



Correspondence

New evidence for the presence of *Atelopus tricolor* (Anura: Bufonidae) in the montane forests of Bolivia, 16 years after its last observation

MAURICIO PACHECO-SUAREZ

Diversidad entre Pendientes, Calle 10, # 29, Achumani, La Paz, Bolivia, e-mail: pachecosuarezm@gmail.com

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Amphibians are amongst the most threatened of all vertebrate groups, experiencing massive population declines all over the globe. According to the IUCN Global Amphibian Assessment, more than one third of all amphibian species are threatened with extinction (STUART et al. 2004, GONZÁLES-MAYA et al. 2013). Species from Neotropical montane regions that are associated with streams are particularly badly affected (e.g., BEEBEE et al. 2005). Several studies have reported amphibian declines in the Neotropics to be a result of the disease chytridiomycosis, which is caused by the skin fungus *Batrachochytrium dendrobatidis* (*Bd*), next to habitat loss, climate change, and chemical contamination among others (e.g., LIPS et al. 2003).

Harlequin frogs, genus *Atelopus* (Bufonidae), are Neotropical endemics distributed across tropical forests, cloud forests, and páramos of Central and South America. Their distribution extends from Costa Rica south to Bolivia (LA MARCA et al. 2005, GONZÁLES-MAYA et al. 2013). *Atelopus* is the largest group within the family Bufonidae, with almost 100 species described (FROST 2020). At the same time, they are among the most threatened amphibians (LA MARCA et al. 2005). The vast majority of species of this genus have experienced catastrophic declines, even in the case of populations that exist in pristine habitats (GONZÁLES-MAYA et al. 2013, LA MARCA et al. 2005, LIPS et al. 2005). Of all described species, two are currently classified as Extinct and 62 as Critically Endangered in the IUCN Red List of Threatened Species (IUCN 2020). Reasons of *Atelopus* declines have been studied, identified and documented (e.g., YOUNG et al. 2001, LA MARCA et al. 2005, LÖTTERS et al. 2005). A main cause is *Bd*-related chytridiomycosis, while habitat alteration or destruction and climate change may play roles, too.

The southernmost species, *A. tricolor* BOULENGER, 1902, has been reported from the eastern Andean versants of Peru and Bolivia, more specifically from the Region

Cusco, Peru, and the Departamentos La Paz (Yungas) and Cochabamba (Chapare) in Bolivia. Here it inhabits montane forests at 600 to 2,500 m a.s.l. This is the only representative of this genus from Bolivia (LÖTTERS & DE LA RIVA 1998, KÖHLER 2000, FROST 2020).

Although this toad has been found at several sites in Bolivia, it has not been recorded from this country since 2003 (LÖTTERS & DE LA RIVA 1998, KÖHLER et al. 2006, DE LA RIVA & REICHLE 2014) when it was found in the Bella Vista Mountain Range, Yungas de La Paz (KÖHLER et al. 2006, DE LA RIVA & REICHLE 2014). Since then, herpetologists visiting different sites of historic occurrence failed to find *A. tricolor* (DE LA RIVA & REICHLE 2014, C. CORTES, A. MUÑOZ, A. JOHN, S. REICHLE and I. DE LA RIVA pers. comm.) – similar to what has been reported for numerous other species of *Atelopus* from other countries (GONZÁLES-MAYA et al. 2013). In 2007, *Bd* was for the first time detected in Bolivia, in *Rhinella quechua* that occurs sympatrically with *A. tricolor* (BARRIONUEVO et al. 2008). More recently, BURROWES & DE LA RIVA (2017) reported the wide-ranging occurrence of *Bd* in Bolivia and *A. tricolor* as a host. Similar to other members of this genus in other countries, *Bd* has likely caused dramatic declines in *A. tricolor* in Bolivia.

Unexpectedly, in the night of 1 January 2020, two individuals of *A. tricolor* were found in a stream that crosses the road between the communities of Caranavi and Copacabana (Fig. 1A) in the Yungas de La Paz (exact coordinates are not provided to protect the population). Both individuals were perched on ferns and small plants with broad leaves that grow on the rocky sides of the stream, between 1 and 1.5 m above the torrent. Two days later, the site was revisited and two additional individuals, recognizable by their distinctive markings on the back and legs, were found. No vouchers were collected.

All specimens observed well matched the descriptions of *A. tricolor* in the literature (REYNOLDS & FOSTER 1992,

LÖTTERS & DE LA RIVA 1998), and since no other *Atelopus* species is known from Bolivia, their identification can be considered reasonably reliable. In these live specimens (Figs 1B–E), the colour of the back was greenish black with numerous small warts evenly distributed. They each had continuous dorsolateral stripes of bright mustard-yellow colour, as well as scattered, irregular spots and markings on the back and limbs. Their ventral sides were cream yellow with black spots, which turned red-orange on the belly, soles of the feet, and palms of the hands.

The stream, in which these specimens were found, crosses the road at an altitude of 1,197 m a.s.l., and from there, the terrain becomes very steep and rocky with several small waterfalls (Figs 2A, B), moss-covered rocks, and large boulders. The stream has retained a relatively well-preserved vegetation cover despite its cutting through a heavily altered area that now hosts crop fields, mainly of corn, tea, and coffee, and fruit tree plantations, which alternate with patches of secondary forest. The stream is located 12.7 km (straight line, Fig. 1A) from one of the last sites where *A. tricolor* was found in 2003 (KÖHLER et al. 2006).

The surroundings of the municipal capital undoubtedly increase the human pressure on it, yet the habitat along the stream seems relatively healthy and maintains populations of several other amphibian species, such as *Cochranella nola*, *Hyalinobatrachium carlesvilai*, *Boana callipleura*, *Rhinella* cf. *margaritifera*, *Pristimantis fenestratus*, *Pristimantis* sp., and *Oreobates cruralis*.

Although the actual threats to *A. tricolor* still have to be identified, Bd and habitat loss are probably the most relevant ones. More information about density, demography, and population status is required to implement conservation measures for this species.

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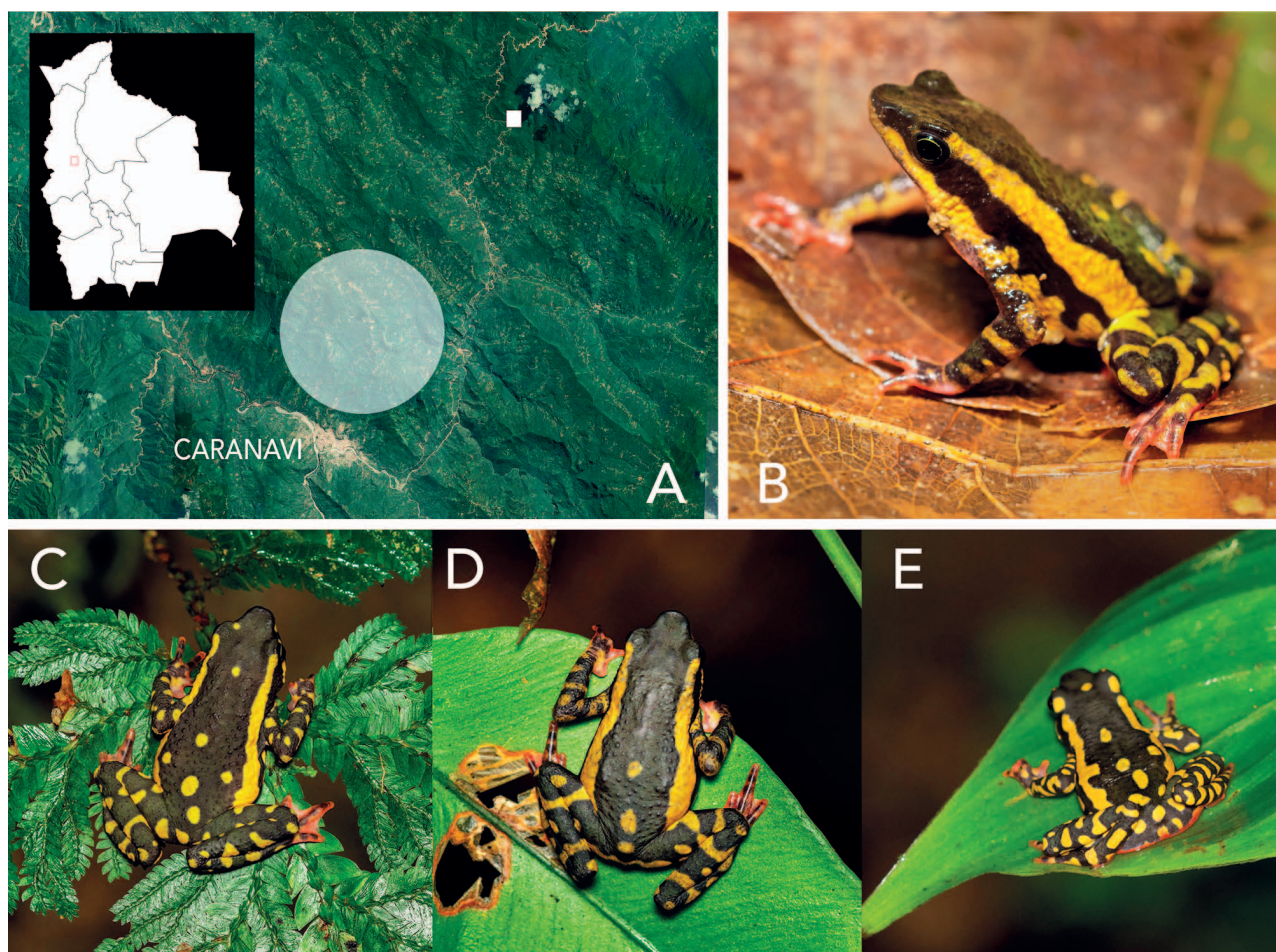


Figure 1. A) Map of part of the Yungas de La Paz showing the general area of the locality where *Atelopus tricolor* was recently found (white circle) and the locality of the last published record of this species (white square) (Google Image Landsat/Copernicus); B) Lateral view and C–E) dorsal views of specimens found.



Figure 2. A) View of the general area in the Yungas de La Paz where *Atelopus tricolor* was found and B) the habitat of this species.

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