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Novel defensive behaviours of both sexes of *Vipera ursinii graeca* (Serpentes: Viperidae)

Edvárd Mizsei[1,*] and Bálint Üveges[1]

Snakes have a variety of defensive behaviours. Some snakes try to defend themselves by biting their aggressors (predators, captors). This antipredatory behaviour is usually a response to stress or predators and the most commonly observed defensive behaviour in vipers. In some of the cases venomous snakes deliver 'dry bites' without envenoming, because of the high cost of venom production (e.g., *Crotalus durissus*, *C. atrox*, *Vipera berus*, Nishioka, Silveira and Bauab, 1995; Young and Zahn, 2001; Karlson-Stiber, Salmonson and Persson, 2006). Other strategies in snakes include expulsion of faeces or anal-gland secretions as well as death-feigning to confuse predators (e.g., *Natrix natrix*, *Heterodon platyrhinos*; McDonald, 1974; Gregory, Isaac and Griffiths, 2007), or tail shaking (e.g., *Bothrops sp.*, *Agkistrodon piscivorus*; Araújo and Martins, 2006; Gibbons and Dorcas, 2002), and the well-known rattling of rattlesnakes (e.g., *Crotalus spp.*). Hemipenis display as a defensive strategy is very rare in snakes, being observed only in the species *Micrurus frontalis* (Elapidae) and *Oligodon cyclurus* (Colubridae) (Allen, 1940; Azevedo, 1960; Wüster and Cox, 1992).

Herein, we report for the first time the hemipenis and cloacal scent gland display as a defensive behaviour of *V. u. graeca*, based on observations on two male and one female specimen in Southern Albania (Nemerçkë and Lunxhërisë Mountains; coordinates not presented because of conservation reasons).

Vipera ursinii graeca (Nilson and Andrén, 1988) is the smallest of the three mountainous subspecies of *V. ursinii*; it can reach a total length (TL) of 402 mm in case of males (snout-vent length (SVL) 348 mm) and 435 mm in case of females (SVL 394 mm). It is endemic to the Pindos Mountain range (Greece and Albania), where it occurs in subalpine short-grass mountain pastures at about 1600-2000 m a.s.l. (Dimitropoulos, 1985; Nilson and Andrén, 1988; Nilson and Andrén, 2001; Korsós, Barina and Pifkó, 2008; Mizsei and Üveges unpublished data).

During our surveys for recording new distribution localities of *V. u. graeca* in Albania, three out of seven handled vipers displayed unusual behaviours when their morphometric characteristics were measured. All vipers, including the ones not presented here, were caught with gloved hands, taken back to camp in linen bags for measurement and then released back to the wild at the exact point of capture. The taxonomical identity of the specimens was determined by scale counting in the field and comparison with descriptions (Nilson and Andrén, 1988; Nilson and Andrén, 2001).

An adult, probably a gravid female of *V. u. graeca* (SVL 350 mm, TL 387 mm, weight 41.2 g) was captured on 21 May 2011 on the Nemerçkë Mountains, Albania. It was basking when captured, at 1785 m a.s.l., at 12:30 h. During the measurement it protruded its cloacal glands and excreted a yellow-coloured secretion (Fig. 1A).

Two males were captured on 25 May 2011, on the Lunxhërisë Mountains, Albania. The first male (SVL 239 mm, TL 277 mm; weight 11.9 g) was basking when captured at 1675 m a.s.l., at 10:40 h. During handling we saw that it repeatedly extruded its left hemipenis for a few seconds. It was never fully everted to just approximately 50% of its whole size at the maximum (Fig. 1B).

The second male (SVL 261 mm, TL 301, weight 14.2 g) was searching for a hiding place or possibly food when captured at 1870 m a.s.l., at 10:54 h. In this case, the left hemipenis was extruded too, but only slightly. Both males were aggressive, fully active, and both hissed and bit the gloves.

Defensive tail display and tail waving were not noticed, all extrusions were spontaneously displayed, without any pressure or massage on the tail.

This is the first report of cloacal defensive behaviour in the genus *Vipera*, in which the repertoires of defensive display consist typically of hissing, imitative or real

1 Department of Evolutionary Zoology and Human Biology, University of Debrecen, H-4010 Debrecen, P.O. Box 3, Hungary

*Corresponding author; e-mail: edvardmizsei@gmail.com

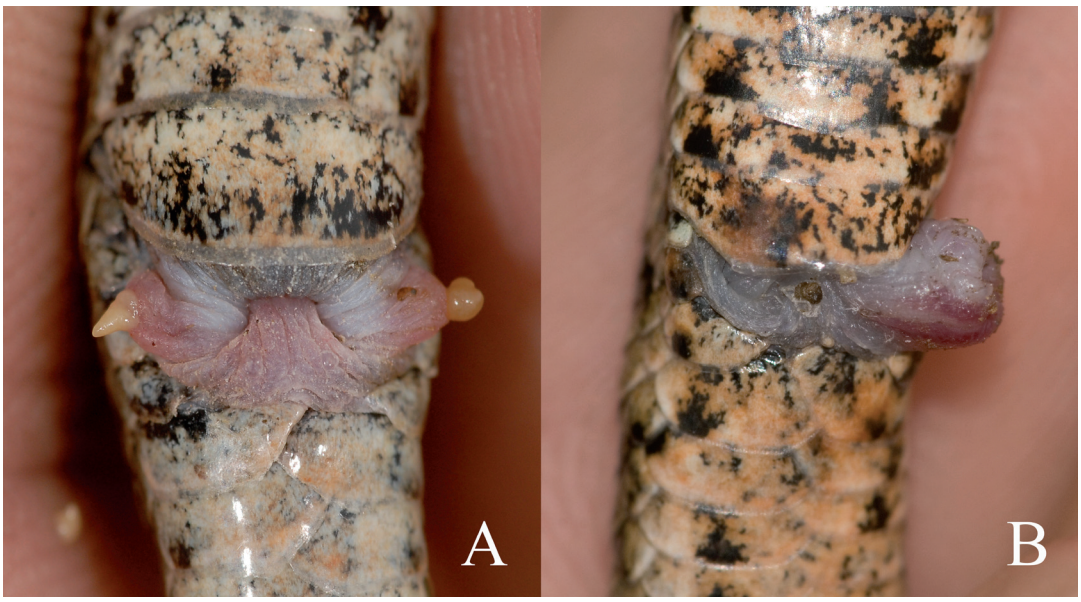

Figure 1. A: protrusion of the cloacal scent gland of the female specimen (with secretions), B: everted hemipenis of the first male specimen. (foto: Edvárd Mizsei)

attack with an attempted bite or defecating (Young et al, 1999; Karlson-Stiber, Salmonson and Persson, 2006, pers. obs.). Greene (1988) and Wüster and Cox (1992) assumed that hemipenis display could be an indicator of fright, and it is either mimicking a defensive structure, such as a stinger; or displaying aposematic colour. Wüster and Cox (1992) also suggested that it may be size or/and age dependent. Another possible explanation for age dependency, apart from smaller, younger specimens being more vulnerable, thus easier to frighten, would be, that defensive hemipenis display is much more probable at juvenile age, simply because the hemipenes are less developed, thus easier to extrude. In our observations, hemipenis display occurred during handling and aposematic coloration was not conspicuous (brownish ventral colour, with greyish-reddish hemipenes).

Defensive cloacal scent gland display in snakes is undocumented up to present. This behaviour seems to be similar to other snakes, such as *Natrix natrix* which uses the secretion of cloacal glands to deter predators. Some specimens of *V. u. rakosiensis* (pers. obs.) defecate when handled. In our case it is possible that this protrusion was meant to make this kind of defensive behaviour more effective by exposing the predator more directly to the secretion.

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