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First Record of Dicephalism in the Common Krait, *Bungarus caeruleus* (Schneider 1801), from Nepal

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The presence of axial bifurcation in snakes consists mainly of dicephalic specimens and is well documented in the literature: Cunningham (1937), Jha and Gupta (1957), Mishra and Shah (1983), Smith and Perez-Higareda (1987), Hoser and Harris (1995), Swanson et al. (1997), McAllister and Wallach (2006), Wallach (1995, 2007, 2012, 2018), Beane (2009), Jandzik (2009), Albuquerque et al. (2010, 2013), Kim et al. (2013), Pezdirc et al. (2013), Wallach and Salmon (2013), Dieckmann et al. (2014), Gvozdenovic and Cavor (2015), Twombley (2015), and Caviglioli et al. (2016). Cunningham (1937) carried out the first comprehensive survey on axial bifurcation in serpents, which was a historical survey of 225 snakes exhibiting mainly two-headed conditions. Subsequently, the number of verified cases of axial bifurcation in snakes has risen to 1,987 and includes 112 genera, 217 species, and 255 species and subspecies (Wallach, unpubl. data). Of 181 reports of two-headed snakes from Asia, one is from Nepal (Mishra and Shah 1983; Wallach 2018, unpubl. data). Only 10 cases of dicephalism are presently known in the family Elapidae (6 species in 4 genera): *Bungarus caeruleus*, *Hemachatus haemachatus*, *Naja atra*, *N. kaouthia*, *N. naja*, and *Sinomicrurus japonicus* (Wallach 2018).

Dicephalism is not a common phenomenon and rarely occurs in nature. Most reports involve snakes. The majority of dicephalic individuals are unable to survive with normal behavior in the wild (i.e., feeding and escaping predation) due to having two independent brains. Specific methods for locating dicephalic snakes in-situ have not been established; therefore, most, if not all, two-headed snakes have been found opportunistically. Herein, we report a noteworthy case of dicephalism in a *Bungarus caeruleus* (Schneider 1801) collected from the Kawasoti Municipality in Nepal along with detailed information on its external morphology and coloration.

The specimen was preserved one year ago in 70% ethanol. The total length (TL), snout-vent length (SVL) and cloaca to tail-tip length (CTL) were taken with a small rope and later converted into millimeters. Length of the head was measured from tip of the snout to the fusion zone. Scales were counted following previously described methods (Dowling 1951). Anomalous half-ventrals were not counted and partly

Fig. 1. Dorsal view of a dicephalic Common Krait (*Bungarus caeruleus*) from Kawasoti, Nepal. Photograph provided by the Kaligandaki Hospital.

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divided ventrals were counted as one scale. Paired organs were recorded as right and left. Sex of the specimen was determined by making a post-cloacal incision between the subcaudals. We dissected the preserved specimen to examine its internal anatomy but were unable to collect any pertinent data. Radiographs of the preserved dicephalic specimen were taken in the Kaligandaki Hospital with the help of the medical team.

This unusual snake was found in May 2018 on the premises of Juddha Bir Shirish Magar's home in Kawasoti Municipality, Nawalpur District, Gandaki Province, Nepal (27°39'01.6"N, 84°06'47.5"E; elev. 196 m). According to local observers, the snake was first seen alive crawling in the house. It was collected and preserved and now is deposited in the Kaligandaki Hospital, Nawalpur, Nepal (cat. no. KGH BC 001). The Digital Voucher Image is deposited in the Lee Kong Chain Natural History Museum, National University of Singapore (cat. no. ZRC(IMG) 2.407a,b).

The specimen is a neonatal female with the following combination of characters (Figs. 1–2): TL = 208 mm (from left head) and 200 mm (from right head); SVL = 175 mm (from left head) and 167 mm (from right head); CTL = 33 mm; dorsal scale row formula 15:15:15; ventrals 207 (left head: 39 + 168) and 189 (right head: 21 + 168); cloacal scale undivided; subcaudals 52; preocular 1; postoculars 2; loreal absent; temporals 1 + 2; supralabials 7 (3rd and 4th touching eye, 6th largest); and infralabials 7. Right head and left head length from snout to fusion zone are 21 mm and 29 mm long (12% and 16% of SVL, respectively). Scales are smooth, heads are slightly broader than necks, and eyes are small with round pupils (Fig. 2). Scales of the vertebral line are hexagonal and larger than adjacent scales. The radiographs of the dicephalic specimen (Fig. 3) revealed approximately 24 vertebrae in the right neck, 36 in the left neck, three in the fusion zone, 162 in the trunk, and 35 in the tail. The original color pattern is slightly faded and different than the color pattern of live snakes due to the duration of preservation. The dorsum is black with narrow paired white transverse bands that continue to the tip of the tail. These bands are absent in the head regions and are replaced by white vertebral spots (Fig. 1). Both the labials and ventrals are glossy white. The tongue is pinkish-red.

Fig. 2. Closeup view of the heads of a dicephalic Common Krait (*Bungarus caeruleus*) from Kawasoti, Nepal. Photograph by Kamal Devkota.

Although only 9% of snakebite envenomed cases were recorded in the Western Development Region of Nepal (Magar et al. 2013), most of the people dislike, fear, and/or want to kill any snakes they encounter (Pandey et al. 2016). This snake's demise could be attributed to insufficient knowledge and lack of awareness by the local people regarding conservation; sadly, therefore, we were unable to study its behavior.

The study of dicephalic snakes is always a curiosity in the ophiological world. Two-headed snakes rarely survive long in the wild but can survive for many years in captivity, with two *Pituophis catenifer* living at least 21–22 years (Wallach 2007). The first record of dicephalism in Nepal was a 185-mm juvenile Checkered Keelback, *Fowlea piscator* reported by Mishra and Shah (1983) and deposited in the Natural History Museum of Nepal (Fig. 4). Jha and Gupta (1957) recorded the first dicephalic specimen of *Bungarus caeruleus*, a 260-mm juvenile, from Lakhaoti, Uttar Pradesh, India (Fig. 5).

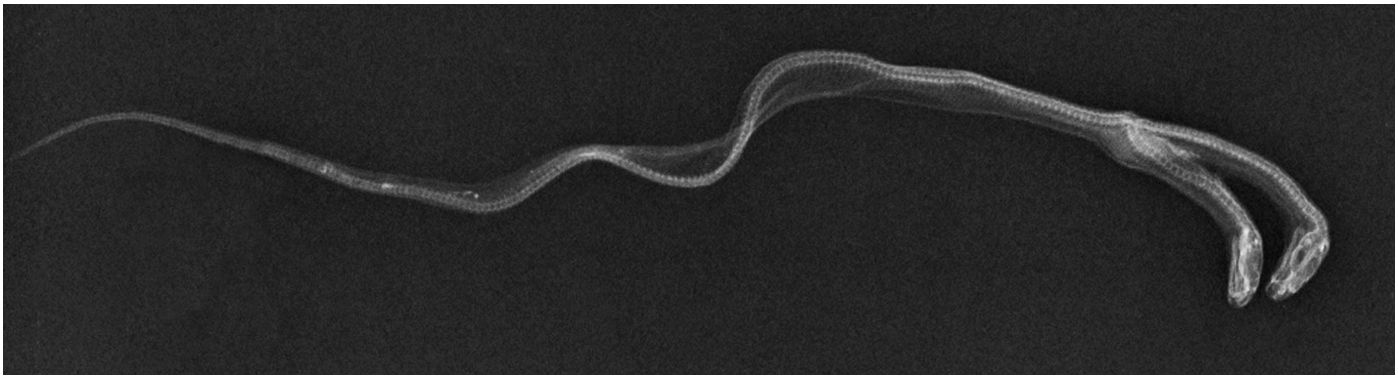

Fig. 3. Radiograph of a lateral view of a dicephalic Common Krait (*Bungarus caeruleus*) from Kawasoti, Nepal. Radiograph provided by the Kaligandaki Hospital.

Fig. 4. First record of dicephalism in Nepal was a Checkered Keelback (*Fowlea piscator*) recorded by Mishra and Shah (1983) and a recent photograph of the specimen in the Natural History Museum of Nepal. Photograph by Kamal Devkota.

Our specimen is a new addition to the list of two-headed snakes and represents only the second record worldwide for *B. caeruleus* and first record from Nepal. It differs slightly from the one recorded by Jha and Gupta (1957) in regard to the degree of bifurcation. According to the classification of Smith and Perez-Higareda (1987), our specimen is clearly proarchodichotomous, whereas the specimen described by Jha and Gupta (1957) was craniodichotomous. Jha and Gupta (1957) were unable to investigate detailed information due to the fragile condition of their specimen.

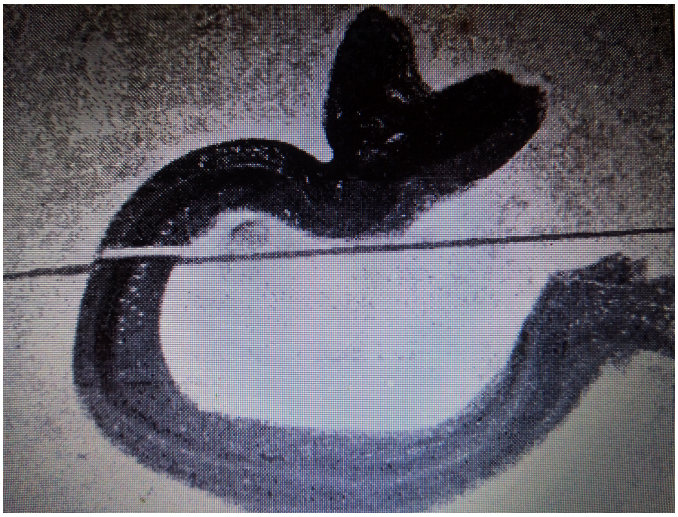

Fig. 5. First record of dicephalism in a Common Krait (*Bungarus caeruleus*), an Indian specimen documented by Jha and Gupta (1957).

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