



First Record of Salazar’s Pitviper (*Trimeresurus salazar*) from Meghalaya, India, with Comments on Hemipenes

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The genus *Trimeresurus* Lacépède 1804 is represented by at least 16 species in India, nine of which occur in the northeastern parts of the country (Captain et al. 2019; Mirza et al. 2020). Salazar’s Pitviper (*T. salazar*) is the most recently described of these species (Mirza et al. 2020), with a type series collected in the Pakke Tiger Reserve, East Kameng District, Arunachal Pradesh, India (26.968790°N, 93.013984°E). Two additional specimens collected in “Assam” were registered in the Zoological Museum of the University of Copenhagen, Denmark (ZMUC R69255–6) in

1881 and were most likely collected in 1811–1816 by Bernt Wilhelm Westerman (D.K. Johansson, in litt., 12 February 2021). However, Assam as defined at that time included the present-day states of Arunachal Pradesh, Assam, Meghalaya, Mizoram, and Nagaland; consequently, those specimens could have originated in any one of these states in northeastern India. Herein we present the first record of *T. salazar* from Meghalaya and confirm the presence of the species in the state of Assam. We also provide additional data on the hemipenes.

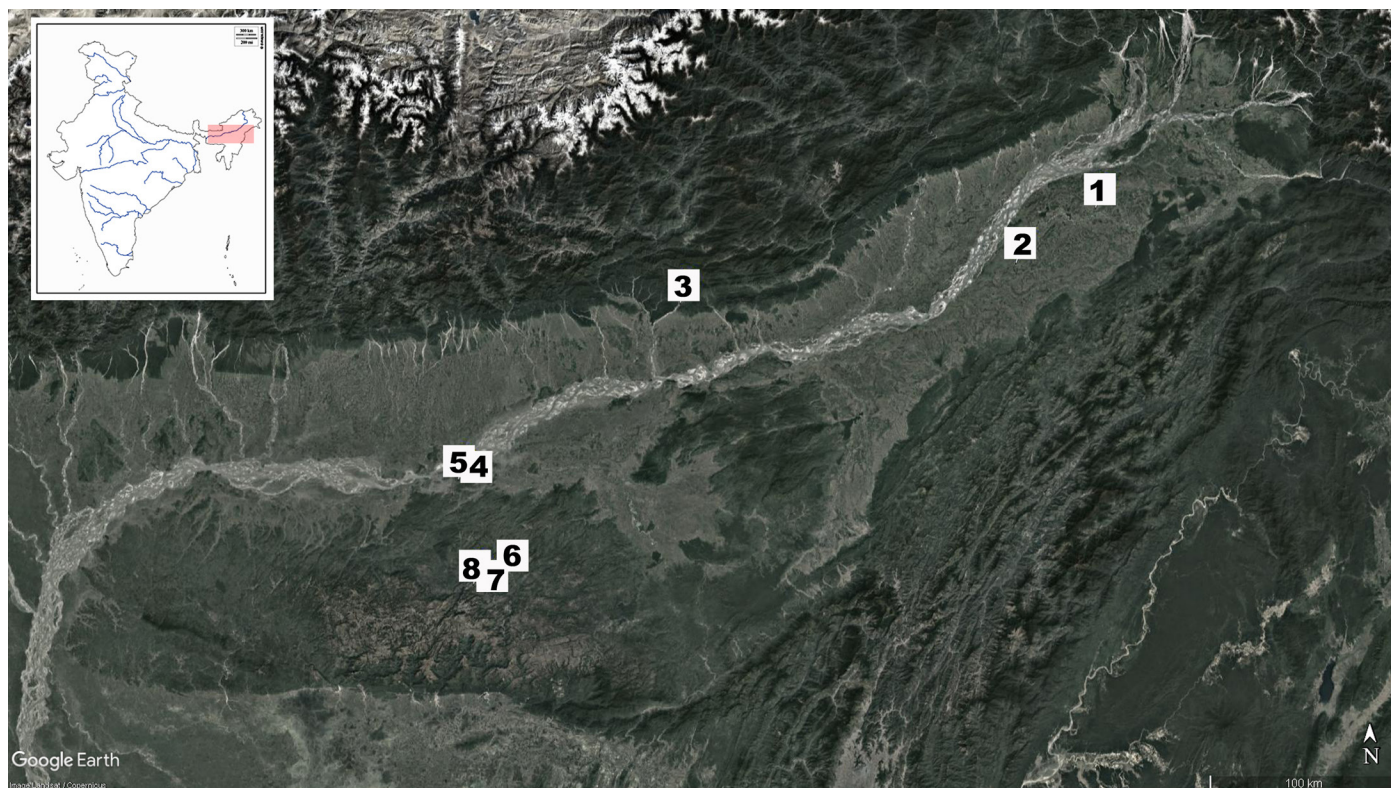


Fig. 1. A map of northeastern India showing known locality records of Salazar’s Pitviper (*Trimeresurus salazar*): Assam: Dibrugarh (1), Demow (2), Amchang Wildlife Sanctuary (4), Khanapara (5); Arunachal Pradesh: Pakke Tiger Reserve (3); Meghalaya: Umroi, Ri-Bhoi (6).

We encountered eight Salazar's Pitvipers from around the Umroi Military Station, Umroi, Ri-Bhoi District, Meghalaya (25°40'54.96"N, 91°56'40.97"E; elev. 930 m asl) (Fig. 1). Of the eight, two males were collected on 22 and 30 November 2020 (personal collection of Yashpal Singh Rathee, YR002 and YR007 and photographic voucher ZRC(IMG) 2.558 in the Lee Kong Chian Natural History Museum, National University of Singapore). Respective data for the two specimens are SVL 560 mm and 550 mm; tail length 100 mm and 105 mm; dorsal scales rows 23/21/15 and 23/21/16; ventrals 170 and 164; subcaudals 68 and 70; interorbital scales 13 and 12; supralabials 10/11 and 11/11; infralabials 12/12 and 13/12; preoculars 2/2 and 2/2; postoculars 3/3 and 3/2; and suboculars 1/1 and 1/1. Genetic data for YR002 were generated following Mirza et al. (2020) using primers 16Sar and 16Sbr (Palumbi et al. 1991) to amplify the 16s rRNA gene. We then compared the generated sequence (GenBank accession no. MW622088) to that of the type series of *T. salazar* and other members of the genus *Trimeresurus*, using Mega 7 to align sequences and to calculate p-distance (Kumar et al. 2016). We reconstructed phylogenetic relationships Maximum Likelihood (ML) in IQ TREE

(Nguyen et al. 2015) with 10,000 ultrafast bootstraps (Hoang et al. 2018) using TIM2+F+I+G4 (Kalyanamoorthy et al. 2017) using *Protobothrops elegans* as the outgroup. The maximum length of the sequences used was 489 base pairs.

The specimens from Meghalaya genetically and morphologically matched the original description of *T. salazar* (Mirza et al. 2020). *Trimeresurus salazar* can be distinguished from all other species of *Trimeresurus* occurring in northeastern India based on the body coloration and the presence of a postocular stripe in males. This is the only species of *Trimeresurus* in northeastern India with yellowish-green body coloration (vs. deep green in other species) and to have an orange or reddish stripe running from behind the eyes to the nape in males (vs. stripeless, with white stripe, or with bicolored stripes [red and white] in other species) (Fig. 2). Genetically the specimen from Meghalaya differs from the type series of *T. salazar* by a uncorrected p-distance of only 0.002–0.004 (Fig. 3, Table 1).

We also recorded the species from new localities in Assam: Amchang Wildlife Sanctuary (26°09'47.17"N, 91°52'5.89"E); Khanapara area of Guwahati (26°07'21.99"N, 91°49'47.56"E); Demow in Sivsagar (27°07'50.42"N,



Fig. 2. Details of a Salazar's Pitviper (*Trimeresurus salazar*) (YR002) from the Umroi Military Station, Ri-Bhoi, Meghalaya, India. Photographs by Jayaditya Purkayastha.

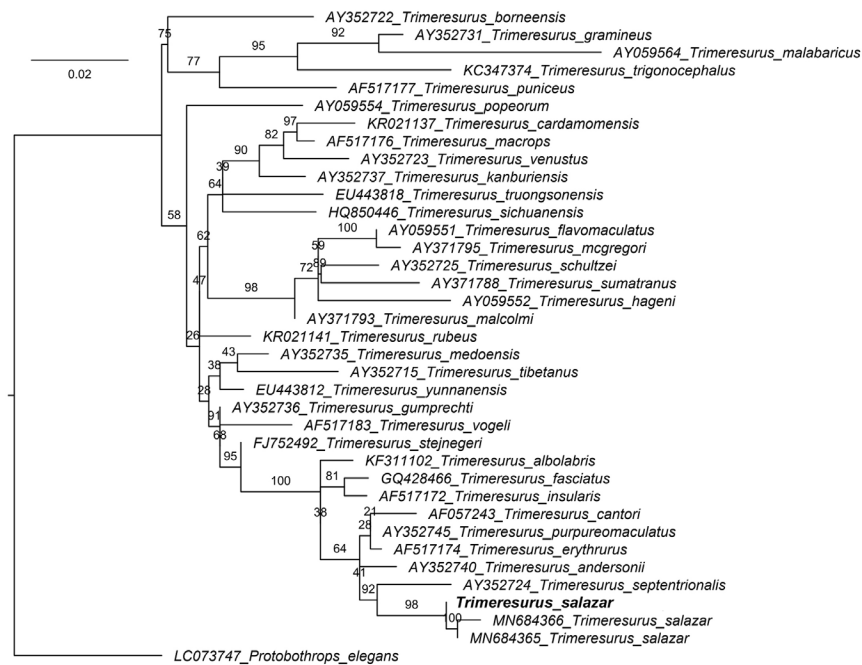


Fig. 3. Maximum-likelihood phylogram (16s rRNA) for species of *Trimeresurus*. The number at each node represents bootstrap support; the alphanumeric preceding each species name denotes the GenBank accession number. The Elegant Pitviper (*Protobothrops elegans*) was used as the outgroup (the bold name denotes the sample sequence in this study).



Fig. 4. Fully everted hemipenis of a Salazar's Pitviper (*Trimeresurus salazar*) (YR002) from the Umroi Military Station, Ri-Bhoi, Meghalaya, India. Photograph by Jayaditya Purkayastha.

94°45'16.41"E), and Naharkatia in Dibrugarh (27°22'41.01"N, 95°10'43.79"E) (Fig. 1).

Mirza et al. (2020) briefly described the hemipenes of *T. salazar* as short, bilobed, and not deeply forked. We, however, found the hemipenes to be deeply forked (Fig. 4) with small spines present from the base to around one-third of hemipenial length. In YR002, the hemipenes were 38 mm in length and 6.1 mm at their greatest width. From the base, the region of bifurcation of the hemipenes started at 8.9 mm.

In many of the faunal records of the region (e.g., Ahmed et al. 2009; Purkayastha 2013), the species referred to as *T. albolabris* is likely to be *T. salazar* and thus the range of the species is presumably larger than currently known. Current records confirm the presence of *T. salazar* in the three states of northeastern India (Fig. 2) and it is likely present in the adjacent states of West Bengal and Tripura in India and possibly in Bhutan and Bangladesh.

Acknowledgements

We thank the Meghalaya Forest Department and the Additional Principal Chief Conservator of Forests, Wildlife & Chief Wildlife Warden, Government of Meghalaya, for providing permission (FWC/G/173/Pt-V/2377-81) to conduct research. We also thank Daniel K. Johansson, Natural History Museum of Denmark, for information on the ZMUC specimens in the Zoological Museum in Copenhagen.

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