



# Caudal Pseudoautotomy in Heller’s Red-necked Keelbacks, *Rhabdophis helleri* (Schmidt 1925)

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Reptiles employ numerous antipredator strategies ranging from crypsis to aposematic coloration, from feigning death to biting, and the deliberate loss of the tail in response to an attack by a predator (Greene 1988). Tail loss occurs in defined regions of caudal vertebrae and can be intra- or intervertebral (Ananjeva and Orlov 1994). Further classifications (Arnold 1984; Slowinski and Savage 1995; Savage and Slowinski 1996; Bateman and Fleming 2009) include “autotomy” (intravertebral breakage along a pre-existing fracture plane that passes through a centrum and neural arch, spontaneous separation, and regeneration), intravertebral breakage along a fracture plane without regeneration, “pseudoautotomy” (intervertebral breakage between adjacent caudal vertebrae, non-spontaneous separation, no regeneration), and intervertebral breakage with some regeneration. Intravertebral breakage without regeneration, known to occur in some amphisbaenians, is considered an intermediate con-

dition, whereas the intervertebral breakage with regeneration occurs in some agamid lizards (Arnold 1984). Only intervertebral breakage is known in snakes, but it can be either specialized for tail loss (tails are fragile, thickened, and extremely long) or unspecialized (Savage and Crother 1989; Savage and Slowinski 1996). Pseudoautotomy has been reported in species of the genera *Scaphiodontophis*, *Pliocercus*, *Thamnophis*, *Rhadinaea*, *Natriciteres*, *Psammophis*, *Xenochrophis*, *Coluber*, *Coniophanes*, *Dendrophidion*, *Drymobius*, *Enulius*, *Nerodia*, *Sibynophis*, *Amphiesma*, and *Vipera* (Duellman 1979; Sharma 1980; Broadley 1987; King 1987; Mendelson 1991; Todd and Wasserzug 2010; Hoogmoed and Avila-Pires 2011; Strugariu et al. 2018).

Heller’s Red-necked Keelback (*Rhabdophis helleri*) is a medium-sized, brightly colored natricid known to occur in southwestern and eastern China, northern Vietnam, Myanmar, Nepal, Bhutan, Bangladesh, and India (David and



Fig. 1. Heller’s Red-necked Keelbacks (*Rhabdophis helleri*) from the vicinity of Naharkatia, Assam, India, with freshly broken tails. Photographs by Sourav Dutta.

Vogel 2021; Liu et al. 2021; Uetz et al. 2021). These snakes reach lengths to 130 cm, feed almost entirely on toads and frogs, are active by day and night, can be both terrestrial and semi-arboreal, and inhabit the vicinity of ponds and streams in lowland and hill forests (Das 2008). Reports of defensive behaviors in congeners include death-feigning (Mutoh 1983), striking, biting, and bluffing (Mori et al. 1996; Mori and Burghardt 2000, 2001, 2008).

From October 2019 to February 2020, we observed broken tails in six (5 females and one male) of eleven Heller's Red-necked Keelbacks encountered in the vicinity of Naharkatia, Assam, India (27°16'48.00"N, 95°19'48.00"E) (Fig. 1). Tail breakage in most individuals was induced by grabbing or lifting the snake by its tail, causing it to twist its body until the tail was detached. Similar behavior has been described in the Eastern Gartersnake (*Thamnophis s. sirtalis*) (Alfieri and Cooper 1993), Horseshoe Whipsnake (*Hemorrhois hippocrepis*) (Marco 2002), Buff-striped Keelback (*Amphiesma stolatum*) (Sharma 1980), Guatemala Neck-banded Snake (*Scaphiodontophis annulatus*) (Savage and Slowinski 1996), Nose-horned Viper (*Vipera ammodytes*) (Strugariu et al. 2018), Caspian Whipsnake (*Dolichophis caspius*), and Dice Snake (*Natrix tessellata*) (Crnobrnja-Isailović et al. 2016).

Tail loss in the keelbacks described above was very quick. Breakage occurred both at the point where the tail was being held or anywhere along its entire length except near the base. In all cases, the amputated portion of the tail thrashed like those of many lizards, albeit at what appeared to be a slower rate, as also observed by Alfieri and Cooper (1993) in an Eastern Gartersnake (*Thamnophis s. sirtalis*). Bleeding was minimal at both broken ends of the wounded tail, suggesting that some mechanism prevented excessive blood loss (Arnold 1984; Alibardi 2010).

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