

Addition to the snake fauna of Pakistan: Mackinnon's Wolf Snake, *Lycodon mackinnoni* Wall, 1906

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Pakistan harbours around 71 snake species (Khan, 2006). A large snake fauna would be expected in Pakistan given that it covers a wide geographical area that includes three major zoogeographical regions and three large mountain ranges (Himalayan, Hindu Kush, and Karakoram). However, to date this snake diversity has probably been underestimated (Khan, 2006). Moreover, some of the species may represent species complexes with unclear taxonomy (e.g. genus *Platyceps*, *Spalerosophis*). Other species are expected to occur in Pakistan in cases where their known distributions reach close to the borders with neighbouring countries (especially India). A good example are species of the genus *Lycodon* Boie in Fitzinger, 1826 (wolf snakes). This genus represents about 50 Asian species but only three are currently known from the territory of Pakistan: *L. aulicus* (Linnaeus, 1758), *L. striatus* (Shaw, 1802) and *L. travancoricus* (Beddome, 1870). The first two are distributed in Pakistan from Sindh to Khyber Pakhtunkhwa Province whereas the third has been recorded only in one locality near Hyderabad, Sindh (Khan, 2006).

In this study, we provide the first record of the rare Mackinnon's Wolf Snake (*L. mackinnoni* Wall, 1906) from Azad Jammu and Kashmir (AJK), north-eastern Pakistan. This species was described by Wall (1906) from a single specimen collected by P. W. Mackinnon from the neighbourhood

of Mussoorie, Uttar Pradesh, India (holotype BMNH 1946.1.13.81). Unusually for a *Lycodon* species the specimen was described as having no loreal scales although there were reservations about this due to the poor condition of specimen's head. Furthermore it has been noted for *Lycodon* that "aberrations such as the union of the loreal scale with the prefrontal are not unknown" and a subsequent description of *L. mackinnoni* has included loreal scales (Smith, 1943).

We undertook herpetofaunal surveys in the Bagh and Hattian Bala districts of AJK from November 2016 to April 2018. These involved active searching of different microhabitats in the two districts, e.g. in the vicinity of stream and ponds, agricultural fields, forests (pine, moist temperate and sub-tropical deciduous forest) and habitats near to human settlements. Local people were also questioned and some of our observations were based on low quality photos provided by them. The snakes recorded were identified using the keys in Lanza (1999) and Khan (2006). If possible, nine morphological and thirteen meristic characters, altitude, coordinates and valuable ecological data were recorded. Morphological measurements were made using digital callipers and geographic data by GPS (WGS 84). A single specimen (male) of *L. mackinnoni* was collected and preserved in 10 %

Table 1. An overview of all published and new distribution records of *L. mackinnoni* from Pakistan and India

Number	Locality	N	E	Elevation (m)	Date	Observations	Source
1	Hari Ghel, Bagh District, AJK	33.9464°	73.7127°	830	April & June 2017	3	This study
2	Dhirkot, Bagh District, AJK	34.0283°	73.5400°	1396	May 2017	4	This study
3	Bagh city, Bagh District, AJK	33.9904°	73.7759°	1127	May 2018	3	This study
4	Hattian, Bala District, AJK	34.1143°	73.8813°	1100	May 2018	3	This study
Published records from India							
5	"Neighbourhood of Mussoorie", Uttar Pradesh – type locality	30.4595°	78.0715°	~1860	-	-	Wall 1906
6	Mussoorie, Uttar Pradesh	30.4595°	78.0715°	~1900	-	-	Smith 1943
7	Alomar near Nainital, Uttarakhand	29.5899°	79.6514°	~1600	-	-	Smith 1943
8	Mukteshar near Nainital, Uttarakhand	29.4619°	79.6538°	~2000	-	-	Smith 1943
9	Nai, Doda district, Jammu and Kashmir	33.0924°	75.7084°	1824	May 24, 2015	1	Manhas et al. 2015

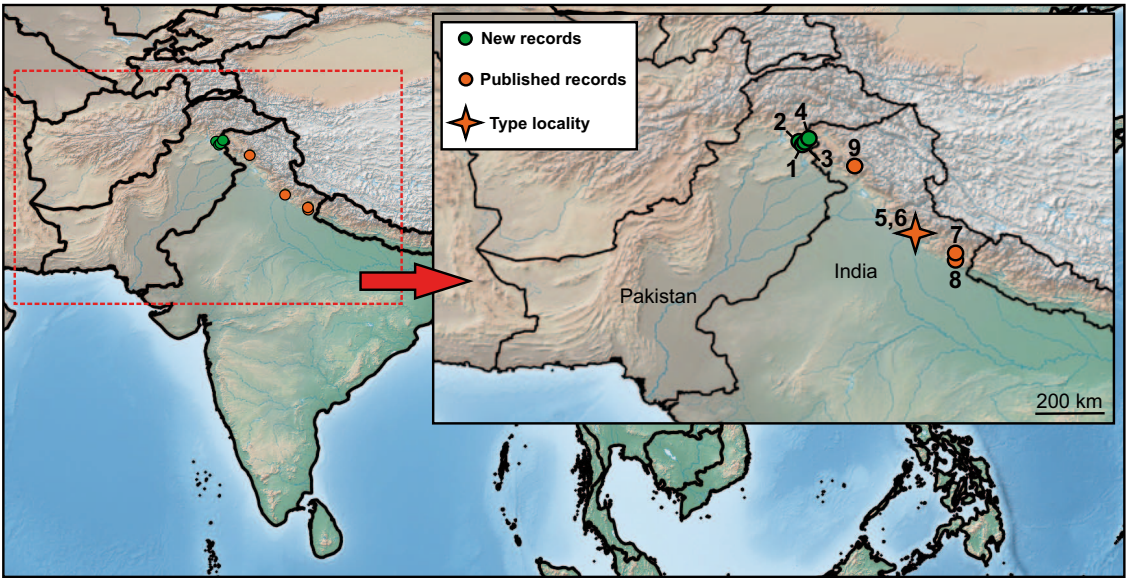


Figure 1. Published and new records of *L. mackinnoni* from India and Pakistan. Numbers on the map correspond with Table 1.

Table 2. A comparison with published measurements and scale counts of *L. mackinnoni*

Morphometry	Measurements (mm)		
	This study	Manhas et al. 2015	Wall 1906
	PMNH 3916 adult, male Hattian Bala, Azad Jammu and Kash- mir, Pakistan	Unvouchered adult, ? Nai, Doda district, Jammu and Kashmir, India	BMNH 1946.1.13.81 adult, female “Neighbourhood of Mussoorie”, Uttar Pradesh, India Type locality
Snout-vent length	350.0	354.0	-
Tail length	88.2	80.0	-
Head length	11.4	12.0	-
Head width	5.0	3.0-5.0 (mouth to neck)	-
Head height	4.1	-	-
Eye diameter	1.7	1.0	-
Distance b/w eyes	3.7	4.0	-
Ventral scales diam- eter (at midbody)	7.3	8.0	-
Total length	438.2	435.0	~355.0
Meristics	Numbers		
Supralabials	8	8	8
Infralabials	7	7	6?
Supraocular	1	2	1
Parietal	2	2	2
Prefrontal	2	2	2
Preocular	1	1	1
Postocular	2	1	2
Loreal	1	1	0
Intranasal	2	2	2
Temporal	5 (2+3)	5 (2+3)	5 (2+3)
Dorsal body scales (one head length, mid- body, one head length before anus)	17-17-15	17-0-15	17-17-15
Ventrals	180	193 (163-187)	192
Subcaudals (paired)	57 (paired)	53	54 (paired)



Figure 2. The preserved specimen PMNH 3916 of *L. mackinnoni* from Hattian Bala, Azad Jammu and Kashmir, Pakistan

formaldehyde while a tissue sample was placed in 96 % ethanol. Both are stored in the Pakistan Museum of Natural History, Islamabad (voucher specimen) and Department of Zoology, Comenius University in Bratislava, Slovakia (tissue sample) under voucher numbers PMNH 3916 and 7944, respectively.

Lycodon mackinnoni was recorded from four geographically close localities of the Bagh and Hattian Bala districts with elevation ranging from 830 to 1396 m a.s.l. (Table 1, Fig. 1). The specimen we collected was a freshly-killed adult male from Hattian Bala. In addition, we recorded, but did not collect, 12 additional observations of adults from other localities (Hari Ghel, Dhirkot, and Bagh city). The snakes

observed in Bagh district were found in humid localities with hot summers (about 37 °C) and cool winters (about 4 °C) but where snowfall is recorded only at higher elevations. Snakes from Hattian Bala district were from localities with warm summers but freezing cold winters. Morphometric and meristic data for the individual collected are shown in Table 2 where they are compared with published data.

Mackinnon's Wolf Snake is very rare and known only from a few localities in the western Himalayas (Wall, 1906; Smith, 1943; Fig. 1). This snake has only recently been recorded from Indian Jammu and Kashmir (Manhas et al., 2015), about 100 km from the border with Pakistani Punjab, a lowland province. Only five specimens are known from the published literature or museum collections and one of them (the holotype) has a damaged head. Thus any morphological data are important to present. Individuals observed by us did not differ in colouration, all having a black-yellow dorsal pattern which fades away in the posterior third but there were differences in subcaudal and ventral scales that may correspond with gender. It is worth noting that in our specimen the loreal scales were present otherwise all other characters fall within the original diagnostic and descriptive range for *L. mackinnoni*.

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