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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* (Cei, 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 (caecilids: Cacivio and Céspedez, 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 ± 2 °C, rainfall 1000 ±100 mm^3) (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

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Table 1. Albinisms in amphibian larvae.

Family	Species	Localization	References
BUFONIDAE	*Melanophryniscus montevidensis*	Cabo Polonio, Rocha, Uruguay	Maneyro and Achaval (2004)
	Rhinella arenarum	South America	Barg and Canepuccia (2003)
	Rhinella ornata	São Paulo, Brazil	Brassaloti and Bertoluci (2008)
HYLIDAE	*Trachycephalus mesophaeus* **	Brazil	Sazima (1974)
	Trachycephalust hyphonius **	Caazapá National Park, Apepú, Paraguay	Motte and Cacciali (2009)
	Hypsiboas albomarginatus	Parque Natural Municipal da Taquara, Duque de Caxias, Rio de Janeiro, Brazil	de Oliveira Lula Salles (2013)
LEPTODACTYLIDAE	*Leptodactylus latrans* **	Parque Natural Municipal da Taquara, Duque de Caxias, Rio de Janeiro, Brazil	Rodrigues and Oliveira (2004)
	Leptodactylus chaquensis	Parque del Sur Lake, Santa Fe, Argentina	The present report
ODONTOPHRYNIDAE	*Odontophrynus occidentalis*	Quebrada de las Flores, Caucete, San Juan, Argentina	Sanabria and Laspiur (2010)
RANIDAE	*Rana cascadae*	Three Creek Lake,Oregon, United States	McCreary (2008)
	Lithobates catesbeianus **	Massanutten, Virginia, Virginia, United States	Mitchell (2005)
ALYTIDAE	*Alytes obstetricans*	Arenas de Iguña, Cantabria, Spain	Rivera *et al.* (1991); Diego-Rasilla and Luengo (2007)
	Alytes cisternassi	Sierra Morena, Andalusia, Spain	Barnestein et al. (2011)
	Alytes dickhilleni	Sierra de Castril Natural Park, Andalucia, Spain	Benavides et al. (2000)
	Discoglossus pictus **	Belsito, Palermo, Sicily	Boulenger (1897), Escoriza (2012)
PELOBATIDAE	*Pelobates cultripes*	Iberian Peninsula	Bosch (1991); Gómez-Serrano (1994)
SCAPHIOPODIDAE	*Scaphiopus holbrookii* **	United States	Johnston (2006)
PELODYTIDAE	*Pelodytes punctatus*	Iberian Peninsula	Arribas (1986)
RHACOPHORIDAE	*Rhacophorus arboreus*	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^{-1} 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 photo-pollution 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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Literature cited

Adlassnig, W., Sassmann, S., Grawunder, A., Puschenreiter, M., Horvath, A., Koller-Peroutka, M. 2013. Amphibians in metal-contaminated habitats. *Salamandra* 49: 149-158.

Arribas, O. 1986. Albinismo en *Pelodytes punctatus* (Daudin, 1802) (Amphibia, Anura, Pelodytidae). *Revista Española de Herpetología* 1: 330-334.

Barg, M. and Canepuccia, A.D. 2003. Albinismo en una larva de *Bufo arenarum. Boletín de la Asociación Herpetológica Española* 14: 29-30.

Barnestein, J.A.M. and González De La Vega, J.P. 2011. Albinismo en *Alytes cisternasii* (Boscá, 1879) en Sierra Morena, Córdoba (Andalucía, Sur de España). *Butlettí de la Societat Catalana d'Herpetologia* 19: 139.

Bechtel, H.B. 1995. Reptile and amphibian variants: colors, patterns, and scales. *Krieger Publishing Company, Malabar, FL.*

Benavides, J., Viedma, A., Clivilles, J., Ortiz, A., Gutiérrez, J.M. 2000. Dos casos de albinismo en *Alytes dickhilleni* y *Salamandra salamandra* en la Sierra de Castril (Granada). *Boletín de la Asociación Herpetológica Española* 11: 83.

Bosch, J. 1991. Albinismo en *Pelobates cultripes* (Cuvier 1829) (Amphibia, Anura, Pelobatidae). *Revista Española de Herpetológica* 5: 101-103.

Boulenger, G.A. 1897. The tailless batrachians of Europe. Part I. Ray Society, London.

Brame, A.H. Jr. 1962. A survey of albinism in Salamanders. *Abhandlungen und Berichte für Naturkunde* 11: 65-81.

Brassaloti, R.A., Bertoluci, J. 2008. Albinism in tadpoles of *Rhinella ornata* (Anura, Bufonidae) from southeastern Brazil. *Herpetological Bulletin* 106: 31-33.

Browder, L.W. 2005. Genetic and embryological studies of albinism in *Rana pipiens*. *Journal of Experimental Zoology* 180: 149-155.

Buchanan, B. W**.,** Savage, H., S. Wise, Bingel, K. 2008. Artificial night lighting affects anuran larval growth and development. *Joint Meeting of Ichthyologists and Herpetologists (ASIH, HL, SSAR)*. Montreal, Quebec.

Cacivio, M.P., Céspedez, J.A. 1998. *Chthonerpeton indistinctum*. First report of albinism. *Natural History. Herpetological Review* 29: 39.

Cei, J. M. 1950. *Leptodactylus chaquensis* n. sp. y el valor sistemático real de la especie Linneana *Leptodactylus ocellatus* en la Argentina. *Acta Zoológica Lilloana* 9: 395-423.

Childs, H.E. 1953. Selection by predation on albino and normal spadefoot toads. *Evolution* 7: 228-233.

de Oliveira Lula Salles, R., Xisto, T., Ferreira, T., Nascimento, B. 2013. Albinism in a tadpole of *Hypsiboas albomarginatus* (Spix, 1824) (Anura: Hylidae) from Southeastern Brazil. *Herpetology Notes* 6: 577-578

Diego-Rasilla, F.J., Luengo, M.R. 2007. Varios casos de albinismo en *Alytes obstetricans* (Laurenti, 1768). *Boletín de la Asociación Herpetológica Española* 18: 92.

Escoriza, D. 2012. Description of a case of albinism in a tadpole of *Discoglossus pictus pictus* (Anura: Discoglossidae) in Sicily. *Herpetology Notes* 5: 311-312.

Gern, W.A., Norris, D.O., Duvall, D. 1983. The effect of light and temperature on plasma melatonin in the neotenic tiger salamanders (*Ambystoma tigrinum*). *Journal of Herpetology* **7**: 228-234.

Gómez-Serrano, M.A. 1984. Un nuevo caso de albinismo en *Pelobates cultripes*. *Boletín de la Asociaciòn Herpetológica Española* 5: 36.

Gosner , K.L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica* 16: 183-190.

Heyer, R., Reichle, S., Silvano, D., Lavilla, E., Di Tada, I. 2004. *Leptodactylus chaquensis*. *In*: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. Available on: <www.iucnredlist.orgdetails/57118/0>. Downloaded on 12 November 2015.

Jablonski D., Alena, A., Vlček, P., Jandzik, D. 2014. Axanthism in amphibians: A review and the first record in the widespread toad of the *Bufotes viridis* complex (Anura: Bufonidae). *Belgium Journal of Zoology* 144: 93-101.

Johnston, G.R. 2006. *Scaphiopus holbrookii holbrookii*, Albinism. *Herpetological Review* 37: 211-212.

Lajmanovich, R.C. 1996. Dinámica trófica de juveniles de *Leptodactylus ocellatus* (Amphibia: Anura), en una isla del Paraná, Argentina. *Cuadernos de Herpetología* 10: 11-23.

Lanza, B., Nistri, A., Vanni, S. 2009. Anfbi d'Italia. Ministero dell'Ambiente e della Tutela del Territorio e del Mare, ISPRA Grandi and Grandi Editori, Savignano sul Panaro (Mo).

López, J.A., Ghirardi, R. 2011. First record of Albinism in *Rhinella fernandezae* (Gallardo, 1957). *Belgian Journal of Zoology* 141: 59-61.

Maneyro, R., Achaval, F. 2004. *Melanophryniscus montevidensis* (Darwin´s Toad). Albino larvae. *Herpetological Review* 35: 261.

Margolin, B.H., Collings, B.J., Mason, J.M. 1983. Statistical analysis and sample-size determinations for mutagenicity experiments with binomial responses. *Environmental Mutagenesis* 5: 705-716.

McCardle, H. 2012. Albinism in Wild Vertebrates. Thesis.Texas State University-San Marcos. Available at: <https://digital.library.txstate.edu/handle/10877/4218>. Accessed on: 12 Nov. 2015.

McCreary, B. 2008. *Rana cascadae*. Albinism. *Herpetological Review* 39: 79-80.

Mitchell, J.C. 2005. Albinism in american bullfrog (*Rana catesbeiana*) tadpoles from Virginia. *Banisteria* 25: 51.

Motte, M., Cacciali, P. 2009. Albinismo en estado larval de *Trachycephalus venulosus* (Anura: Hylidae). *Boletín de la Asociación Herpetológica Española* 20: 65-67.

Okada, T., Okada D.S. 2008. Record of albino *Rhacophorus arboreus* larvae from Mt. Hyonosen, Tottori Prefecture (Japanese). *Bulletin of the Herpetological Society of Japan*. 1: 23-25.

Pearl, C.A., Major, D.A., Bury, R.B. 2002. Natural history notes: *Ascaphus truei* (tailed frog). Albinism. *Herpetological Review* 33:123.

Perry, G., Buchanan, B. W., Fisher, R., Salmon, M., Wise, S. 2008. Effects of artificial night lighting on reptiles and amphibians in urban environments. *In*: Chapter 16 - Urban Herpetology:

Ecology, Conservation and Management of Amphibians and Reptiles in Urban and Suburban Environments. J. C. Mitchell, R. E. Jung Brown and B. Bartholomew (ed.). *Herpetological Conservation* 3: 211-228.

Rivera, X.; Aguilar, F., Solans, D. 1991. Un nuevo caso de albinismo en *Alytes obstetricans* (Laurenti, 1768) (Amphibia: Anura: Discoglossidae). *Revista Española de Herpetología* 5: 105-107.

Rodrigues, A.P., Oliveira, J.C. 2004. *Leptodactylus ocellatus* (Rã-manteiga). Tadpole albinism. *Herpetological Review* 35: 373.

Sanabria, E.A., Laspiur, L.B.Q.A. 2010. First record of partial albinism and scoliosis in *Odontophrynus occidentalis* tadpoles (Anura: Cycloramphidae). *Brazilian Archives of Biology and Technology* 53: 641-642.

Sazima, I. 1974. An albino hylid frog, *Phrynohyas mesophaea* (Hensel). *Journal of Herpetology* 8: 264-265.

Spadola, F., Insacco, G. 2010. Incomplete albinism in *Discoglossus pictus* (Otth, 1837). *Acta Herpetológica* 5: 245-253.

Takatsuji, K., Nakamura, A. 1987. Abnormality in the optic nerve of albino mutant quails. *Investigative Ophthalmology and Visual Science* 28: 384-390.

Toledo, L.F., Rodrigues Da Silva, N., Dos Santos Araújo, O.G. 2011. Albinism in two Amazonian frogs: *Elachistocleis carvalhoi* (Microhylidae) and *Lithobates palmipes* (Ranidae). *Herpetology Notes* 4: 145-146.

Vershinin, V.L. 2004. Frequency of iris depigmentation in urban populations of *Rana arvalis* frogs. *Russian Journal of Ecology* 35: 58-62.

Wojnowski, D., Malonza, P.K., Ng'Asike, J.T. 2010. *Tomopterna cryptotis* (Cryptic Sand Frog). Albinism. *Herpetological Review* 41: 482.