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Autohaemorrhaging in a Bahamian pygmy boa, *Tropidophis curtus barbouri*

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Snakes use a wide variety of antipredatory behaviours, including gaping, exuding musk, defecating, convolving, feigning death, and autohaemorrhaging (Greene, 1994).

Autohaemorrhaging, or the deliberate ejection of blood, in snakes occurs via either the cloaca or the orifices of the head (i.e. nares, mouth and orbits). In reptiles, autohaemorrhaging is already known from a few species of snakes in the genera *Heterodon*, *Nerodia*, *Rhinocheilus*, *Natrix*, *Zamenis*, and *Tropidophis* as well as in the lizard genus *Phrynosoma* (Smith et al., 1993; Greene, 1994; Sherbrooke & Middendorf, 2001; Gregory et al., 2007; Iiftime & Iftime, 2014). In the genus *Tropidophis* specifically, which is also unusual in that some species are known to be able to change colour, cephalic autohaemorrhaging has so far been recorded in 13 out of 32 species (Smith et al., 1993; Greene, 1994; Torrest et al., 2013; Iturriaga, 2014). In a brief report, Hecht et al. (1955) were the first to describe autohaemorrhaging in *Tropidophis curtus curtus* (formerly known as *Tropidophis pardalis*). Here we offer greater detail of cephalic autohaemorrhaging in a different sub-species, the Bahamian pygmy boa (*Tropidophis curtus barbouri*), including access to the first-ever published video footage of this behaviour in any snake species **(YouTube, 2019)**.

Knowing that *T. c. barbouri* is found on several islands across the Bahamian archipelago where it inhabits mesic, wooded areas (Henderson & Powell 2009; Powell & Henderson, 2012), we conducted an expedition and found an adult individual under a small rock in the Leon Levy Plant Preserve on Eleuthera, The Bahamas, on 20 October 2019 at 16:25 h. The snout vent length of the snake was 352 mm and tail length 42 mm, dorsally it was coloured beige-brown and ventrally the tail was yellow (Fig. 1).

Immediately after capture, it defecated and discharged musk. When gentle pressure was applied to the head, the eyes almost immediately filled with blood and a drop was exuded from the mouth (Fig. 2). After 2.4 sec of pressure both eyes began to fill with blood (starting from the postocular side) and were fully flooded within 0.7 sec. Blood started to exude from the mouth 0.8 sec after the eyes were fully filled and only two drops were expelled. After 4.4 sec the blood was re-absorbed from the postocular side and the eyes were completely clear within 1.6 sec. Overall, it took 6.7 sec from the start of the cephalic autohaemorrhaging to the full clearing of the eyes. After autohaemorrhaging, the snake appeared to be in full health and was returned to the location in which it was found.

Figure 1. Bahamian pygmy boa (*T. curtus barbouri*) found at the Leon Levy Preserve showing the tail with yellow colouring ventrally

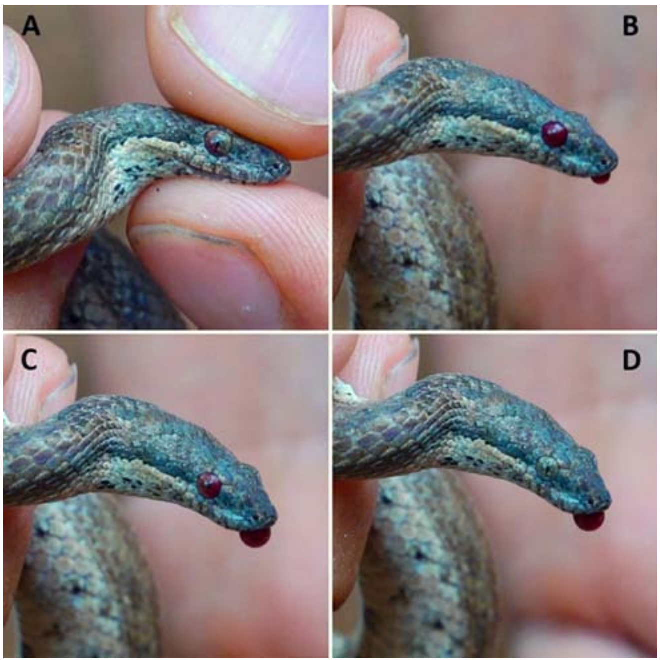

Figure 2. Four different stages of a cephalic autohaemorrhaging display in a Bahamian Pygmy Boa (*T. curtus barbouri*). **A)** Start of the autohaemorrhaging, after 2.4 sec of pressure both eyes began to fill with blood starting from the postocular side; **B)** Fully flooded eyes within 0.7 sec and expelled drop of blood from the mouth 0.8 sec after blood-filled eyes; **C)** Start of the clearing of the eyes from the postocular side 4.4 sec after full flooding; **D)** Fully cleared eyes with a drop of blood still hanging from the mouth within 1.6 sec. Overall, it took 6.7 sec from the initial start of the autohaemorrhaging to the full clearing of the eyes.

The physiological processes involved in cephalic autohaemorrhaging in *Tropidophis* spp. and the effect of expelled blood on predators are still unknown and thus complicate the attribution of this behaviour to a specific function. Hecht et al. (1955) and Greene (1994) suggested that autohaemorrhaging is an antipredatory response. Our observations support this as we witnessed cephalic autohaemorrhaging in *T. c. barbouri* alongside other defensive behaviours including defecating, exuding musk and convolving (forming a tight ball, see cover photo). While defecation and exudation of musk are often thought to render a snake unpalatable to a predator, this could be exacerbated by ejected blood. Toxic or foul smelling compounds are often added to the expelled blood in many species of insects (Blum & Sannasi, 1974; Stocks, 2008; Bateman & Fleming, 2009) to deter predators. In the case of *T. curtus curtus* (Hecht et al., 1955), this was investigated by injecting the snake's autohaemorrhaged blood into a prey animal, which presented no evidence of toxic properties.

The exact function of cephalic autohaemorrhaging is yet to be understood and predatory experiments as well as toxicological analyses of the expelled blood could shed light into how this behaviour could aid *Tropidophis* spp. deter predators. We also suggest that knowledge of the physiological processes involved in the very rapid onset and prompt stop of haemorrhaging in members of *Tropidophis* could have potential applications in medical fields.

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