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SHORT COMMUNICATION

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Defensive behaviour in *Rana graeca*

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Defensive behaviours in frogs and toads have been well reviewed (e.g. Toledo et al., 2011; Jablonski & Balej, 2014; Jablonski, 2017) indicating different families of amphibians are reported to show different types of defense against potential threats. This includes the Ranidae (Toledo et al., 2011; Carretero et al., 2011) and here we describe the first observation of defensive behaviour in *Rana graeca*. This species is endemic to the Balkan Peninsula ranging from Bosnia and Herzegovina through central and southern parts of the peninsula to eastern Bulgaria (Speybroeck et al., 2016). Except in distribution, only scattered information is known about this species.

On 12 October 2014 (near the village of Chora Getson, Peloponnese, Greece; 36.948°N, 22.254°E, WGS84, 605 m elev.; Fig. 1A) and on 29 October 2018 (near the village of Krini, Peloponnese, Greece; 38.179°N, 21.749°E, WGS84, 206 m elev.; Fig. 1B) we observed defensive behaviour known as "eye-protection" in three adult individuals of *R. graeca*. These individuals were captured from the surface of the water in a small stream. The animals were captured by hand around the noon and immediately took up the defensive posture after direct touch. They remained in this posture for up to 5 minutes. The individuals were released back to their habitat after photography. After release, they remained in this defensive posture for a few seconds until it reached the bottom of the stream and then moved normally. In all cases the eyes were open (Fig. 1). No defensive call was heard or defensive odour detected. During field work from spring to autumn the first author examined approximately 100 individuals of the species and recorded this behaviour only once.

This defensive behaviour is known in different members of the Ranidae as well as other families of amphibians (Toledo et al., 2011; Schlüpmann, 2000; Carretero et al., 2011) and it is hypothesised that the main function is protection of the eyes that could be damaged during possible regurgitation (Toledo et al., 2011). However, such explanation may be misleading and observed behaviour could be only a part of complex defensive mechanisms that are currently understudied. Similar behaviour is well known for the genus *Bombina* (unkenreflex) but is usually attributed to warning colouration of skin toxins when on land and to fish swimming below when floating on the surface (Jablonski & Balej, 2014; Bordignon et al. 2018). The possibility that the posture would be of benefit if the individual was regurgitated seems improbable. Usually if an amphibian is swallowed, the head is the first (common for snake predators) before the front limbs which are forced backwards away from the eyes. During regurgitation they would be held in this position and unprotected. Hypothetically, this posture may i) make the individual appear more difficult to swallow (especially for snakes), ii) as a variant of thanatosis it could be an attempt to be inconspicuous to increase its survival (Brodie et al., 1998). Our observations as well as in the literature (e.g. Jablonski & Gvoždík, 2009; Carretero et al., 2011) suggest the possibility

Figure 1. Individuals of *R. graeca* displaying defensive posture - Chora Getson **(A)**, Krini **(B)**

that some Palaearctic frogs use this behaviour more often at lower temperature (depending on year, season, time of day, elevation etc.) when they are hypothermic. In this case (middle and late October), our observed individuals displayed slower reactions and adopted the observed behaviour defence instead of attempting to escape. The lower temperatures during autumn may play a role (Haberl & Wilkinson, 1997), but do not have to be the core factor involved.

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