NATURE NOTES

Amphibia: Anura

Shrinking behavior in *Pristimantis pardalis* (Amphibia: Anura: Craugastoridae) from Costa Rica

Toledo et al. (2010) defined two main defensive behaviors in amphibians, depending upon the response of the prey to a certain aggressive stimulus by the predator. The most common and well known of these behaviors is death feigning (thanatosis), which is used as a defensive strategy by many species of amphibians, reptiles, and mammals to avoid predation by assuming a dead posture (Edmunds, 1974; Caro, 2014). For anurans, thanatosis can be defined as follows: the posture is motionless, even when the animal is touched, the limbs are loose, and the eyes usually are open. This behavior mostly is used by non-toxic terrestrial and semi-arboreal anurans. Another passive defensive behavior is what Toledo et al. (2010) called "shrinking," which is used mostly by toxic terrestrial and arboreal anurans and can be defined as: the posture is motionless and the eyes usually remain closed, the arms and forelimbs are bent and maintained close to the body, and generally contracted against the belly.

The genus *Pristimantis* is the largest known genus of terrestrial vertebrates (Padial et al. 2014). To date, passive or aggressive behaviors (thanatosis or shrinking) have not been reported for any species in this genus (Toledo et al. 2010; L. Toledo, pers. comm.). Herein we report a case of shrinking behavior in *Pristimantis pardalis* (Barbour, 1928), which entailed some peculiarities. This species is little known and almost no data is available on its biology and habitat, other than it is nocturnal and found on low vegetation within dense forest in the Premontane Rainforest zone, and that it occurs from southern Costa Rica to eastern Panama at elevations from 50 to 1,450 m (Savage, 2002; Leenders, 2016). In appearance this frog is small (males up to 19 mm, females up to 29 mm) with a dark gray to black dorsum and dark brown venter (according to Savage, 2002; but see ventral coloration in images below), with white and black flash markings on the groin (Savage 2002, Leenders 2016). Recently, an individual in Panama was found infected with carnivorous fly larvae that were in the process of consuming its intestines (Leenders, 2016).

While walking in Premontane Wet Forest (Savage, 2002) at Casa Tordesillas, Socorro de Platanares, Provincia de San José, Costa Rica (9°12'30"N, 83°41'01"W; elev. 988 m), we observed five individuals of *P. pardalis*. Two of them were females, and both acted in a similar fashion. The first female was perched vertically on a dry leaf at a height of 1.5 m (Fig. 1A). After photographing the frog for less than 1 min it appeared to release its grip and fell into the leaf litter, where it remained motionless with the limbs contracted against the body (Fig. 1B, C). This behavior lasted for several minutes, and at that point we placed the frog on a leaf to take more photographs. During this time it also remained motionless. We did not detect any specific odor during the encounter. Soon after we came across another female that displayed similar behavior. This individual was perched horizontally on a green leaf, and when we approached it contracted its body and remained motionless but did not fall into the leaf litter. Subsequently, we encountered three males, and none displayed death-feigning or shrinking behavior. After accidentally contacting one of these frogs with the lens of a camera, it jumped for at least 1 m; however, we could not locate the animal to see if he had undergone any apparent physical changes. The other two males we came across were difficult to photograph because they kept walking away slowly (Fig. 1D), and neither displayed shrinking behavior. We cannot provide a clear explanation as to why only the two females displayed this behavior, whereas the three males escaped by jumping or walking away.

The proposed "shrinking" behavior described by Toledo et al. (2010) normally is used by toxic species such as bufonids, and some hylids and phyllomedusids. In this case we do not have information on the toxicity of *P. pardalis*, although the black and white flash markings on the groin area of this species might be used to deter predators. The individuals that underwent the shrinking behavior, however, did not show their flash markings. Further, the two female *P. pardalis* did not close their eyes when displaying the shrinking behavior, as occurs with most species known to use this type of defensive mechanism (Toledo et al, 2010).

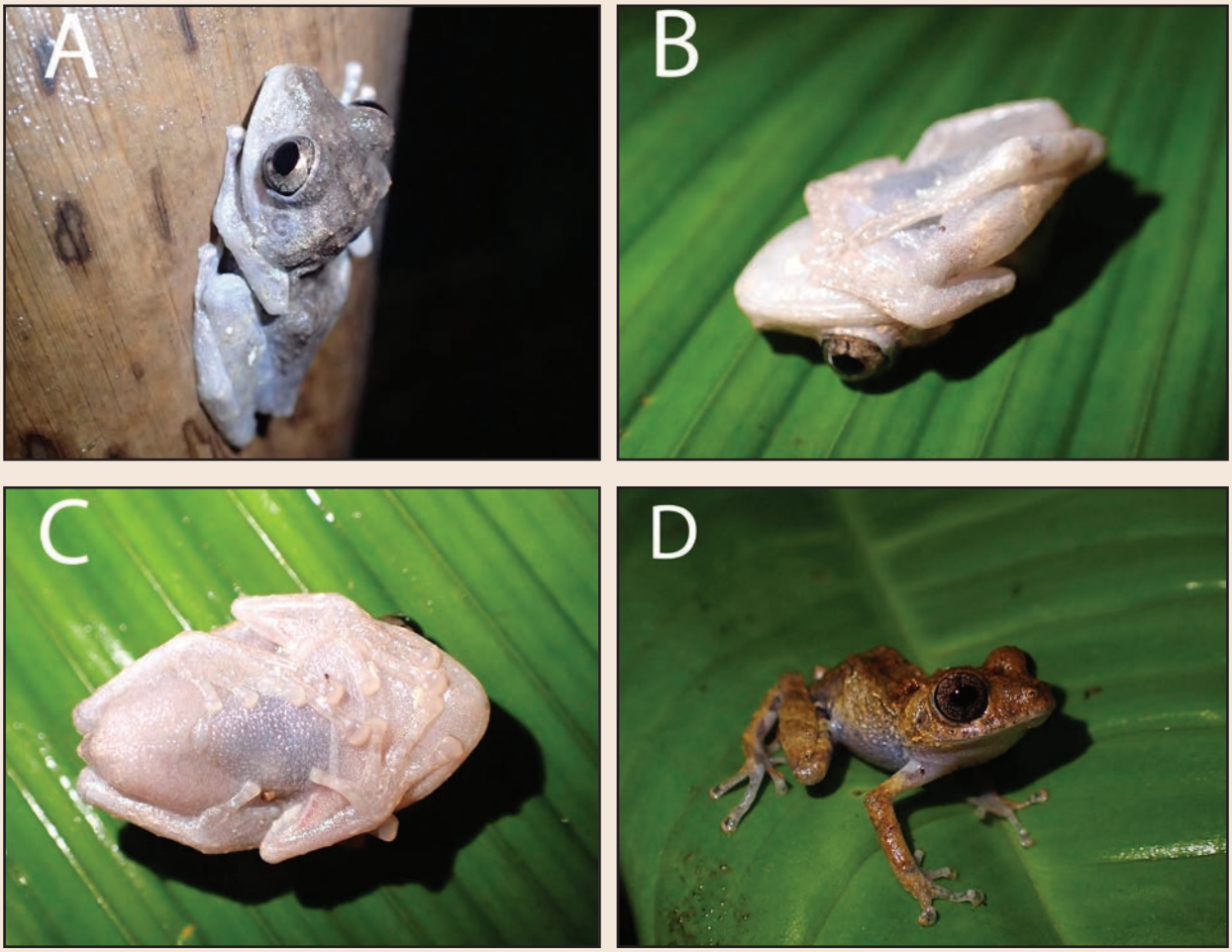

Fig. 1. Adult individuals of *Pristimantis pardalis* found at Casa Tordesillas, Socorro de Platanares, Provincia de San José, Costa Rica. (A) An adult female found in a vertical position on a dry leaf; (B) the same individual after falling to the ground, displaying shrinking behavior; (C) the second female displaying shrinking behavior; and (D) an adult male on a leaf prior to leaving the scene. © Cesar Barrio-Amorós

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