

Case of defensive behavior in *Pelobates syriacus* (Amphibia: Pelobatidae)

Daniel Jablonski^{1*} and Petr Balej²

Defensive or antipredator behavior of amphibians can have several forms (see Brodie, 1983; Toledo, Sazima and Haddad, 2011). According to these authors, escape is the most common defensive reaction, but many species also take advantage of passive defenses. These species utilize their cryptic coloration and body shape to remain motionless when encountering a predator, a defense strategy called “immobility” (e.g., Bufonidae, Hylidae, Odontophrynidae, Megophryidae). An extreme case of such immobility is thanatosis, death feigning, shrinking or contracting (Toledo, Sazima and Haddad, 2010, 2011). Dispensing toxins in the skin can be also an efficient defensive strategy. Relatively poisonous species advertise their toxicity via bright aposematic coloration (e.g., Dendrobatidae, Salamandridae). Other species advertise their toxicity by specific behavior, while they enlarge the body and expose their paratoid glands like *Bufo* spp. to a predator (e.g., Sharma et al., 2011). An exceptional antipredator strategy at amphibians is “Unkenreflex” (Hinsche, 1926) first described for *Bombina* spp. This strategy is very well known in the literature which involves lifting and withdrawing of the legs off the substratum, arching the body, showing ventral aposematic colors, close eyes and produce toxic secretions (Toledo, Sazima and Haddad, 2011). Similar behavior has been reported in diverse evolutionary or geographic groups of amphibians, including salamanders [*Lissotriton boscai* (Marco and Leguía, 2001), *Salamandrina terdigitata* (Lanza, 1967)], frogs [e.g. *Boophis albilabris* (Andreone, 2002), *Hemisus marmoratus* (Greenbaum et al., 2012), *Hypsiboas* spp. (Angulo and Funk, 2006), *Lithobates capito* (Means,

2004), *Nyctixalus pictus* (Das, Leong and Tan, 2004), *Rana* spp. (Haberl and Wilkinson, 1997; Schlüpmann, 2000; Jablonski and Gvoždík, 2009; Carretero et al., 2011), *Rhacophorus* spp. (Duong and Rowley, 2010; Streicher, Smith and Harvey, 2011)] or toads [e.g. *Melanophryniscus* spp. (Brusquetti, Baldo and Motte, 2007; Almeida-Santos et al., 2010), *Neobatrachus pictus* (Williams et al., 2000)].

The Syrian spadefoot toad (*Pelobates syriacus* Boettger, 1889; Pelobatidae) is found in the Balkans (Bulgaria, FYROM, Greece, Romania and Serbia), Turkey, Middle East and the Caucasus region (Arnold and Ovenden, 2002). There, they inhabit typical terrestrial habitats, including sandy and loamy soils with a variety of permanent or semi-permanent ponds for reproduction. Among other congeners of Pelobatidae, “immobility” is only known from *P. fuscus* (Hinsche, 1928; Jablonski and Gvoždík, 2009).

During a trip to south-eastern Bulgaria in July 2013, coastal biotopes near the town of Primorsko were visited. While exploring the surroundings of an abandoned building in the pine-oak woods (north of the town, 42.286808° N, 27.749842° E; altitude 16 m a. s. l.) one of us (PB) found an adult specimen of *P. syriacus* (approximately 45 mm SVL) under an old wooden board. The animal was found at 17:49 (local time) on 22 July 2013. After lifting the wooden board, the animal remained motionless and slightly pinned to the ground for about 10 seconds (Fig. 1A). There was a layer of old polystyrene beneath the board, which detached after a few seconds and fell onto the animal. The animal immediately took up the defensive posture. It flattened its body, closed its eyes, lifted its front limbs and located it alongside head up the substrate (Fig. 1B). The specimen remained in such a posture for a couple of minutes, and then returned to a normal position just after the direct touch by observer.

To our knowledge this is the first report of a defensive behavior resembling the Unkenreflex in *P. syriacus*, and the first report for the Pelobatidae family. Similar

¹ Department of Zoology, Comenius University in Bratislava, Mlynská dolina B-1, 842 15, Bratislava, Slovakia

² Zdeňka Bára 114/4, 700 30 Ostrava, Czech Republic

*Corresponding author; e-mail: daniel.jablonski@balcanica.cz

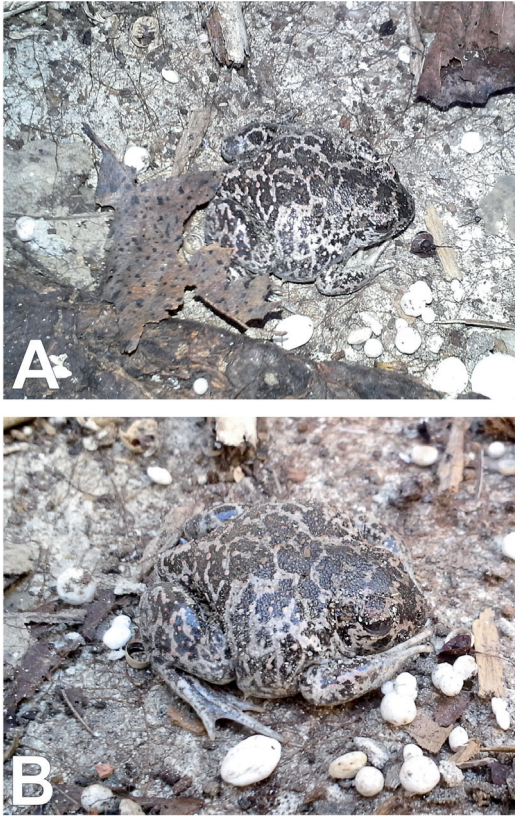


Figure 1. A - The found specimen *Pelobates syriacus* before the defensive behavior. B – The same specimen presenting the defensive behavior of eye-protection.

behaviors have been recorded for many species of amphibians (see citations above). However, the appropriate terminology of similar behavior is not completely unified. As with our observations, not every described case from the literature describes the Unkenreflex (recorded for *Bombina*, *Melanophryniscus*, *Pseudophryne* and *Smilisca*; Toledo, Sazima and Haddad, 2011), because: (i) many species have an absence of aposematic coloration (e.g. *Hypsiboas*, *Rana*, *Rhacophorus*), (ii) many species miss specific toxins, (iii) in many cases, specimens bow only their front part of body instead of the whole body like the genus of *Bombina* spp., (iv) not every specimen hides its eyes in the typical Unkenreflex. That is why the description of behaviors as the Unkenreflex is, in the majority of described situations, inaccurate. In connection with the characteristic posture, the new separate term for this type of defensive reaction was coined “eye-protection”

(Toledo, Sazima and Haddad, 2011). Features during Unkenreflex and eye-protection can be combined (Toledo, Sazima and Haddad, 2011). For example, these authors considered the case of the hyloid species *Smilisca fodiens* (Firschein, 1951) to be Unkenreflex, but this species lacks aposematic coloration. This case is similar to other species (Ranidae, Rhacophoridae; see citations above), whose defensive behaviors were also described as Unkenreflex, even though the aposematism of the ventral body part was missing. In addition, Toledo, Sazima and Haddad (2011) distinguished so-called full and partial Unkenreflex on the basis presence or absence specific features during this defensive behavior. With regard to different presence of features, we assume that instead of using the term full Unkenreflex, which is a defensive behavior only with the presence of aposematic coloration, we should use another type of behavior described as eye-protection.

We have not answered the question regarding the initiator of the behavior and what its function might be. We can hypothesize that the main function is protection of the eyes, the most important sense organ of frogs, in the case of acute danger from predators. Jablonski and Gvoždík (2009) found that the defensive reaction can be more often artificially provoked in *R. temporaria* by tapping on the frog’s head or back to imitate an attack by predators from above (snakes, birds or mammals; Stojanov, 2005; Toledo, Sazima and Haddad, 2011). Owing to our subsequent observations (also from *R. dalmatina*) it is possible that some specimens benefit from this behavior more often at lower temperatures (early spring, high altitude, morning etc.) when they are hypothermic. In this case, observed specimens of ranid frogs had slower reactions and more often preferred the latter described defensive reaction instead of escape. The temperature of surroundings thus can probably play a role in the presence of this behavior (see Haberl and Wilkinson, 1997), but it does not have to be an initiating factor in general (e.g. at tropical species; see Streicher et al., 2011; Roelke et al., 2011). To sum up, other reports of similar types of behavior at various species in the nature or systematic and experimental observation in artificial conditions are thus very important in order to understand the evolution of behavior patterns in amphibians.

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