10.11609/jott.2026.18.3.28455-28606
www.threatenedtaxa.org

26 March 2026 (Online & Print)
18(3): 28455-28606
ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

Building evidence for conservation globally

Journal of Threatened Taxa

Open Access

40 Years zoo reach Zoo Outreach Organisation

ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher
Wildlife Information Liaison Development Society
www.wild.zooreach.org

Host
Zoo Outreach Organization
www.zooreach.org

Srivari Illam, No. 61, Karthik Nagar, 10th Street, Saravanampatti, Coimbatore, Tamil Nadu 641035, India
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Cover: Digital illustration of Smooth-coated Otter *Lutrogale perspicillata* by Dupati Poojitha. Reference from the picture taken by Rana & Sugandhi.

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 March 2026 | 18(3): 28479–28494
ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)
https://doi.org/10.11609/jott.10309.18.3.28479-28494
#10309 | Received 17 December 2025 | Final received 15 February 2026 | Finally accepted 04 March 2026
OPEN ACCESS
ARTICLE

New record of two natricine snakes, *Hebius gilhodesi* (Wall, 1925) and *Herpetoreas davidi* Nguyen et al., 2024 (Reptilia: Squamata: Colubridae), from India

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Abstract: Two natricine snakes, *Hebius gilhodesi* and *Herpetoreas davidi*, are reported for the first time from India based on mitochondrial DNA and morphological data. This study extends the northwestern-most distribution of *H. gilhodesi* by 107 km and *H. davidi* by 577 km, both of which were thus far known only from adjacent Myanmar. Additionally, a detailed description of the hemipenial morphology of *H. gilhodesi* is provided.

Keywords: Arunachal Pradesh, keelback, Mizoram, morphology, Myanmar, natural history, northeastern India, phylogeny, range extension.

Editor: S.R. Ganesh, Kalinga Foundation Agumbe, India. **Date of publication:** 26 March 2026 (online & print)

Citation: Dutta, S., B. Boruah & A. Das (2026). New record of two natricine snakes, *Hebius gilhodesi* (Wall, 1925) and *Herpetoreas davidi* Nguyen et al., 2024 (Reptilia: Squamata: Colubridae), from India. *Journal of Threatened Taxa* 18(3): 28479–28494. https://doi.org/10.11609/jott.10309.18.3.28479-28494

Funding: 1—National Geographic Society Explorer Grant (NGS-74044R-20); 2—SERB-DST (CRG/2018/000790).

Competing interests: The authors declare no competing interests.

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Author contributions: SD conducted field work, studied specimens and prepared the manuscript draft. BB conducted field work, did the phylogenetic analyses and reviewed the manuscript. AD conceptualized the work, conducted field work and reviewed the manuscript.

Acknowledgements: We thank the National Geographic Society for the Explorer Grant (NGS-74044R-20) and SERB-DST (CRG/2018/000790) for financial support. We are thankful to the forest department of Arunachal Pradesh, Meghalaya and Mizoram for providing research permission (CWL/GEN/355/2021/3178 dated 28 September 2021; WL/FG.31/Technical Committee/2019, dated 18 July, 2019; Memo No. FWC/Research/1061401-1409 dated 13 July 2022 and Memo No.B.19060/1/2020-CWLW/112 dated 2 February 2020). We thank Sh. Aduk Paron (former Field Director), Dr Tajum Yomcha (APDF), Sh. Mayur Variya (Biologist) and all the forest staff of Namdapha Tiger Reserve for their support. We thank Sh. Harshraj Wathore (DFO), Sh. Bunty Tao (Range Officer) and Sh. Aditya Das (Biologist), Kamlang Tiger Reserve for their help during field work. We are thankful to Dr G.S. Bhardwaj (Director), Dr Ruchi Badola (Dean), Wildlife Institute of India, Dehradun for constant support. Our thanks to Dr Samuel Lalronunga, Dr Santanu Dey, Sh. Malsawmdawngliana, Sh. Isaac Zosangliana, Sh. K. Lalhmangaiha, Sh. Naitik G. Patel, Sh. Vijayan Jithin, Sh. Jason D. Gerard, Sh. Vignesh, Sh. Aphu Yoha Yobin, Sh. Akhida and field assistants for field work.

INTRODUCTION

The natricine snake genus *Hebius* Thompson, 1913, currently represents over 50 species, widely distributed throughout eastern and southeastern Asia (Gao et al. 2024; Li et al. 2026; Uetz et al. 2026). In India, this genus is represented by seven species (Basfore et al. 2024; Uetz et al. 2026), namely: *H. clerki* (Wall, 1925); *H. khasiensis* (Boulenger, 1890); *H. lacrima* Purkayastha & David, 2019; *H. modestus* (Günther, 1875); *H. parallelus* (Boulenger, 1890); *H. taronensis* (Smith, 1940); and *H. venningi* (Wall, 1910). Recently, Bohra et al. (2025) resurrected *H. gilhodesi*, which was synonymised under *H. khasiensis* by Wall (1926). *Hebius gilhodesi* is currently known from the type locality, Hutung in Bhamo District and Alangdunhku in Putao District of Myanmar (Bohra et al. 2025).

Another natricine snake genus *Herpetoreas* Günther, 1860, is represented by nine species, distributed across the foothills of western and eastern Himalaya, including northeastern Pakistan, northern & northeastern India, Nepal, Bhutan, southwestern China, Bangladesh, and Myanmar (Ren et al. 2022). In India, five species of this genus have been reported (Basfore et al. 2024; Nguyen et al. 2024; Uetz et al. 2026), namely: *H. murlen* Lalremsanga, Bal, Vogel & Biakzula, 2022; *H. pealii* (Sclater, 1891); *H. platyceps* (Blyth, 1855); *H. sieboldii* Günther, 1860; and *H. xenura* (Wall, 1907). Among these five species, *H. murlen* and *H. pealii* are endemic to northeastern India. Recently, Nguyen et al. (2024) described *Herpetoreas davidi* from southwestern Myanmar, which is known only from the type locality Rakhine Yoma Elephant Sanctuary.

During the herpetological surveys in northeastern India, some unidentified populations of natricine snakes were encountered that did not fit the definitions of taxa known from India. Phylogenetic analyses and morphological data suggest two populations from Arunachal Pradesh are *H. gilhodesi* and one from Mizoram is *H. davidi* which are reported herein as the first record from India.

MATERIALS AND METHODS

Sample collection and fixation

Specimens of natricine snakes were hand-collected from Arunachal Pradesh, Meghalaya, and Mizoram in northeastern India during 2021 and 2023. Collected samples were euthanized using Tricaine Methanesulfonate (MS222) and fixed in 3% formalin. Prior to fixation, liver tissue was collected and stored in molecular-grade ethanol for DNA extraction. Collected specimens were registered and deposited at the Wildlife Institute of India, Dehradun.

DNA extraction and phylogenetic analyses

Genomic DNA was extracted from liver tissue samples stored in absolute ethanol at –20 °C, using the DNeasy (Qiagen) blood and tissue kit. Cytochrome b (Cyt-b) gene (~ 1100 base pairs) was amplified and sequenced using the primers L14910 (5'-GACCTGTGATMTGAAAACCAYCGTTGT-3') and H16064 (5'-CTTTGGTTTACAAGAACAATGCTTTA-3') (Burbrink et al. 2000). Polymerase chain reaction (PCR) condition followed was initial denaturation at 95 °C for 5 min, followed by 35 cycles of denaturation at 95 °C for 45 s, annealing at 54 °C for 45 s, and extension at 72 °C for 55 s. The final extension was at 72 °C for 10 min. Bidirectional sequences were manually checked using CHROMAS v.2.6.6 software (http://technelysium.com.au/wp/chromas) and aligned using ClustalW (Thompson et al. 1994) with default prior settings implemented in MEGA v.7 (Kumar et al. 2016). We checked for unexpected stop codons by translating the sequence to amino acids in MEGA v.7. The new sequences generated in this study were aligned with 49 sequences downloaded from GenBank (Benson et al. 2007), and *Amphiesma stolatum* was used as an outgroup (Appendix 1). Maximum likelihood (ML) analysis was performed using the GUI version of the IQ-TREE (Nguyen et al. 2015), implemented in PhyloSuite (Zhang et al. 2020). The dataset was partitioned by codon position. The ModelFinder (Kalyaanamoorthy et al. 2017) was used to find the best-fitting models. The best fit models suggested by ModelFinder were Partition 1: TN+F+I+G4, Partition 2: HKY+F+I, Partition 3: TIM+F+G4. We also performed a Bayesian inference (BI) analysis using the program MrBayes 3.2 (Ronquist et al. 2012) implemented in PhyloSuite (Zhang et al. 2020). We used PartitionFinder v1.1.1 (Lanfear et al. 2012) with default settings to find the best-fit model of sequence evolution for the same dataset used for ML analysis. The best fit models suggested by PartitionFinder were Partition 1: HKY+I+G, Partition 2: HKY+I, Partition 3: GTR+G. Four separate runs were set up, each with eight Markov chains, initiated from random trees and allowed to run for 10 million generations, sampling every 1,000 generations. Analyses were terminated when the standard deviation of the split frequencies was less than 0.001, the first 25% of trees were discarded as burn-in, and trees were constructed using a 50%

majority consensus rule. We obtained the ESS values using TRACER v1.6 (Rambaut et al. 2018) and confirmed greater than 200 for the priors. Support for the internal branches for the ML and BI was quantified using 10,000 pseudoreplicates (ultrafast bootstrap UFB) and posterior probability (PP), respectively. The resulting tree was edited in Figtree v.1.4.4 (Rambaut 2018). Uncorrected pairwise distances (p–distances) were calculated in MEGA v7.1 with pairwise deletion of missing data and gaps.

Morphological examination

Morphological measurements and terminologies followed Das et al. (2021) as mentioned in the following: snout-vent length (SVL); tail length (TL); head length (HL): distance between posterior edge of last supralabial and tip of the snout; head width (HW): at angle of jaws; head depth (HD): height at the occipital region; eye diameter (ED): horizontal diameter; eye to nostril distance (EN): anterior corner of eye to posterior edge of nostril; eye to snout distance (ES): anterior corner of eye to tip of snout; interorbital distance (IO): measured at the anterior corner of orbit. All linear measurements, except SVL and TL, were taken using Mitutoyo digital callipers (accuracy 0.01 mm). The SVL and TL were measured using a thread and metal scale. We also counted head and body scales as follows: SL: number of supralabials; IL: number of infralabials; SL-E: number of supralabials entering orbit; PreO: numbers of preocular; PostO: number of postocular; Tmp: number of temporals; PVS: number of preventrals; DSR: dorsal scales row at one head length behind neck, at midbody, and one head length before vent; VS: number of ventrals; AN: anal plate divided or entire; SC: number of subcaudals. Ventral scale counts and hemipenial descriptions followed Dowling (1951); Dowling & Savage (1960) respectively. Abbreviation used are WII-ADR: Wildlife Institute of India Abhijit Das Reptile collection.

RESULTS

Phylogenetic analyses

Both ML and BI analyses yielded nearly similar tree topologies (Figures 1 & 2). The newly collected materials (WII-ADR1792, WII-ADR1793, WII-ADR1800, WII-ADR3303, WII-ADR3320) from Namdapha Tiger Reserve, Gandhigram, and Kamlang Tiger Reserve in Arunachal Pradesh (Figure 3) clustered with the published sequences of *Hebius gilhodesi* from Myanmar. The genetic divergence of these newly collected samples from northeastern India and samples from Myanmar is 2.2–3.2 % in the Cyt-b gene. One specimen (WII-ADR1051) collected from Ngengpui Wildlife Sanctuary, Mizoram (Figure 3) nested with the published type sequences of *Herpetoreas davidi* from Myanmar (Figures 1 & 2). The genetic divergence between these two samples is 0.7% in the Cyt-b gene.

Morphology

The specimens from Arunachal Pradesh (WII-ADR1792, WII-ADR1793, WII-ADR1800, WII-ADR3303, WII-ADR3320) (Images 1 & 2) were referred to *Hebius gilhodesi* based on the following set of morphological characters: 1) dorsal scale rows 19: 19: 17; 2) scales are moderately keeled; 3) dorsal scale rows reduce from 19–17 between 91st–97th ventrals in males and between 84th–89th ventrals in females where the third and fourth dorsal scale rows fuse; 4) ventrals 142–148; 5) subcaudals 71–103; 6) nine supralabials, generally fourth to sixth supralabials enter the orbit; 7) dorsally dark brown, a very faint, rusty brown dorsolateral stripe from the neck to the tip of the tail, interrupted by buff spots.

The specimen (WII-ADR1051) (Image 3) from Mizoram was referred to *Herpetoreas davidi* based on the following set of characters: 1) small body size, 490 mm; 2) 19: 19: 17 dorsal scale rows, scales strongly keeled; 3) ventrals 153; 4) subcaudals undivided; 5) nine supralabials; 6) a white sagittal line just behind the parietal present; 7) head dorsally rusty brown; 8) dorsum light to dark brown with a dorsolateral series of white spots from nape to base of the tail; 9) ventral surface creamish or off white with dark spots along the lateral edge of each ventral and subcaudal scales.

Thus, this study reports two Myanmar natricine snakes *Hebius gilhodesi* and *Herpetoreas davidi* for the first time from India (Figure 3) based on phylogenetic and morphological data. Morphological descriptions of newly collected specimens of the two species from India are given below.

***Hebius gilhodesi* (Wall, 1925)**

(Table 1; Figure 1–3; Images 1, 2)

Materials examined (n = 5): adult male (WII-ADR1793), adult female (WII-ADR1792) and subadult female (WII-ADR1800) collected from Gandhigram (27.26514° N, 96.93704° E, elevation 1,115 m), Changlang District, Arunachal Pradesh, India on 17–19 September 2022 by Abhijit Das, Bitupan Boruah, Naitik G. Patel; adult male (WII-ADR3320) collected from Kamlang Tiger

Table 1. Morphometric and meristic data of newly collected *Hebius gilhodesi* and *Herpetoreas davidi* from India, with available data. Bilateral characters are given in right and left order separated by "/"; "n" denotes samples size, "-" indicates data not provided, and "*" measurement/ counts incomplete because of tail missing.

	Hebius gilhodesi							*Herpetoreas davidi*		
Voucher specimen	**WII-ADR1793**	**WII-ADR3320**	**WII-ADR1800**	**WII-ADR1792**	**WII-ADR3303**	**Bohra et al. 2025 (n = 15)**		**WII-ADR1051**	**Nguyen et al. 2024 (n = 2)**	
Sex	Male	Male	Female	Female	Female (juvenile)	Male	Female	Female	Male	Female
SVL	370	410	250	370	170	288–368	156–435	490	292–384	259–482
TL	145	210	105	190	80	152–181	68–183	140*	126–168	115–178
HL	14.80	14.50	11.30	15.80	8.90	13.4–16.4	13.1–17.9	21.15	-	-
HW	8.55	8.0	5.88	8	7.70	3.2–4.1	3.2–4.2	10	-	-
HD	8.60	6.10	4.68	5.85	3.50	-	-	7.46	-	-
ED	2.56	2.60	2.18	2.61	1.85	2.2–2.9	2.5–2.9	3.26	-	-
E-N	2.52	2.45	1.78	2.52	1.47	2.3–2.9	2.4–3.3	3.14	-	-
E-S	4.45	4.25	3.10	4.20	2.50	3.2-4.1	3.2–4.2	5.21	-	-
IN	2.85	2.90	2.10	2.75	1.79	-	-	3.35	-	-
IO	4.40	4.25	3.32	4.07	2.82	-	-	5	-	-
PVS	2	2	1	2	3	-	-	2	-	-
VS	145	148	146	142	147	144–153	143–151	153	154–156	151–155
SC	71, 72	99, 100	86, 87	93, 92	102, 103	99–111	87–98	59*	97–99	97–100
DSR	19: 19: 17	19: 19: 17	19: 19: 17	19: 19: 17	19: 19: 17	19:19:17	19:19:17	19: 19: 17	19: 19: 17	19: 19: 17
SL	10, 9	9, 9	8, 9	9, 9	9, 9	9, rarely 8	9	8, 8	9	9
SL-E	5, 6, 7/ 4, 5, 6	4, 5, 6/ 4, 5, 6	3, 4, 5/ 4, 5, 6	4, 5, 6/ 4, 5, 6	4, 5, 6/ 4, 5, 6	4-6, rarely 4, 5	4, 5, 6	4, 5/ 3, 4, 5	4–6	4–6
IL	10/10	10/10	9/ 10	10/ 10	10/ 10	10	10, rarely 11	10/ 10	9 or 10	9 or 10
Tmp	2+2/ 2+2	1+2/1+2	1+1 / 1+1	1+1/ 1+1	1+1/ 1+1	1+1, rarely 2+1	1+1, rarely 2+1	2+2/ 2+1	1+2 or 2+2	1+2 or 2+2
PreO	1/1	1/1	1/1	2/2	1/1	1, rarely 2	1, rarely 2	1/1	1	1
PostO	¾	3/3	3/3	3/3	3/3		3, rarely 2	3/2	3	3
AN	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Single	Single

reserve (27.69583° N, 96.44585° E, elevation 1,205 m), Lohit District, Arunachal Pradesh, India on 19 July 2023 by Abhijit Das, Jason D. Gerard and Rajiv N.V.; juvenile female (WII-ADR3303) collected from Kamala Valley (27.46127° N, 96.42569° E, elevation 645 m), Namdapha Tiger Reserve, Changlang District, Arunachal Pradesh, India on 2 June 2023 by Abhijit Das, Sourav Dutta, Jason D. Gerard and Rajiv N.V. (Figure 3).

Description of new Indian material (Image 1)

A moderate sized snake, SVL 370–410 mm in males and 250–370 mm in females. Body subcylindrical, widest at midbody, slightly tapering anteriorly and posteriorly; tail moderately long, TL/SVL= (0.39–0.51) in males and TL/SVL= (0.42–0.51) in females. Head moderately distinct from neck, longer than wide, HW/HL = (0.55–0.57) in males and HW/HL= (0.50–0.52) in females; snout nearly rounded, gradually sloping towards the tip; nostril visible from dorsal aspect; rostral almost hidden from dorsal aspect, only posterior border is slightly visible; internasal paired, as long as broad; prefrontal wider than long, laterally extended towards loreal; frontal posteriorly pointed, longer than broad, anteriorly wide, slightly longer than the supraocular; supraocular elongated, widest at posterior part; parietals long, anteriorly wide, posterior margin extends at the level of more than half of the last supralabial length. In lateral view tip of snout acute; rostral partially visible; nostril horizontally elliptical, laterally placed, closer to snout than to orbit; nasal divided by a vertical slit, posterior nasal larger than anterior one, in contact with first and second supralabials; loreal region slightly concave; loreal single, sub-rectangular, dorsally widely contacting with prefrontal, and below in contact with second and third supralabials; in WII-ADR1793, loreal in contact with third and fourth supralabials; generally a single preocular

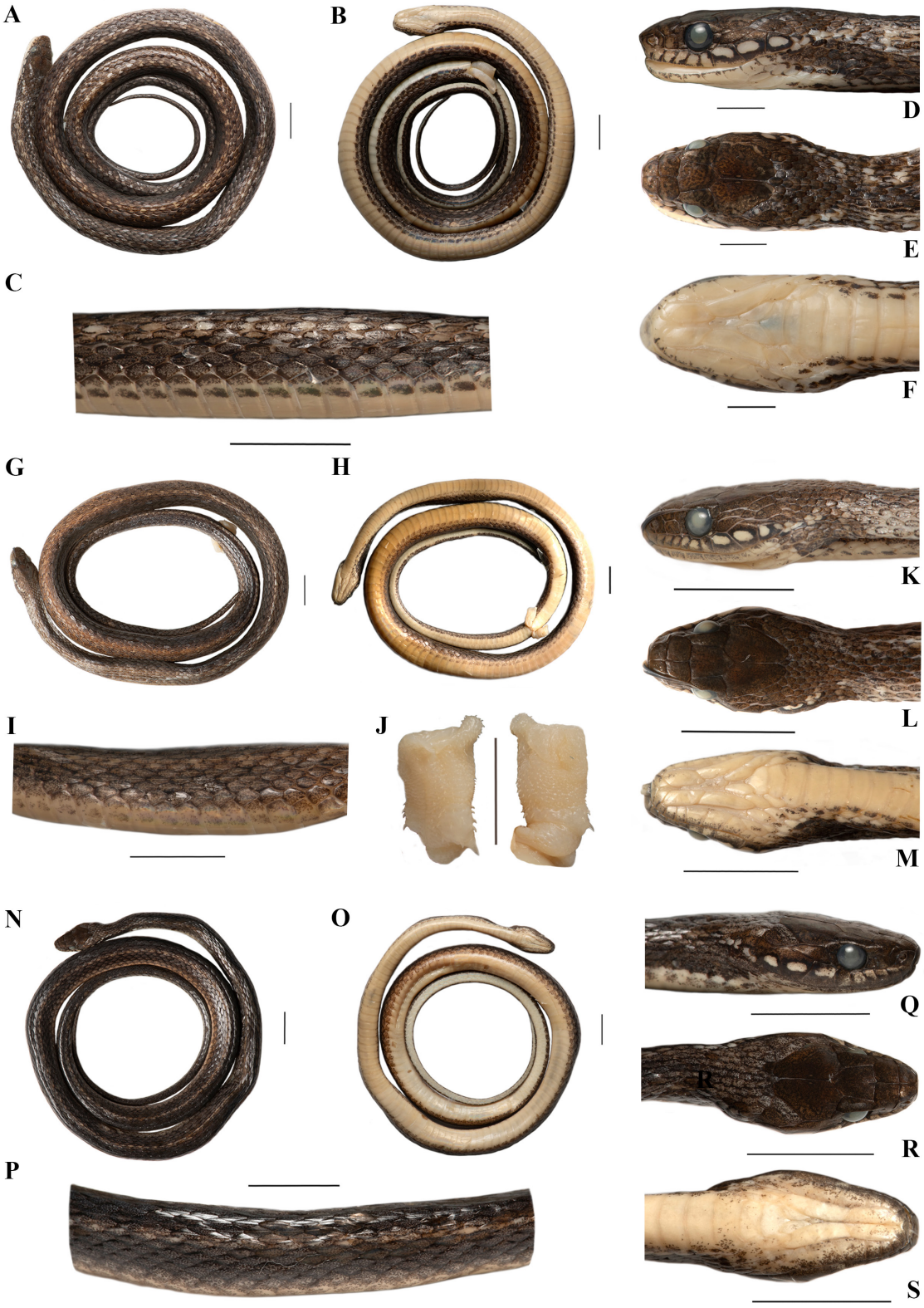

Image 1. Newly collected specimens of *Hebius gilhodesi* in preserved condition, from India. A–F—WII-ADR3320 | A—dorsal view of full body | B—ventral view of full body | C—closeup of dorsal scales of midbody | D—lateral side of head | E—dorsal side of head | F—ventral side of head | G–M—WII-ADR1793 | G—dorsal view of full body | H—ventral view of full body | I—closeup of midbody dorsal scales | J—sulcate and asulcate view of hemipenis | K—lateral side of head | L—dorsal side of head | M—ventral side of head | N–S—WII-ADR1792 | N—dorsal view of full body | O—dorsal view of full body | P—closeup of midbody dorsal scales | Q—lateral side of head | R—dorsal side of head | S—ventral side of head. Scale bar—10 mm. © A. Das, B. Boruah & S. Dutta.

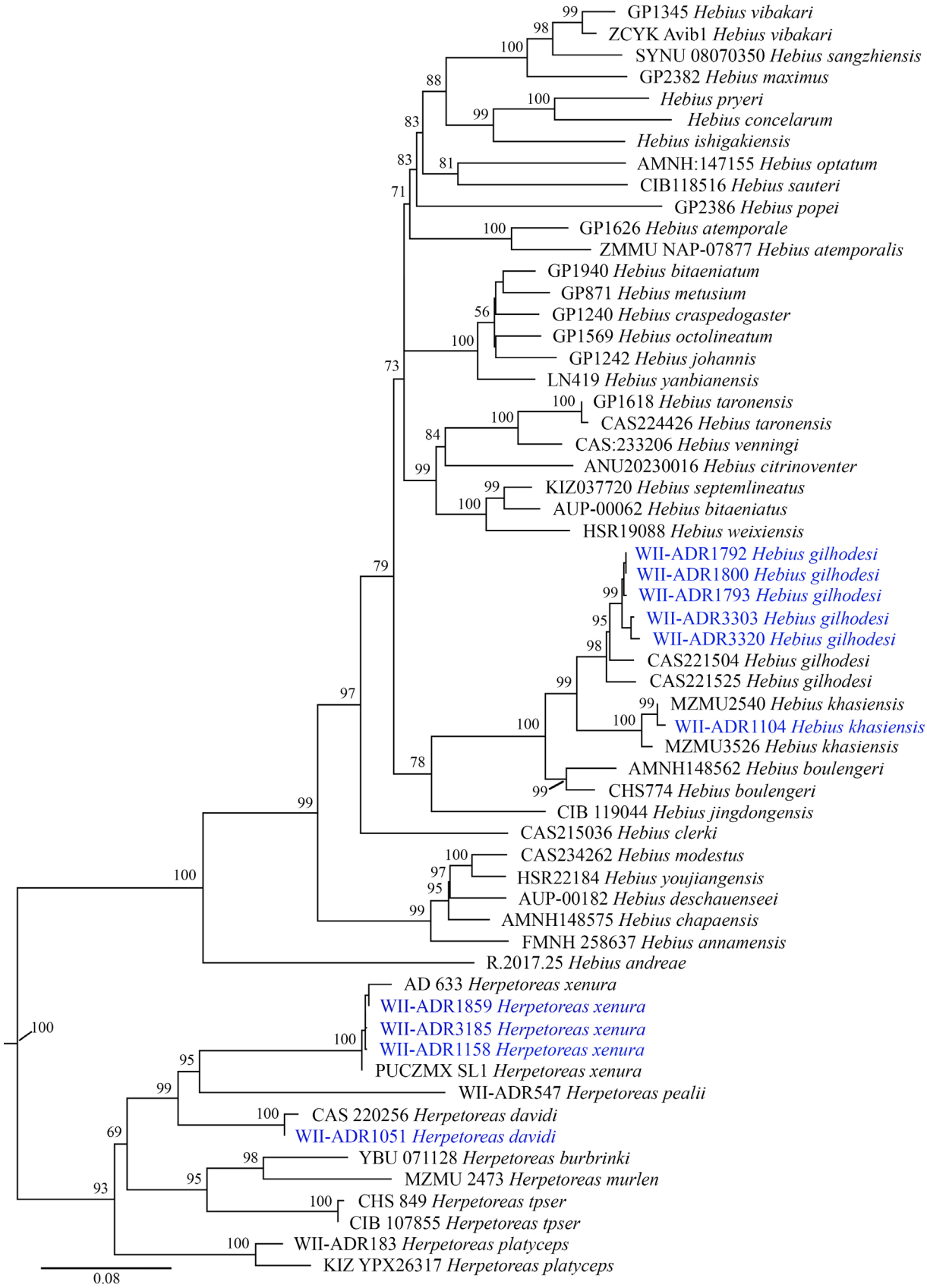

Figure 1. Maximum likelihood phylogeny of *Hebius* spp. and *Herpetoreas* spp. based on the Cyt-b gene, showing clustering of sequenced Indian specimens of *H. gilhodesi* and *H. davidi* reported here. DNA Sequences generated in this study are in blue colour.

present, but in WII-ADR1792 two preoculars present; preocular vertically elongated, dorsally wide, below in contact with fourth supralabial, in WII-ADR1793, preocular in contact with fifth supralabial; eye large with rounded pupil; orbit semi-circular, orbital diameter less than snout length; three postoculars, topmost postocular largest and widely connected to parietal, middle postocular connected to anterior temporal, and third postocular posteriorly connected to anterior temporal and below in contact with sixth and seventh supralabials, in WII-ADR1793, the bottom postocular in contact with seventh and eighth supralabials; anterior temporal single but two in WII-ADR1793; anterior temporal narrow and elongated; two posterior temporals on each side; 8–10 supralabials, first one smallest, wider than tall; second to fourth supralabials taller than wide, equal in size, and usually fourth to sixth supralabials connected to eye, but in WII-ADR1800 and WII-ADR1793 the third to fifth supralabials and fifth to seventh supralabials connected to eye on the left side respectively; seventh to ninth supralabials wider than tall, eighth supralabial largest among all; mental subtriangular, much wider than long; 10 infralabials on each side, nine on left side of WII-ADR1800, first to fifth infralabials in contact with first pair of genials, first pair in midline contact; second pair smallest, second to fourth infralabials taller than wide, fifth infralabial largest among all; anterior genials short and elongated; posterior genials long and posteriorly oblique, anteriorly separated from each other by two small scales and posteriorly separated by a pair of enlarged scales.

Dorsal scales narrow and posteriorly nearly pointed, arranged in 19: 19: 17 rows; dorsal scales moderately keeled, except those on first row, which are feebly keeled or nearly smooth on anterior body; apical pits absent; dorsal scales closer to the vent comparatively large; all dorsal scale rows on tail moderately keeled; 145–148 ventrals in males and 142–147 in females; 1–3 preventrals, anterior most preventral separated from posterior pair of genials by one pair of enlarged scales; subcaudals divided, 71–100 in males and 86–100 in females. Morphometric and meristic data of the newly collected specimens in this study are provided in Table 1.

Dorsal scales reduction varies among the four individuals as follows:

WII-ADR3320 (Male): $19\ \frac{3+4(95)}{-}\ 18\ \frac{-}{3+4(97)}\ 17$

WII-ADR1793 (Male): $19\ \frac{-}{3+4(91)}\ 18\ \frac{3+4(93)}{-}\ 17$

WII-ADR1792 (Female): $19\ \frac{-}{3+4(84)}\ 18\ \frac{3+4(86)}{-}\ 17$

WII-ADR1800 (Female): $19\ \frac{-}{3+4(87)}\ 18\ \frac{3+4(89)}{-}\ 17$

Hemipenis

Organ short, thin and unilobed; extended up to the level of fourth to fifth subcaudals. The organ with a slightly extended apical tip on left side of the organ; organ entirely covered with small spines from base to apical tip on both sulcate and asulcate side; sulcate side with few enlarged spines at mid-base, and a large basal hook present at proximal part of truncus; sulcus spermaticus single, shallow (deep in WII-ADR1793) and simply oblique, extending to inner side of right apical tip; sulcal lip almost indistinct; apical necked area smooth.

Colouration in preservative

Head on dorsal aspect light brown, pale rusty brown towards parietals, scattered with small dark spots throughout (Image 1); laterally cream coloured and posteriorly light brown; supralabials cream coloured up to sixth scale and bordered with dark brown on posterior and lower edge of each scale, rest are white on middle and surrounded by broad dark brown colour; enlarged white spots on supralabials continue to nape; in WII-ADR1792, these two stripes are disconnected; a short and narrow faint whitish stripe on posterior dorsal aspect of head. Dorsum on anterior one third dark greyish, vertebral scales dark greyish, scales towards lateral side pale reddish-brown with greyish tinge; each dorsal scale scattered with tiny cream-coloured speckles; a faint dorsolateral stripe along the body, interrupted by buff spots; tail dorsally dark greyish-brown. Ventral aspect of head pale cream-coloured, infralabials mottled with dark brown on outer edge; on ventral side, anterior part of body pale cream-coloured and posteriorly whitish; tail ventrally whitish; each ventral and subcaudal scales has distinct or indistinct dark brown spots along the lateral side.

Colouration in life (Image 2)

Nearly the same as in preserved condition. Head dorsally and laterally light or dark brown, mottled with dark brown and black throughout; supralabials cream coloured or whitish with dark edge; on each side, white

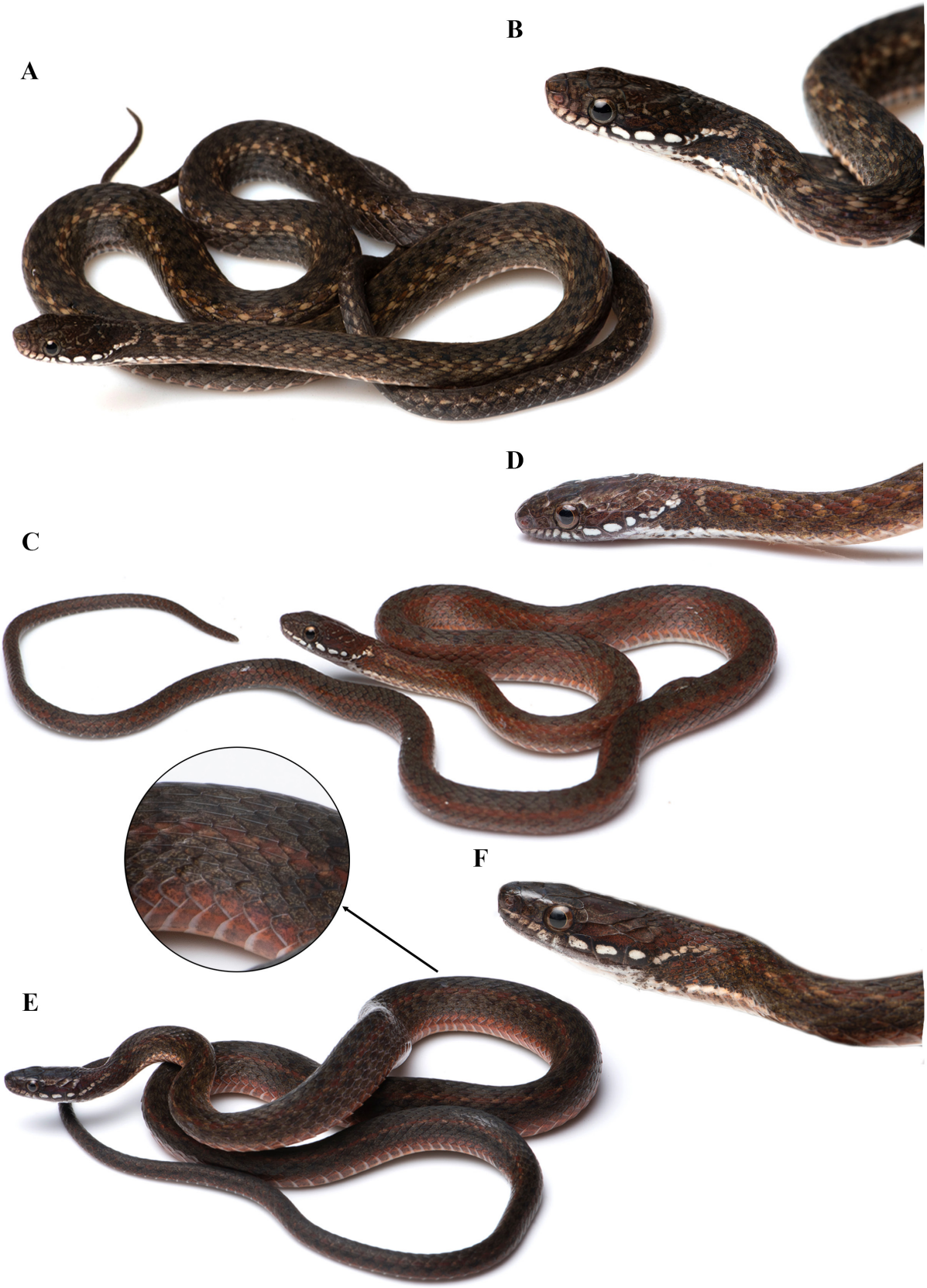

Image 2. *Hebius gilhodesi* in life from India: A–B—WII-ADR3320 | A—full body in dorsolateral view | B—closeup of head | C–D—WII-ADR1793 | C—full body in dorsolateral view | D—closeup of head | E–F—WII-ADR1792 | E—full body in dorso-lateral view | F—closeup of head. © A. Das; edited by S. Dutta.

spots on the supralabials continue to the nape; pupil entirely dark with light outer margin; iris light golden brown. Dorsum reddish or dark brown, mottled with dark spots throughout; a very faint, rusty brown dorsolateral stripe from the neck to the tip of the tail, interrupted by prominent or obscure buff spots. Each ventral and subcaudal scale has dark spots along the lateral edge.

Natural history and distribution

We recorded *H. gilhodesi* along the edge of small streams with shallow water in Gandhigram and at Kamala Valley in Namdapha Tiger Reserve, and in Kamlang Tiger Reserve, Arunachal Pradesh, India between 1900–2200 h. The forest type at the locality was tropical evergreen and semievergreen. The forest floor was covered with ferns and shrubs. Other reptile species such as *Pseudoxenodon macrops*, *Ptyctolaemus namdaphaensis,* and *Sphenomorphus* sp. were recorded at that location. We also observed anurans such as *Nasutixalus jerdonii*, *Raorchestes orientalis*, *Gracixalus patkaiensis, Xenophrys* sp., and *Kurixalus naso* in this locality.

***Hepetoreas davidi* Nguyen, Lalremsanga, Biakzuala & Vogel, 2024**

(Table 1; Figure 1–3; Image 3)

Material examined (n = 1): adult female (WII-ADR1051) collected from Ngengpui Wildlife Sanctuary (22.48498° N, 92.75653° E, elevation 215 m), Lawngtlai District, Mizoram, India on 7 September 2021 by Abhijit Das, Bitupan Boruah, Naitik G. Patel, and Samuel Lalronunga.

Description of new Indian material (Image 3)

Body and tail subcylindrical, widest at mid body, substantially narrower towards neck, and slightly tapering towards vent; tail moderately long (incomplete) (TL/SVL = 0.2*). Head moderately distinct from neck and longer than broad (HW/HL = 0.4); head widest at posterior axis of jaw, slightly tapering before mandibular joint; rostral nearly hidden as seen from above, only posterior border slightly visible; internasal paired, slightly wider than its height; two prefrontals, laterally extended towards loreal; frontal much longer than its width, slightly longer than supraocular, anteriorly broad; parietals elongated, widest at anterior part; in lateral view, parietal region anteriorly flattened, from frontal to internasal slightly elevated; tip of snout acute in lateral view; rostral partially visible in lateral aspect; nostril small and vertically elliptical, laterally oriented, closer to snout tip than to eye; nasal divided by a vertical slit; loreal region narrowly concave; a single loreal on each side, sub-rectangular in shape, widely contact to prefrontal above, and below to second supralabial; single preocular, vertically elongated, dorsally wide; eye large, with rounded pupil, orbit horizontally elliptical, eye diameter less than snout length (ED/SL= 0.5); three postocular on right and two on left, topmost one largest; two anterior temporal, narrow and elongated, two posterior temporal on right and single on left; eight supralabials on each side, first six supralabials taller than wide, seventh and eighth wider than tall, first supralabial smallest and in contact with nasal, second supralabial connected to post nasal and loreal, third supralabial connected to preocular and slightly entering to orbit; fourth and fifth below eye, widely entering to orbit, fifth supralabial posteriorly in contact with lower postocular; and sixth in contact with second and third postocular and lower anterior temporal; seventh supralabial largest and widely connected to lower anterior and posterior temporals; eighth supralabial posteriorly narrow; mental much wider than long; 10 infralabials on each side, first to fifth in contact with first pair of genials; first infralabials in mid line contact; second infralabial smallest; second to fourth taller than the wide; fifth infralabial largest; anterior genials shorter than posterior paired; posterior genials elongated and posteriorly oblique.

Dorsal scales strongly keeled, except the first row, keels are posteriorly serrated, arranged in 19: 19: 17 rows; first dorsal row large and feebly keeled on anterior body, posteriorly moderately keeled; topmost third and fourth rows on dorsum slightly narrow and pointed than those on bellow; tail scales strongly keeled; 153 ventral and two preventrals; anterior most preventral separated from posterior pair of genials by a pair of small scales; subcaudal scales single, 59 in number (incomplete).

Dorsal scale reduction: $19 \frac{4+5(96)}{-} 18 \frac{-}{3+4(98)} 17$

Colouration in preservative

Head dorsally rusty brown, mottled with tiny dark spots, posteriorly darker; supralabials cream-coloured with irregular dark brown patches; a whitish stripe running behind eye to above nape on each side and medially connected on nape; an indistinct, narrow, white streak on posterior part of head; dorsum dark brown; first dorsal scale row predominantly cream coloured; each dorsal scales marked with tiny cream coloured spackles; a series of white spots from nape to base of the tail dorsolaterally present. Ventral surface of head and body cream-coloured; anterior infralabials with dark brown spots; tail ventrally whitish; ventral and

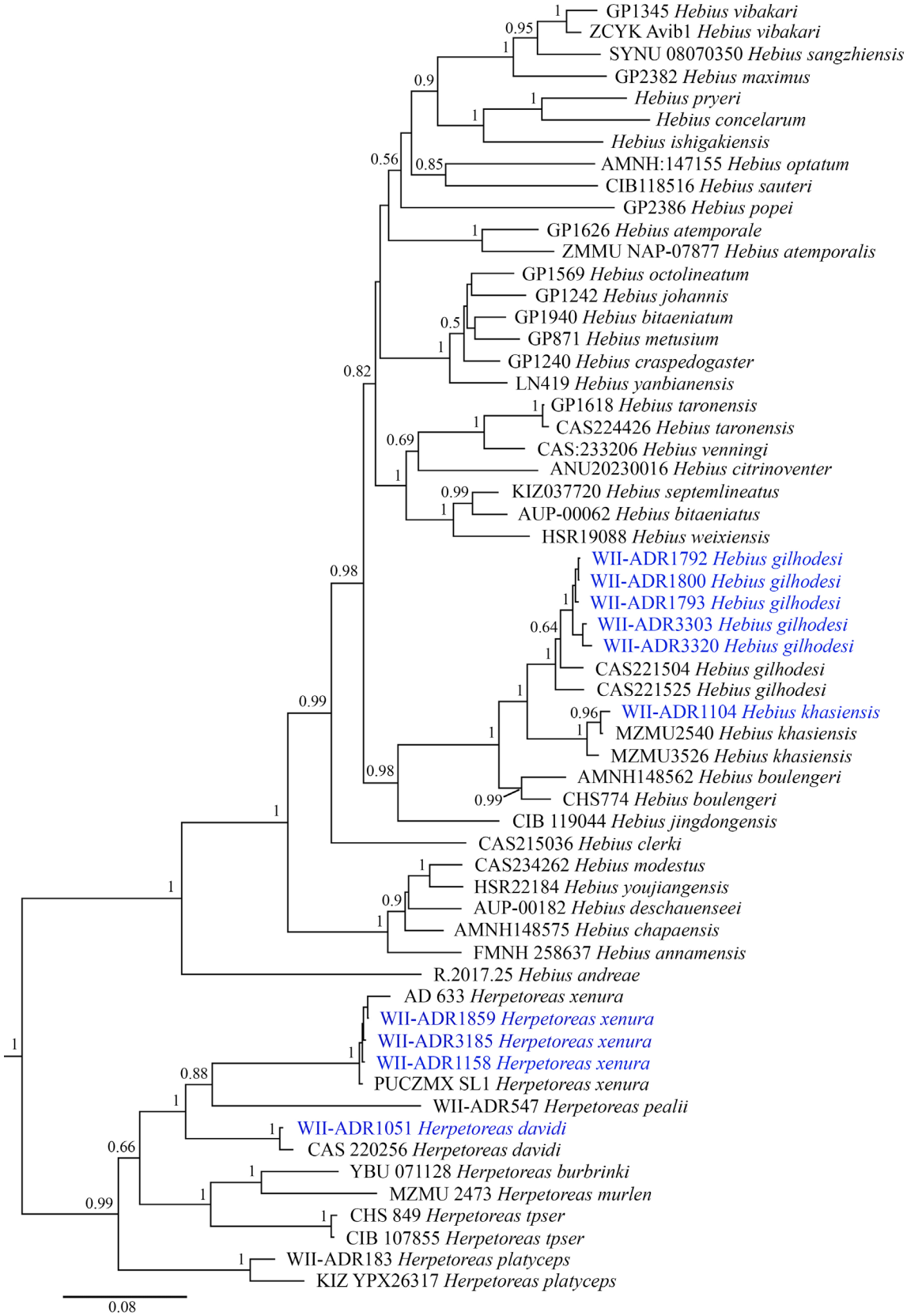

Figure 2. Bayesian phylogeny of *Hebius* spp. and *Herpetoreas* spp. based on the Cyt-b gene, showing clustering of sequenced Indian specimens of *H. gilhodesi* and *H. davidi* reported here. Posterior probability values <0.5 are not shown in the figure. DNA sequences generated in this study are in blue colour.

Image 3. Newly collected *Herpetoreas davidi* specimen (WII-ADR1051) from India: A—dorsal view of full body | B—full body ventral view | C—lateral view of head | D—dorsal view of head | E—ventral view of head | F—keeled scales at mid body. Scale bar—10 mm. © A. Das; edited by S. Dutta.

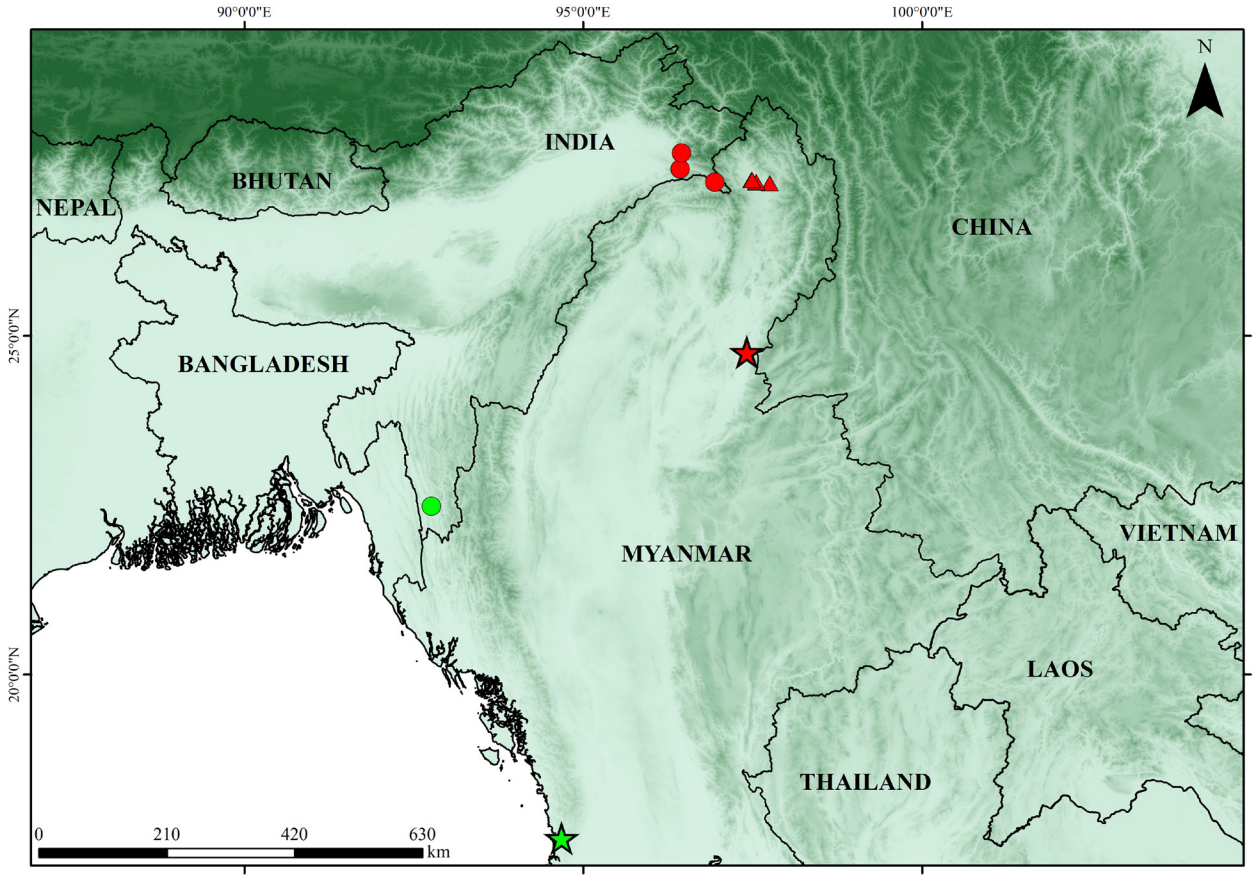

Figure 3. Map showing distribution of *Hebius gilhodesi* (in red) and *Herpetoreas davidi* (in green). Type localities are shown with star, previous records with triangle (*H. gilhodesi*) and new records from India with circle.

subcaudals scales with obscure dark spots along lateral aspect.

Natural history and distribution

We recorded the species among the leaf litter at the edge of a small stream in Ngengpui Wildlife Sanctuary, Mizoram, India at around 09.30 h. Forest type at the locality was lowland evergreen forest. We observed *Tropidophorus assamensis*, *Sphenomorphus* sp., *Dendrelaphis* sp. at the same locality. Anurans such as *Limnonectes khasianus*, *Ingerana borealis* were observed along the stream where the individual of *Hepetoreas davidi* was recorded.

DISCUSSION

Northeast India falls under Tibeto-Yunanese / Indo-Chinese biogeographic zones and is known to have a rich and unique snake diversity (Das 1996; Das et al. 2009; Malsawmdawngliana et al. 2022; Basfore et al. 2024). In the past as well as in more recent years, several new records of snakes have been reported in India from the northeastern region (Captain & Patel 1998; David et al. 2001; Mohapatra et al. 2010; Biakzuala et al. 2024; Gerard et al. 2024; Ray et al. 2025).

Hebius gilhodesi recently revalidated by Bohra et al. (2025), and was previously known only from a few localities in northernmost Myanmar. The present study reported this species from Namdapha Tiger Reserve and Kamlang Tiger Reserve of Arunachal Pradesh, India. This record extends the western and northwestern distribution limit of the species by 103 km and 107 km (areal distance) respectively from the closest locality of the species in Kachin state, Myanmar. The new locality records of this species are 280–339 km northwest of the type locality, Huton, Bhamo District, Myanmar. With this new record, the number of species of the genus *Hebius* in India now gets raised to eight.

It is observed that the following morphological characters in the newly collected specimens of *H. gilhodesi* which are incongruent with that of previous

literature. According to Wall (1925), the dorsolateral stripe of *H. gilhodesi* starts from neck and extends up to vent, in all the examined specimens this stripe extended to the tip of the tail. Bohra et al. (2025) mentioned that *H. gilhodesi* lacks dorsolateral stripes but has a series of spots whereas in all the examined specimens of *H. gilhodesi,* including the subadult, it was observed that light reddish or rusty brown dorsolateral stripes on which the buff-coloured spots are arranged. This stripe remains visible even in preserved condition. Notably, Wall (1925) also stated a reddish dorsolateral stripe is present in all examined specimens. Furthermore, the holotype of *H. gilhodesi* depicted in Bohra et al. (2025) (Figure 11A, page 487) clearly shows the presence of dorsolateral stripe. Bohra et al. (2025) reported scale reduction involving the fourth and fifth row which does not correspond to the original description by Wall (1925). This data of both adult male and female specimens (n = 4) are consistent with Wall (1925) where the third and fourth rows are involved in the reduction. In addition to this, the dorsal scale row reduction is observed among our newly collected materials. The first reduction of dorsal scale rows (19–18) in males was found at 91st–95th ventral and in females at 84th–87th ventral. The second reduction (18–17) was found at 93rd–97th ventral in males and at 86th to 89th ventral in females. Thus, the reduction in females is more anterior in trunk position compared to males. However, this reduction is due the merging of third and fourth dorsal scale rows, which is consistent in all the specimens. This intraspecific variation of dorsal scale reduction has also been previously recorded in the species belonging to other Indian colubrid genera such as *Ahaetulla* and *Oligodon* (Deepak et al. 2019; Mirza et al. 2021).

Herpetoreas davidi was originally described from the Rakhine Yoma Elephant Sanctuary, in Myanmar. In the present study, it is reported that this species from the southern part of Mizoram, which represents a range extension of 577 km (areal distance) northwestern from the type locality. This disjunct distribution could be a result of sampling gap. Further sampling along Indo-Myanmar border may reveal unknown localities of this species. With this new record, the number of species of the genus *Herpetoreas* increased to six in India. Previously, Nguyen et al. (2025) reported this species at an elevation range 120–175 m. The present study recorded this species from Ngengpui Wildlife Sanctuary at an elevation of 215 m, representing the highest elevation known for the species to date.

The minor morphological variations mirror the mild genetic divergences noted in Indian vs. Myanmar specimens of *H. gilhodesi*. The Indian specimen of *H. davidi* was much more congruent with the type series in morphology and genetics. Ironically, the geographic distances between the known Myanmar distributions and the new Indian records were lesser for the more divergent *H. gilodesi* than *H. davidi*. It remains to be tested if the sample size being larger for the Indian material of *H. gilodesi* than *for H. davidi,* may be a reason for this discordance in intra-specific variation patterns. The new distribution records in recent years from northeastern India, including these two new records of natricine snakes highlights the urgent need of extensive faunal surveys in this region.

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Appendix 1. Details of the DNA sequences (Cyt-*b*) used in this study.

Species	Locality	Voucher no.	Accession number	Reference
Hebius vibakari	Liaoning, China	GP1345	KJ685676	Bohra et al. 2025
Hebius vibakari	Eastern Asia	ZCYK Avib1	LC640368	Bohra et al. 2025
Hebius sangzhiensis	Hunan, China	SYNU 08070350	MK340763	Bohra et al. 2025
Hebius maximus	Sichuan, China	GP2382	KJ685696	Bohra et al. 2025
Hebius pryeri	Kagoshima, Japan	NA	AB989126	Bohra et al. 2025
Hebius concelarus	Okinawa, Japan	NA	AB989268	Bohra et al. 2025
Hebius ishigakiensis	Okinawa, Japan	NA	AB989292	Bohra et al. 2025
Hebius optatum	Vinh Phuc, Vietnam	AMNH147155	KJ685662	Bohra et al. 2025
Hebius sauteri	Guangdong, China	CIB118516	OP937178	Bohra et al. 2025
Hebius popei	Guizhou, China	GP2386	KJ685697	Bohra et al. 2025
Hebius atemporalis	Guangdong, China	GP1626	KJ685680	Bohra et al. 2025
Hebius atemporalis	Vietnam	ZMMU NAP-07877	OK315813	Bohra et al. 2025
Hebius bitaeniatus	Guangxi, China	GP1940	KJ685688	Bohra et al. 2025
Hebius metusia	Sichuan, China	GP871	KJ685707	Bohra et al. 2025
Hebius craspedogaster	Guizhou, China	GP1240	KJ685672	Bohra et al. 2025
Hebius johannis	Guizhou, China	GP1242	KJ685673	Nguyen et al. 2024
Hebius octolineatus	Yunnan, China	GP1569	KJ685678	Nguyen et al. 2024
Hebius yanbianensis	China	LN419	OR215499	Bohra et al. 2025
Hebius taronensis	Myanmar	GP1618	KJ685679	Nguyen et al. 2024
Hebius taronensis	Myanmar	CAS224426	OK315828	Bohra et al. 2025
Hebius venningi	Kachin, Myanmar	CAS233206	KJ685670	Bohra et al. 2025
Hebius citrinoventer	Yingjiang, China	ANU20230016	PP472750	Bohra et al. 2025
Hebius septemlineatus	China	KIZ037720	MZ570486	Bohra et al. 2025
Hebius bitaeniatus	Thailand	AUP-00062	OK315816	Bohra et al. 2025
Hebius weixiensis	Lijiang, Yunnan, China	HSR19088	OQ085074	Bohra et al. 2025
Hebius gilhodesi	Gandhigram, Changlang, Arunachal Pradesh, India	WII-ADR1792	PZ160968	This Study
Hebius gilhodesi	Gandhigram, Changlang, Arunachal Pradesh, India	WII-ADR1800	PZ160970	This Study
Hebius gilhodesi	Gandhigram, Changlang, Arunachal Pradesh, India	WII-ADR1793	PZ160969	This Study
Hebius gilhodesi	Kamala Valley, Namdapha Tiger Reserve, Arunachal Pradesh, India	WII-ADR3303	PZ160971	This Study
Hebius gilhodesi	Glaw lake, Kamlang Tiger Reserve, Arunachal Pradesh, India	WII-ADR3320	PZ160972	This Study
Hebius gilhodesi	Kachin state, Myanmar	CAS221504	KJ685668	Bohra et al. 2025
Hebius gilhodesi	Kachin state, Myanmar	CAS221525	KJ685669	Bohra et al. 2025
Hebius khasiensis	Sailam, Aizawl, Mizoram, India	MZMU2540	PQ288048	Bohra et al. 2025
Hebius khasiensis	Phuldungsei, Dampa Tiger Reserve, Mizoram, India	WII-ADR1104	PZ160963	This Study
Hebius khasiensis	Mairang, Eastern West Khasi hills, Meghalaya, India	MZMU3526	PQ288047	Bohra et al. 2025
Hebius boulengeri	Ha Giang, Vietnam	AMNH148562	KJ685664	Bohra et al. 2025
Hebius boulengeri	China	CHS774	MK201520	Bohra et al. 2025
Hebius jingdongensis	Jingdong, China	CIB 119044	OR285310	Bohra et al. 2025
Hebius clerki	Nujiang, Yunnan, China	CAS215036	KJ685666	Bohra et al. 2025
Hebius modestus	Yunnan, China	CAS234262	KJ685671	Bohra et al. 2025
Hebius youjiangensis	Guanxi, China	HSR22184	OQ085073	Bohra et al. 2025
Hebius deschauenseei	Thailand	AUP-00182	OK315827	Bohra et al. 2025
Hebius chapaensis	Ha Giang, Vietnam	AMNH148575	KJ685665	Bohra et al. 2025

Species	Locality	Voucher no.	Accession number	Reference
Hebius annamensis	Laos	FMNH 258637	OK315812	Bohra et al. 2025
Hebius andreae	Laos	R.2017.25	MK253674	Bohra et al. 2025
Herpetoreas xenura	Narpuh Wildlife Sanctuary, Meghalaya, India	WII-ADR3185	PZ160965	This Study
Herpetoreas xenura	Teirei, Dampa Tiger Reserve, Mizoram, India	WII-ADR1158	PZ160966	This Study
Herpetoreas xenura	Mizoram, India	PUCZMX SL1	MN993850	Nguyen et al. 2024
Hepetoreas pealli	Poba Reserve Forest, Arunachal Pradesh, India	WII-ADR547	MT571586	Das et al. 2020
Hepetoreas davidi	Gawa, Rakhine, Myanmar	CAS 220256	OK315830	Nguyen et al. 2024
Hepetoreas davidi	Ngengpui Wildlife Sanctuary, Mizoram, India	WII-ADR1051	PZ160967	This Study
Hepetoreas burbrinki	Tibet, China	YBU 071128	GQ281781	Nguyen et al. 2024
Hepetoreas murlen	Mizoram, India	MZMU2473	ON204025	Nguyen et al. 2024
Hepetoreas tpser	Tibet, China	CHS849	MK201567	Nguyen et al. 2024
Hepetoreas tpser	Medog, Tibet, China	CIB107855	OM313292	Nguyen et al. 2024
Hepetoreas platyceps	Uttarakhand	WII-ADR183	MT571587	Das et al. 2020
Hepetoreas platyceps	Gyirong, Tibet, China	KIZ YPX26317	MW111464	Nguyen et al. 2024
Amphiesma stolatum	Ha Giang, Vietnam	CAS215037	KJ685667	Guo et al. 2014

Journal of Threatened Taxa is indexed/abstracted in Bibliography of Systematic Mycology, Biological Abstracts, BIOSIS Previews, CAB Abstracts, EBSCO, Google Scholar, Index Copernicus, Index Fungorum, JournalSeek, National Academy of Agricultural Sciences, NewJour, OCLC WorldCat, SCOPUS, Stanford University Libraries, Virtual Library of Biology, Zoological Records.

NAAS rating (India) 5.64

Print copies of the Journal are available at cost. Write to:
The Managing Editor, JoTT,
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3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore,
Tamil Nadu 641006, India
ravi@threatenedtaxa.org & ravi@zooreach.org

Journal of Threatened Taxa

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

March 2026 | Vol. 18 | No. 3 | Pages: 28455–28606
Date of Publication: 26 March 2026 (Online & Print)
DOI: 10.11609/jott.2026.18.3.28455-28606

Publisher & Host

WILD zoOreach
Zoo Outreach Organisation

Threatened Taxa