults.

Albinisms in amphibians were observed worldwide in larvae, juveniles and adults. The literature for larvae included reports of different species on different continents (Table 1) and generally described total albinism in few larvae in a species. Albino larvae are usually accompanied by morpho-physiological malformations such as delay in growth rate, low activity rate and absence of eyes and nostrils (e.g., Barg and Canepuccia, 2003), which can affect adversely individual survival (Takatsuji and Nakamura, 1987; Vershinin, 2004). Actually, albino larvae may be further at risk from predation and have lower

survivorship after metamorphosis relative to normal individuals (Childs, 1953).

As part of continuous amphibian monitoring in the Middle-East of Argentina, on 21 November 2014 we random collected with authorization of the Ministerio de Aguas, Servicios Públicos y Medio Ambiente (Santa Fe Province, Argentina) two foam nests (embryos stages 14-16, Gosner, 1960) of *Leptodactylus chaquensis* from an urban lake named “Parque General Manuel Belgrano” (PGMB) named commonly as “Parque del Sur” (PS) (31°39'55.31”S, 60°42'48.69”W). Moreover, *L. chaquensis* is distributed in northern Argentina, Chaco and western oriental region of Paraguay, northern Uruguay, lowland Bolivia, and parts of western and southern Brazil (Heyer *et al.*, 2004). It is important to note that the urban lake is filled with groundwater but also with the drainage of swimming pools. In addition, the lake has wet-temperate climate (Temperature  $18 \pm 2$  °C, rainfall  $1000 \pm 100$  mm<sup>3</sup>) (Lajmanovich, 1996), its vegetation is mainly domain by ornamental trees and shrubs, and lacks of natural photoperiod due to light are continuous present during photopic (day, natural light) and scotopic (night, artificial light by numerous luminaries) phases (illuminations < 200 lx).

Each foam nest containing 550 embryos were raised into separated tanks at outdoor in the experimental sector of Facultad de Bioquímica y Ciencias Biológicas (FBCB) of Universidad Nacional del

**Table 1.** Albinisms in amphibian larvae.

Family	Species	Localization	References
BUFONIDAE	<i>Melanophryniscus montevidensis</i>	Cabo Polonio, Rocha, Uruguay	Maneyro and Achaval (2004)
	<i>Rhinella arenarum</i>	South America	Barg and Canepuccia (2003)
	<i>Rhinella ornata</i>	São Paulo, Brazil	Brassaloti and Bertoluci (2008)
HYLIDAE	<i>Trachycephalus mesophaeus</i> **	Brazil	Sazima (1974)
	<i>Trachycephalus hyphonioides</i> **	Caazapá National Park, Apepú, Paraguay	Motte and Cacciali (2009)
	<i>Hypsiboas albomarginatus</i>	Parque Natural Municipal da Taquara, Duque de Caxias, Rio de Janeiro, Brazil	de Oliveira Lula Salles (2013)
LEPTODACTYLIDAE	<i>Leptodactylus latrans</i> **	Parque Natural Municipal da Taquara, Duque de Caxias, Rio de Janeiro, Brazil	Rodrigues and Oliveira (2004)
	<i>Leptodactylus chaquensis</i>	Parque del Sur Lake, Santa Fe, Argentina	The present report
ODONTOPHRYNIDAE	<i>Odontophrynus occidentalis</i>	Quebrada de las Flores, Caucete, San Juan, Argentina	Sanabria and Laspiur (2010)
RANIDAE	<i>Rana cascadae</i>	Three Creek Lake, Oregon, United States	McCreary (2008)
	<i>Lithobates catesbeianus</i> **	Massanutten, Virginia, United States	Mitchell (2005)
ALYTIDAE	<i>Alytes obstetricans</i>	Arenas de Iguña, Cantabria, Spain	Rivera <i>et al.</i> (1991); Dieg-Rasilla and Luengo (2007)
	<i>Alytes cisternassi</i>	Sierra Morena, Andalusia, Spain	Barnestein <i>et al.</i> (2011)
	<i>Alytes dickhilleni</i>	Sierra de Castril Natural Park, Andalusia, Spain	Benavides <i>et al.</i> (2000)
	<i>Discoglossus pictus</i> **	Belsito, Palermo, Sicily	Boulenger (1897), Escoriza (2012)
PELOBATIDAE	<i>Pelobates cultripes</i>	Iberian Peninsula	Bosch (1991); Gómez-Serrano (1994)
SCAPHIOPODIDAE	<i>Scaphiopus holbrookii</i> **	United States	Johnston (2006)
PELODYTIDAE	<i>Pelodytes punctatus</i>	Iberian Peninsula	Arribas (1986)
RHACOPHORIDAE	<i>Rhacophorus arboreus</i>	Japan	Okada and Okada (2008)

\*\* Historical names: *Phrynohyas mesophaea*; *Trachycephalus venulosus*; *Leptodactylus ocellatus*; *Rana catesbeiana*; *Discoglossus pictus pictus*; *Scaphiopus holbrookii holbrookii*.

Litoral (UNL). The tanks were filled with water of the urban lake (250 L, 4,5 mg l<sup>-1</sup> dissolved oxygen, pH 7.5). Larvae were fed with boiled lettuce every 3 days. After hatching we monitored the larvae daily until metamorphosis, approximately for 2 months.

Metamorphs were collected from each tank after reaching Stage 42 (Gosner, 1960) (i.e., all four limbs were present and tail regression had begun) and they were housed in moistened plastic cups into the laboratory until they completed tail resorption and the

urostyle was clearly discernible (Gosner Stage 46). Differences in proportion of albino larvae and metamorph of each nest were examined for significance in pairs by the Binomial test and were considered significant at  $P \leq 0.05$  (Margolin *et al.*, 1983). The specimens were deposited on the Herpetological collection of FBCB-UNL as a pool (PL-FBCB-3018).

Each foam nest presented  $n = 90$  and  $n = 82$  albino larvae, respectively (Fig. 1 A, C). There were not statistical differences between proportion of albino larvae in both nest ( $Z=0.61$ ;  $p>0.05$ ). Proportion of the total albinos completed the metamorphosis (18%;  $n = 17$  and 29%;  $n = 24$ ) (Fig. 1 B, D) were statistical significant ( $Z=0.67$ ;  $p>0.05$ ). The remaining ones died after reached Stage 37. The metamorphs were completely albino froglet and survived a few days (1–10 days).

The appearance of amphibian albinisms is not clear and it is not well studied worldwide. Some authors demonstrated in larvae that this condition could be favored by environmental distress (Vershinin, 2004), mainly by light pollution due to alteration of plasma levels of photoperiodic hormones such as melatonin (essential in the secretion of melanin, Gern *et al.*, 1983; Buchanan *et al.*, 2008; Perry *et al.*,

2008). Therefore, if metabolic alteration by photopollution impacts skin and eye melanophores of amphibian larvae, complete albinism occurs (Lanza *et al.*, 2009; Spadola and Insacco, 2010). Although the last hypothesis is tested based on experiments in laboratory, and it might be linked with the albinisms in *L. chaquensis* larvae and characteristic of the area of collection, more studies are needed to relate anuran larvae skin coloration under constant light pressures. Moreover, field studies indicating that amphibian living in metal-contaminated areas present high percentages of albinos in adult stages (Addlassnig *et al.*, 2013) must be also considered for future research. Finally, the presence of completely albino larvae could be included in monitoring of a population (Brassaloti and Bertoluci, 2008), since frequency of albinos in vertebrates fluctuates between 1:10.000 and 1:30.000 individuals (Bechtel, 1995).

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**Figure 1.** Normally-patterned *Leptodactylus chaquensis* larvae and metamorph (A, B) and albino larvae and metamorph (C, D) from the same location (Parque del Sur Lake, Santa Fe Province, Argentina). Upper Bars 4.87 mm; bottom bars 2.04 mm.

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