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NATURAL HISTORY NOTE

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The first observation of an attempt by *Natrix natrix* to predate an aquatic snail with an operculum

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Specialists slug- or snail-eating snakes can be found across all continents except Europe, Australia and Antarctica. They have evolved specific morphological adaptations in the structure of their heads and in certain cases feeding apparatus, such as their mandibular dentition (Hoso et al., 2007). *Natrix natrix* (L., 1758) is a widely distributed species encompassing four subspecies. Their habitat stretches from central Europe to the southern regions of Iraq and Iran, extending eastwards to Mongolia and Baikal (Asztalos et al., 2021; Jablonski et al., 2023). *Natrix natrix* is an adaptable generalist feeder and usually prefers amphibians and fish if conditions allow (Luiselli et al., 2005). There are documented observations of these snakes consuming invertebrates (Hemmer, 1966). Despite the absence of specialised snail-eating snake species in Europe, there have been sporadic reports of several snakes, including *N. natrix*, preying on this kind of prey. This note highlights an incident in which a *N. natrix* died whilst attempting to ingest a snail with an operculum.

On 19 May 2022, at about mid-day, we discovered a subadult male *N. natrix* with an aquatic snail *Viviparus contectus* (Millet, 1813) in its mouth (Fig. 1). The total length of the snake was 415 mm. The observation was made within the boundary of Pustý Mlyn village near the Rudava river (48° 33'12" N, 17° 18'02" E). The Rudava river is a slow running stream, with littoral vegetation formed mainly of *Phragmites australis* and *Carex* sp. The snake with the snail in its jaws was found on littoral vegetation, whereas the snake´s tail was in the stream (Fig. 1B). The head of the *N. natrix* was trapped between the snail's shell and closed operculum (Fig. 2). The outer lip of shell was situated on the dorsal part of the snake's head (Fig. 1A), meanwhile the snail´s operculum was pressed onto the snake's lower jaw (Fig. 2F). The trapped part of the head originally included the whole of the frontal scale and included some of the parietal scales (Fig. 1A). The snake and snail were collected and placed in a vivarium for further observation. During capture the position of the snail shell moved so that the most caudal part of frontal scale became visible (Fig. 2E). The trapped part of the head still included the eyes, and the snake could still protrude its glottis through the left side of the jaws enabling it to breathe (Fig. 2D); in this way it survived 10 hours in captivity. The snail and dead snake were subsequently preserved in ethanol and both specimens (no. 12992) are available at the herpetological collection curated by the last author. Based on the snake being trapped, we assume that the snake had bitten the snail's head while the snail was moving along the bottom of the stream. According to our observations *V. contectus* is the most common species of water snail at the locality, although other species of water snail observed were *Lymnaea stagnalis* and *Planorbarius corneus*.

Figure 1. The position of the snake *Natrix natrix* with the snail *Viviparus contectus* during the observation - **A.** Close up, and **B.** Wider angle to show general alignment of snake to the vegetation

To the best of our knowledge, this represents the fourth documented record of *N. natrix* attempting to consume a snail (Opatrný, 1960; Consul, 2009; Zimić & Klisura, 2016). The first published account (Opatrný, 1960) describes a preserved dead specimen of *N. natrix* with a permanently clinched upper jaw in a body of an aquatic snail *P. corneus* from the collection of the Charles University, Prague. The shell of the snail covers the eyes of the snake meanwhile the snake's glottis is protruded. There is an assumption that after biting the snail, the snake lost its orientation, and this led to drowning (Opatrný, 1960). Subsequent observations detail two successful instances of at least partial consumption of a *P. corneus*. The authors of these observations noted that during ingestion, the snake's eyes were covered by the shell, significantly limiting its sight, and so rendering these individuals vulnerable to predators (Consul, 2009; Zimić &

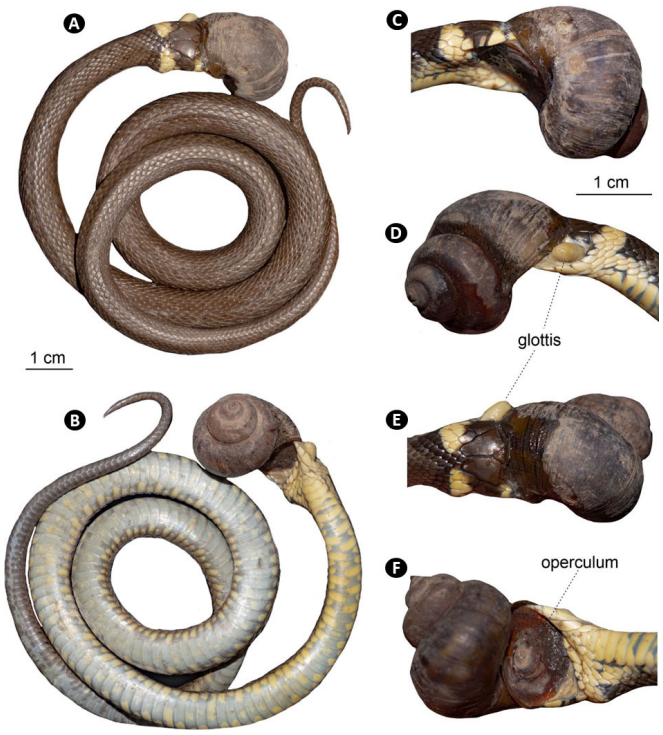

Figure 2. The dead specimen of *Natrix natrix* with its head trapped between the shell and operculum of the aquatic snail *Viviparus contectus*, found in Pustý Mlyn at Rudava River, Slovakia- **A.** to **F.** The same specimens from a variety of angles

Klisura, 2016). The first documented record (Opatrný, 1960) of *N. natrix* attempting to consume a snail mentions that the snake is a medium-sized individual whereas the other three discoveries (Consul, 2009; Zimić & Klisura, 2016), including our observation, the snakes were subadults. There might be a relationship between the snakes' age in these observations; this has been suggested by other authors (Christopoulos & Kotselis, 2023).

Even though four groups of snakes are specialist feeders on snails (Sazima, 1989; Hoso & Hori, 2006), previous records and our own observation suggest that non-malacophagous snake species are typically exposed to danger when attempting to feed on a snail. This assertion is supported by the documented case of an individual from another natricid snake species, *Amphiesma stolatum*, whose lower jaw became trapped between the shell and operculum of a *Pila* sp. snail (Sing & Purkayastha, 2023). On the other hand, there is a finding which indicates that slugs might be commonly predated by *Zamenis situla* (Christopoulos & Kotselis, 2023).

While our observation is not the first case of a snake trapped by a snail, to the best of our knowledge it is the first record of *N. natrix* attempting to consume a snail with an operculum.

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