

Scientific note

**Anti-predator behaviour of the charismatic
treefrog *Cruziohyla craspedopus*
and its first record for central Peru**

(Amphibia, Phyllomedusidae)

Frank Glaw, Ernesto Castillo-Urbina, César Aguilar-Puntriano, Miguel Vences & Jörn Köhler

The treefrog *Cruziohyla craspedopus* (Funkhouser, 1957) is among the most charismatic amphibians of the Amazon region and, although only rarely encountered, is a rather widespread species (Fraga & Torralvo 2019). During herpetological surveys in the Area de Conservación Privada Panguana, a private protected area of low-altitude rainforest in Amazonian Peru (Niessner et al. 2020), we discovered an individual of *C. craspedopus* (probably an adult male, field number FGZC 6303; Fig. 1) perching on a large leaf in the vegetation, ca. 2.0–2.5 m above the ground along a largely dried stream with remnant pools, on 12 November 2019 at night (ca. 22:30 h). The location is locally known as the crossing of the “river trail” with the “crocodile stream” (GPS coordinates 9.614269°S, 74.929859°W, 238 m above sea level), and is ca. 630 m air distance east of the Panguana research station. In order to confirm the taxonomic identity of our *Cruziohyla* specimen, we used a partial sequence of the mitochondrial 16S rRNA gene (GenBank accession number MZ576209), which revealed ca. 1.8 % pairwise sequence divergence to a sample (GenBank MH377072) from “near Nasuta, Loreto, Peru” (see Gray 2018), ca. 600 km north of Panguana, confirming its attribution to *C. craspedopus*.

This new locality record is only the seventh published of this species for Peru and the first for the Departamento de Huánuco in central Peru. Former published Peruvian records include three localities in the north of the country: (1) the Iquitos region (Rodríguez & Duellman 1994), (2) Nasuta (Gray 2018), both in the Departamento de Loreto, and (3) the vicinity of Galilea in the Departamento de Amazonas (Hoogmoed & Cadle

1991). In addition, three localities are known from Departamento de Madre de Dios in southern Peru: (4) Cocha Cashu and (5) Tambopata (Hoogmoed & Cadle 1991), and (6) Cusco Amazónico (Duellman 2005). Additional photographic records on the internet (i.e. inaturalist.org) from Peru all also originate either from the Iquitos region in the north or the forested areas around Puerto Maldonado in the south. Three specimens of *C. craspedopus* stored in the Universidad Nacional Mayor de San Marcos, Museo de Historia Natural, Lima, Peru (MUSM 10250, 18537, 21937) all originate from the south of the country (Departamento Madre de Dios: Tambopata and P. N. Manu).

After capturing the frog by hand, it did not try to jump away, but displayed a distinct posture, which can be interpreted as an anti-predator behaviour: It bent its head and body to form a convex dorsal surface, closed its eyes, partly covered the anterior head and the eyes by its hands, and folded its limbs in front of its belly (Fig. 1c–e). Due to this ball-like posture the frog had “turned off” the adhesion of its feet to the underground and could easily fall down from the hand. In a natural situation, this behaviour might help the frog to escape a potential predator by falling down from the tree. In addition, this posture effectively dissolved the natural shape of the frog and made the orange-yellow ventral surfaces visible. This sudden dynamic change in striking vs. cryptic colouration during the falling might serve to protect the frog from predation by misrepresenting the prey’s moving location due to the neural processing delay in predators caused by the flash lag effect and by displaying a different

Frank Glaw (corresponding author), Zoologische Staatssammlung München (ZSM-SNSB), Münchhausenstr. 21, 81247 München, Germany; e-mail: glaw@snsb.de

Ernesto Castillo-Urbina & César Aguilar-Puntriano, Universidad Nacional Mayor de San Marcos, Museo de Historia Natural (MUSM), Departamento de Herpetología, Av. Arenales, 1256, Lima 11, Peru

Miguel Vences, Zoological Institute, Technische Universität Braunschweig, Mendelssohnstr. 4, 38106 Braunschweig, Germany

Jörn Köhler, Hessisches Landesmuseum Darmstadt, Friedensplatz 1, 64283 Darmstadt, Germany



Fig. 1. *Cruziohyla craspedopus* from Panguana (FGZC 6303) photographed the day after capture (a, b) and in defense postures immediately after capturing; contracting (c) and contracting combined with eye protection (d, e).

and contrasting colouration in comparison to that of the resting posture (Murali 2018, Loeffler-Henry et al. 2018). Although this behaviour was displayed at night, we hypothesize that this flash colouration anti-predator effect would be more successful during the day, when sudden changes in colour and shape of the frog would be much easier recognizable by potential predators such as birds. During handling the frog also emitted release calls. Similar anti-predator behaviours, named contracting behaviour, have been reported for various anuran families including other phyllomedusid species (e. g., Toledo et al. 2010, 2011, Borteiro et al. 2014, Ferreira et al. 2019), and also eye-protection by hands has been described for a variety of anuran species (Toledo et al. 2011).

Despite its unique appearance and colouration, *C. craspedopus* was never recorded from Panguana in over 50 years of intensive inventory research of its species diversity (Niessner et al. 2020), confirming the general assumption that this treefrog spends most

of its life high up in the canopy and is therefore difficult to detect. One night before (on 11 Nov. 2019) and one night after our observations (on 13 Nov. 2019) we observed numerous individuals of four other phyllomedusid species (*Phyllomedusa chaparroi*, *P. vaillanti*, *Pithecopus palliatus* and *Callimedusa tomopterna*) in low vegetation in a completely dried pond (locally known as “Estanque”), suggesting that all these frogs had descended from their typically higher positions in the vegetation in order to wait for heavy rain and to start their reproductive activities.

Acknowledgements. We are grateful to Juliane Diller for providing logistic support for our research in Panguana, to Armin Niessner for providing the exact geographic coordinates, and to the Servicio Nacional Forestal y de Fauna Silvestre (SERFOR) for issuing research permits (RDG No 071-2020-MINAGRI-SERFOR-DGGSPFFS, RDG No D000067-2021-MINAGRI-SERFOR-DGGSPFFS).

References

- Borteiro, C., Baldo, D., Kunz, T. S., Perez, R., Elz, R. P. & Kolenc, F. 2014. Contracting behaviour in three species of *Phyllomedusa* (Anura: Hylidae: Phyllomedusinae). *Herpetology Notes* 7: 393–395.
- Duellman, W. E. 2005. Cusco Amazónico. The lives of amphibians and reptiles in an amazonian rainforest. 433 pp., Ithaca (Cornell University Press).
- Ferreira, R. B., Lourenço-de-Moraes, R., Zocca, C., Duca, C., Beard, K. H. & Brodie Jr, E. D. 2019. Antipredator mechanisms of post-metamorphic anurans: a global database and classification system. *Behavioral Ecology and Sociobiology* 73: 69.
- Fraga, R. de & Torralvo, K. 2019. New record of the fringed leaf frog, *Cruziohyla craspedopus* (Anura: Phyllomedusidae) extends its eastern range limit. *Acta Amazonica* 49: 208–212.
- Gray, A. R. 2018. Review of the genus *Cruziohyla* (Anura: Phyllomedusidae), with description of a new species. *Zootaxa* 4450(4): 401–426.
- Hoogmoed, M. S. & Cadle, J. E. 1991. Natural history and distribution of *Agalychnis craspedopus* (Funkhouser, 1957) (Amphibia: Anura: Hylidae). *Zoologische Mededelingen* 65(8): 129–142.
- Loeffler-Henry, K., Kang, C., Yip, Y., Caro, T. & Sherratt, T. N. 2018. Flash behavior increases prey survival. *Behavioral Ecology* 29(3): 528–533.
- Murali, G. 2018. Now you see me, now you don't: dynamic flash coloration as an antipredator strategy in motion. *Animal Behaviour* 142: 207–220.
- Niessner, A., Monzon, J., Gerlach, G. & Diller, J. 2020. Biological research station and private conservation area Panguana. *Ecotropica* 22: 202004.
- Rodríguez, L. O. & Duellman, W. E. 1994. Guide to the frogs of the Iquitos Region, Amazonian Peru. 114 pp., Lawrence (Natural History Museum of the University of Kansas).
- Toledo, L. F., Sazima, I. & Haddad, C. F. B. 2010. Is it all death feigning? Case in anurans. *Journal of Natural History* 44(31): 1979–1988.
- , Sazima, I. & Haddad, C. F. B. 2011. Behavioural defences of anurans: an overview. *Ethology, Ecology & Evolution* 23(1): 1–25.