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First description of the female of *Achalinus vanhoensis* Ha et al., 2022 (Squamata, Xenodermidae), with a new distribution record from northern Vietnam

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https://zoobank.org/67DC59C3-834E-46CE-9A7E-DCEFAE84D189

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Abstract

Achalinus vanhoensis Ha et al., 2022 was previously known only from the adult male holotype collected in Van Ho, Son La Province, northwestern Vietnam. The second known specimen and first known female of the species are reported from Cuc Phuong National Park, Ninh Binh Province, northern Vietnam. Morphologically, the female differs from the male holotype mainly in having a proportionally shorter tail (tail length/total length ratio 0.192 vs. 0.264), more ventrals (202 vs. 176), and fewer subcaudals (74 vs. 84). These differences may reflect sexual dimorphism in *A. vanhoensis*. However, as the species is currently known from only one specimen of each sex, additional specimens are required to determine whether these differences represent consistent sex-related variation or individual variation. Molecular phylogenetic analyses showed that the newly collected specimen clustered with the holotype with moderate support and exhibited an uncorrected COI *p*-distance from it of 3.8%, supporting its identification as *A. vanhoensis*. The new record extends the known range of the species approximately 112 km southeastward and lowers its documented elevational limit from 1,121 to 440 m a.s.l. An updated identification key to the nine species of *Achalinus* recorded from Vietnam is also provided, and it is provisionally recommended that *A. vanhoensis* be assessed as Data Deficient (DD) under the IUCN Red List Categories and Criteria (IUCN Standards and Petitions Committee 2024).

Key Words

COI, Cuc Phuong National Park, Data Deficient, first female, morphological variation, range extension, road mortality

Introduction

The odd-scaled snake genus *Achalinus* Peters, 1869 comprises small, secretive, semifossorial snakes distributed across East and Southeast Asia (Poyarkov et al. 2023; Nguyen and David 2024; Xu et al. 2024a, 2024b, 2026a; Uetz et al. 2026). Members of the genus are infrequently encountered, and several species remain known from only one or a few specimens. Consequently, information on intraspecific morphological variation, sexual differences,

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ecology, and geographic distribution remains limited for many species (Ziegler et al. 2019; Luu et al. 2020; Miller et al. 2020; Ha et al. 2022).

Vietnam currently harbors nine recognized species of *Achalinus*, four of which are endemic to the country: *A. quangi* Pham, Pham, Le, Ngo, Ong, Ziegler & Nguyen, 2023, *A. timi* Ziegler, Nguyen, Pham, Nguyen, Pham, van Schingen, Nguyen & Le, 2019, *A. tranganensis* Luu, Ziegler, Ha, Lo, Hoang, Ngo, Le, Tran & Nguyen, 2020, and *A. vanhoensis* Ha, Ziegler, Dinh, Le, Nguyen & Luu, 2022 (Nguyen and David 2024; Uetz et al. 2026). The recent descriptions of these species indicate that the diversity and distribution of *Achalinus* in Vietnam remain incompletely documented (Ziegler et al. 2019; Luu et al. 2020; Ha et al. 2022; Pham et al. 2023).

Achalinus vanhoensis was described by Ha et al. (2022) based on a single adult male collected in a limestone forest at Hua Tat Village, Van Ho District (now Van Ho Commune), Son La Province, northwestern Vietnam. The species was distinguished from its congeners by a combination of 32 maxillary teeth; an internasal suture distinctly longer than the prefrontal suture; the loreal fused with the prefrontal; prefrontals extending toward the supralabials; dorsal scales keeled and arranged in 25–23–23 rows; six or seven supralabials; six infralabials; two pairs of chin shields; temporals 2+2; 176 ventrals; 84 entire subcaudals; and an entire cloacal plate (Ha et al. 2022). No additional specimen or locality has subsequently been documented.

During a herpetological survey in Cuc Phuong National Park, northern Vietnam, an adult female *Achalinus* was collected. Its external morphology and mitochondrial cytochrome *c* oxidase subunit I (COI) sequence support its assignment to *A. vanhoensis*. The first known female is described, compared with the male holotype, and morphological variation within the species is documented. New information on its distribution and natural history, a preliminary conservation assessment, and an updated identification key to the nine species of *Achalinus* recorded from Vietnam are also provided.

Materials and methods

Sampling and morphological examination

The specimen was found in Cuc Phuong National Park, Ninh Binh Province, northern Vietnam, in June 2019 by T.V. Nguyen and D.T. Le. It was encountered at approximately 19:00 h following light rain, shortly after being struck by a vehicle while attempting to cross a concrete road. The specimen was still alive but moribund when found and died approximately 10 min later. Geographic coordinates and elevation were recorded using a Garmin GPSMAP 64s handheld receiver under the WGS 84 datum. After its death, a muscle tissue sample was taken and preserved in 96% ethanol. The specimen was opportunistically recovered as a road-killed individual and subsequently deposited in the zoological collection of Duy Tan University (DTU), Da Nang, Vietnam.

Morphological terminology and examination methods followed Ha et al. (2022) and Xu et al. (2026b). Snout–vent length (SVL) and tail length (TAL) were measured to the nearest 1 mm by gently straightening the specimen along a flexible ruler; total length (TL) was calculated as SVL + TAL. Dorsal scale rows (DSR) were counted at one head length posterior to the head, at midbody, and at one head length anterior to the cloaca. Ventrals (VEN) were counted following Dowling (1951), excluding preventrals. Subcaudals (SC) were counted from the first scale posterior to the cloacal plate to, but excluding, the terminal tail tip. Bilateral characters are reported as left/right when they differ. Sex was determined by examination of the gonads.

Molecular identification

Genomic DNA was extracted from ethanol-preserved muscle tissue using a standard phenol–chloroform–proteinase K protocol, with a final proteinase K concentration of 1 mg mL^{-1}, followed by isopropanol precipitation (Hillis et al. 1996). DNA quality was assessed by agarose gel electrophoresis with ethidium bromide staining, and DNA concentration was measured using a NanoDrop 2000 spectrophotometer (Thermo Scientific). A fragment of the mitochondrial cytochrome *c* oxidase subunit I (COI) gene was amplified by polymerase chain reaction following Che et al. (2012), using the primers Chmf4 (5′-TYTCWACWAAYCAYAAAGAYATCGG-3′) and Chmr4 (5′-ACYTCRGGRTGRCCRAARAATCA-3′). Successful PCR products were purified and sequenced by Evrogen (Moscow, Russia) using an ABI 3730xl Automated DNA Analyzer (Applied Biosystems). Raw sequence reads were assembled and edited using SeqMan in the DNASTAR software package (Burland 2000). The newly generated sequence was deposited in GenBank under accession number PZ878901.

The molecular dataset comprised 32 samples, including 30 ingroup samples representing *Achalinus*, with *Stoliczkia vanhnuailianai* Lalronunga, Lalhmangaiha, Zosangliana, Lalhmingliani, Gower, Das & Deepak and *Xenodermus javanicus* Reinhardt included as outgroups (Suppl. material 1: table S1). Sequences were aligned using MAFFT v. 7.037b under default settings (Katoh and Standley 2013) and manually inspected in MEGA 11 (Tamura et al. 2021). Phylogenetic relationships were inferred using maximum likelihood (ML) and Bayesian inference (BI). Maximum-likelihood analysis was conducted in IQ-TREE v. 1.6.12 (Nguyen et al. 2015). The optimal substitution model, TIM+F+R3, was selected using ModelFinder in PhyloSuite v. 1.2.3 under the Akaike information criterion (AIC) (Akaike 1973, 1974; Kalyaanamoorthy et al. 2017; Zhang et al. 2020). Nodal support was assessed using 10,000 ultrafast bootstrap

(UFB) replicates, with UFB values ≥ 95% considered to indicate strong support (Hoang et al. 2018). Bayesian-inference analysis was conducted in MrBayes v. 3.2.7a (Ronquist et al. 2012), using GTR+F+I+G4 as the optimal substitution model selected by ModelFinder for MrBayes under AIC. Two independent Markov chain Monte Carlo runs were performed for 1 × 10^7 generations, with sampling every 1,000 generations and the initial 25% of samples discarded as burn-in. Bayesian posterior probabilities (BPP) ≥ 0.95 were considered to indicate strong support (Huelsenbeck and Ronquist 2001). Resulting trees were visualized using FigTree v. 1.4.4 (Rambaut 2018). Uncorrected pairwise genetic distances (*p*-distances) were calculated in MEGA X (Kumar et al. 2018).

Results

Taxonomic account

Achalinus vanhoensis Ha, Ziegler, Dinh, Le, Nguyen & Luu, 2022

Examined specimen. DTU 521 (field number NB.2019.9), adult female, collected by T.V. Nguyen and D.T. Le from Cuc Phuong National Park, Cuc Phuong Commune, Ninh Binh Province, Vietnam (20.272452°N, 105.696698°E; elevation 440 m a.s.l.), on 28 June 2019.

Identification. Morphologically, the specimen is assigned to *Achalinus vanhoensis* based on the following combination of characters: internasal suture distinctly longer than the prefrontal suture; loreal fused with the prefrontal; prefrontals extending toward the supralabials; supralabials seven; infralabials six; two pairs of chin shields; dorsal scales keeled, except for enlarged, smooth scales in the outermost row, and arranged in 25–23–23 rows; cloacal plate entire; and subcaudals entire. These characters agree well with the diagnosis of the male holotype provided by Ha et al. (2022). Phylogenetic analyses based on the COI gene recovered the female specimen from Ninh Binh Province in a moderately supported clade with the holotype of *A. vanhoensis* (UFB 94/BPP 0.89; see Fig. 2). The two specimens exhibited an uncorrected COI *p*-distance of 3.8%, further supporting the identification of the newly collected specimen as *A. vanhoensis*.

Description of the female (Fig. 1A1–A3; Suppl. material 1: fig. S1). Adult female; body slender and cylindrical; head slightly distinct from neck (head length 16.1 mm, head width 8.2 mm). SVL 400 mm; TAL 95 mm; TL 495 mm; TAL/TL 0.192. Rostral small, triangular, not visible from above; nasal divided; internasals paired, suture between internasals (2.84 mm) longer than that between prefrontals (1.3 mm); prefrontals paired, extending laterally toward supralabials; loreal fused with prefrontal; preocular and postocular absent; supraocular 1/1. Temporals 2+2/2+2; anterior upper temporal small, triangular, entering orbit; anterior lower temporal remarkably enlarged, approximately hexagonal, occupying most of the anterior and middle temporal regions, but separated from and not entering orbit. Supralabials 7/7; first very small; fifth and sixth entering the orbit; seventh largest and longest on both sides. Mental single, very small; infralabials 6/6, first pair in contact medially behind the mental; first three infralabials in contact with the anterior chin shields; two pairs of chin shields; posterior chin shields slightly longer than the anterior pair and laterally in contact with the third and fifth infralabials. Dorsal scales lanceolate, keeled except for enlarged, smooth scales in the outermost row, arranged in 25–23–23 rows; ventrals 202, excluding one preventral, laterally rounded; cloacal plate entire; subcaudals 74, all entire.

Coloration in the freshly dead specimen. The following description is based on photographs taken immediately after the specimen had been struck by a vehicle. Dorsal surfaces of the head, body, and tail dark chocolate brown to nearly black, without a distinct vertebral stripe and with a strong iridescent sheen. Lateral surfaces of the head slightly lighter brown than the dorsum; chin region and infralabials grayish brown, with paler scale margins. Ventral surfaces of the body and tail dark grayish brown and lighter than the dorsum, with narrow pale brown to grayish posterior margins on the ventrals and subcaudals. Eye entirely black, with pupil indistinguishable.

Comparison with the male holotype. The female agrees with the male holotype in having the internasal suture distinctly longer than the prefrontal suture, the loreal fused with the prefrontal, and keeled dorsal scales arranged in 25–23–23 rows. Compared with the male holotype, the female has more ventrals (VEN 202 vs. 176), fewer subcaudals (SC 74 vs. 84), and a proportionally shorter tail (TAL/TL 0.192 vs. 0.264). The differences in ventral and subcaudal counts and relative tail length may indicate sexual dimorphism. Comparable sex-associated differences are common in *Achalinus* and have been reported in most species of the genus (see Xu et al. 2024a, 2024b, 2025, 2026a). However, because only one specimen of each sex is currently known for *A. vanhoensis* and the two specimens originate from different localities, sexual, individual, and geographical variation cannot yet be distinguished.

Expanded diagnosis. Based on the two known specimens, *Achalinus vanhoensis* is characterized by the following combination of characters: (1) 32 maxillary teeth in male holotype; (2) suture between internasals distinctly longer than that between prefrontals (ratio of internasal suture length to prefrontal suture length 1.33–2.18); (3) loreal fused with the prefrontal, with prefrontals extending toward supralabials; (4) dorsal scales keeled, except for the enlarged and smooth scales in the outermost row, and arranged in 25–23–23 rows; (5) supralabials six or seven; (6) infralabials six; (7) two pairs of chin shields; (8) temporals 2+2; (9) ventrals 176 in the male and 202 in the female; (10) subcaudals 84 in the male and 74 in the female, all entire; (11) cloacal plate entire; and (12) TAL/TL 0.264 in male and 0.192 in female.

Distribution, natural history, and conservation status. *Achalinus vanhoensis* was previously known

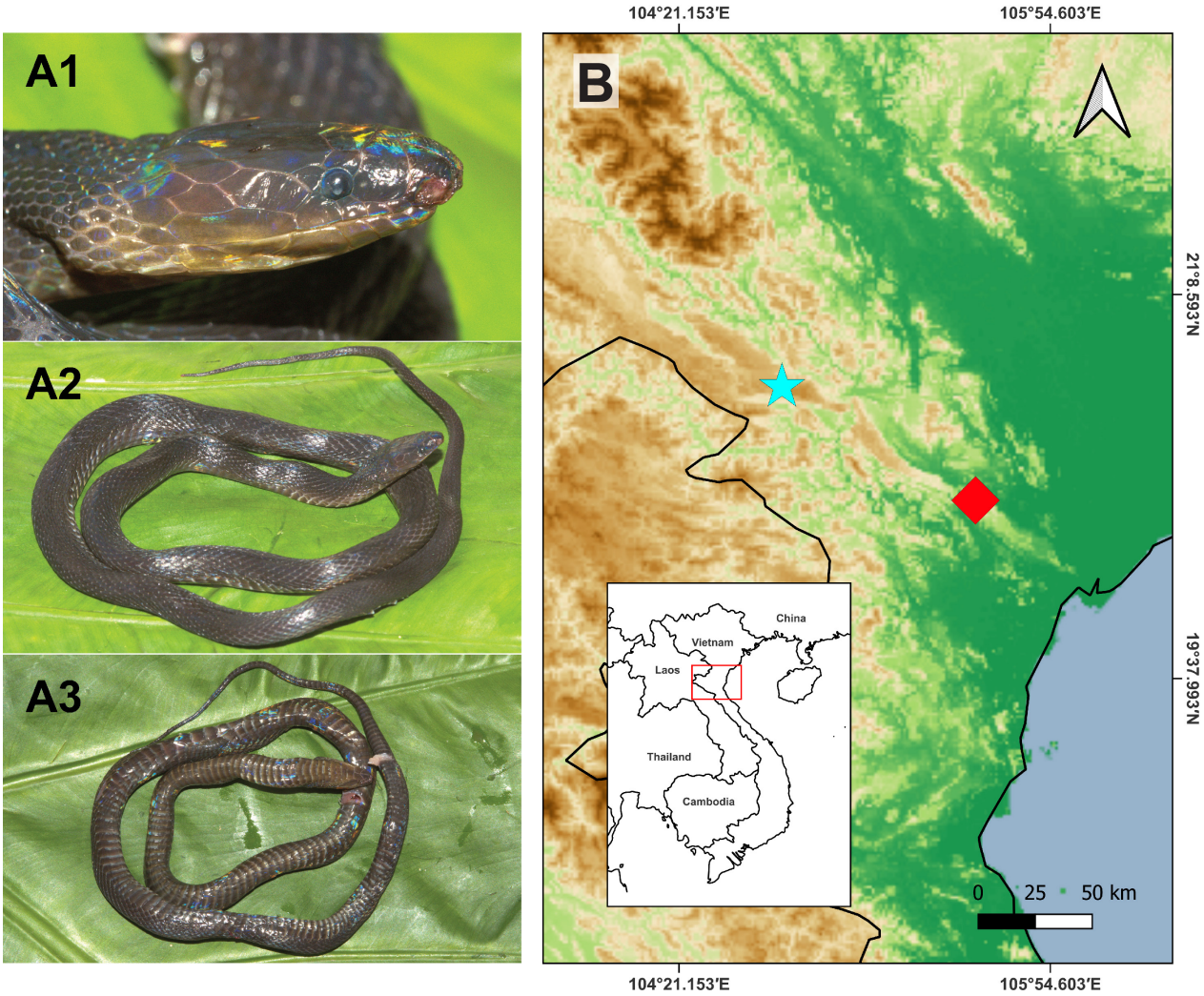

Figure 1. Freshly dead adult female of *Achalinus vanhoensis* (DTU 521) from Cuc Phuong National Park, Ninh Binh, Vietnam, and the known distribution of the species. **A1.** Lateral view of the head; **A2.** Dorsal view of the body; **A3.** Ventral view of the body and tail; **B.** Distribution map showing the type locality in Van Ho, Son La, Vietnam (cyan star), and the new locality in Cuc Phuong National Park (red diamond). Photographs by T.V. Nguyen.

only from its type locality in limestone forest at Hua Tat Village, Van Ho District (now Van Ho Commune), Son La Province, northwestern Vietnam (Ha et al. 2022). The longitude of the type locality reported by Ha et al. (2022) as 105°45.677'E is evidently a typographical error because it places the locality outside Van Ho District; the correct longitude is 104°45.677'E. The corrected coordinates, 20°46.327'N, 104°45.677'E, were therefore used for mapping and distance calculation. The new record from Cuc Phuong National Park, Cuc Phuong Commune, Ninh Binh Province, represents the second confirmed locality and extends the known range of the species approximately 112 km southeastward (Fig. 1B). It also lowers the documented elevational limit from 1,121 to 440 m a.s.l. The female was encountered at approximately 19:00 h following light rain while attempting to cross a concrete road. The specimen had been struck by a vehicle and was found mortally injured. It died shortly after discovery without intervention and was subsequently collected as a road-killed specimen. The road was bordered on both sides by limestone cliffs and secondary forest characterized by large trees and dense understory vegetation interspersed with limestone outcrops. Vehicular traffic along the road was relatively heavy, and road-killed amphibians, snakes, and lizards were frequently observed (T.V. Nguyen pers. obs.). *Achalinus vanhoensis* has not previously been evaluated for inclusion in the IUCN Red List. The species is currently known from only two specimens and two confirmed localities, and information on its population size and trends, area of occupancy, habitat requirements, and exposure to threats remains unavailable. Although the new locality lies within Cuc Phuong National Park, its occurrence within a protected area alone is insufficient to support an assessment of Least Concern. Given the extremely limited information currently available, it is provisionally recommended that *A. vanhoensis* be assessed as Data Deficient (DD) following the IUCN Red List Categories and Criteria (IUCN Standards and Petitions Committee 2024).

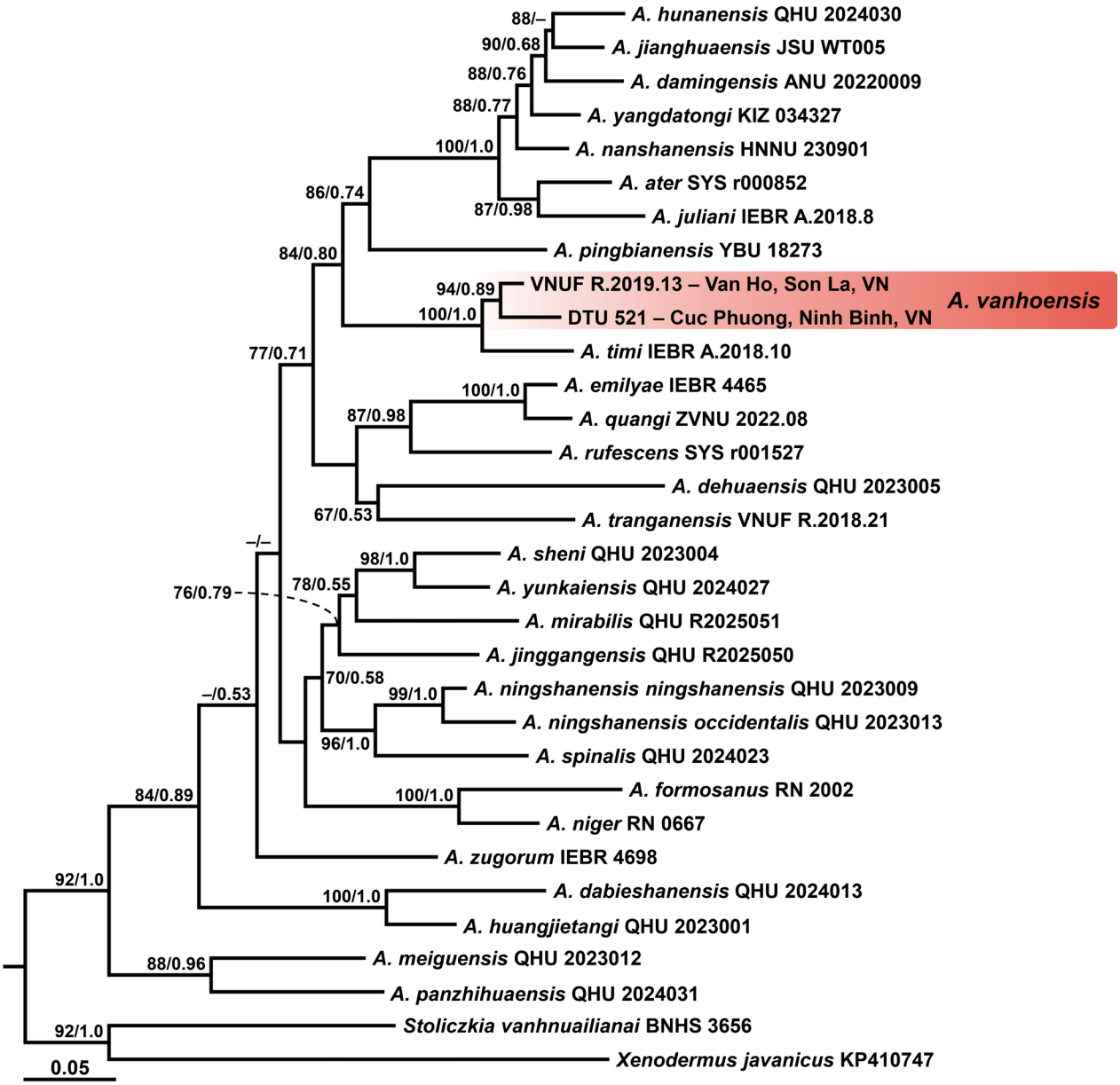

Figure 2. Maximum-likelihood phylogenetic tree of *Achalinus* inferred from mitochondrial COI sequences. Numbers at nodes represent ultrafast bootstrap support values (UFB) from the maximum-likelihood analysis and Bayesian posterior probabilities (BPP), respectively. Dashes indicate nodes not recovered in the corresponding analysis. The scale bar represents 0.05 substitutions per site.

Discussion

Specimen DTU 521 represents the second documented individual, the first known female, and the second confirmed locality of *Achalinus vanhoensis*. It shares with the male holotype the principal diagnostic characters of the species, including the internasal suture distinctly longer than the prefrontal suture, the loreal fused with the prefrontal, seven supralabials, six infralabials, two pairs of chin shields, and keeled dorsal scales arranged in 25–23–23 rows. These characters are particularly informative because Cuc Phuong National Park lies close to the known range of *A. tranganensis*, which differs from *A. vanhoensis* in having a distinct loreal separated from the prefrontal (Luu et al. 2020). The uncorrected COI *p*-distance between the Cuc Phuong female and the male holotype was 3.8%. Together, the morphological and molecular evidence support the identification of DTU 521 as *A. vanhoensis*.

The two known specimens nevertheless differ markedly in head scalation, meristic counts, and body proportions. The female has more ventrals (202 vs. 176), fewer subcaudals (74 vs. 84), and a shorter relative tail (TAL/TL 0.192 vs. 0.264). However, because only one specimen of each sex is known and the two specimens originate from different localities, sexual, individual, and geographical variation cannot yet be distinguished. Broader sampling across the intervening limestone landscapes, together with multilocus data, is needed to better characterize morphological and genetic variation within the species and clarify its relationships with geographically adjacent congeners.

The limitations associated with diagnoses based on single specimens are not restricted to *A. vanhoensis*. Several Vietnamese congeners remain known from extremely limited material, most notably *A. timi*, which is documented in the taxonomic literature only from its male holotype, and *A. tranganensis*, which is documented in the taxonomic literature only from its female holotype. Consequently, their currently reported ventral and subcaudal counts, body proportions, and head-scale configurations represent individual states, and their intraspecific, sexual, and geographical variation remains unknown. The newly documented variation in *A. vanhoensis* demonstrates that some characters initially considered diagnostic may vary when additional specimens become available. Further sampling of *A. vanhoensis*, *A. timi*, and *A. tranganensis*, particularly specimens of both sexes accompanied by molecular data, is therefore required to characterize their morphological variation, evaluate the stability of currently used diagnostic characters, and improve the reliability of identification keys for Vietnamese *Achalinus*.

Established in 1962 as Vietnam's first national park, Cuc Phuong is among the country's longest-studied protected areas. Nevertheless, its herpetofaunal diversity remains incompletely documented, particularly for secretive, semifossorial, and karst-associated species. The park lies near the biogeographical transition between the Northwest Uplands and Northeast Lowlands of northern Indochina (Poyarkov et al. 2021, 2023) and encompasses an extensive limestone karst landscape interspersed with primary and secondary forests. Its herpetological importance is demonstrated by the discovery of several new species from the park and surrounding limestone landscapes, including *Cyrtodactylus cucphuongensis* Ngo & Chan, *Micryletta nigromaculata* Poyarkov, Nguyen, Duong, Gorin & Yang, *Hebius vogeli* Nguyen, Li, Huang, Han, Nguyen, Poyarkov, David & Ren, and *Lycodon duytan* Nguyen, Poyarkov & Vogel (e.g., Ngo and Chan 2011; Poyarkov et al. 2018; Nguyen et al. 2025a, 2025b).

The circumstances surrounding the discovery of DTU 521 illustrate the value of opportunistic road searches, particularly at night following rain, for detecting secretive and semifossorial snakes. Road-killed specimens have provided important distributional, morphological, and natural-history data for several poorly known snakes, including species of *Parafimbrios* Teynié, David, Lottier, Le, Vidal & Nguyen, *Gongylosoma* Fitzinger, and *Calamaria* H. Boie in F. Boie (Hoang et al. 2026; Korolev et al. 2026; Xu et al. 2026b). However, the frequent occurrence of road-killed amphibians and reptiles along the surveyed road also indicates that traffic mortality may represent a local conservation threat within Cuc Phuong National Park. Although the present record broadens the known geographic and elevational range of *A. vanhoensis*, the scarcity of confirmed records and the absence of population data support its provisional assessment as Data Deficient (DD) following the IUCN Red List Categories and Criteria. Further surveys should focus on limestone forests in Phu Tho and Thanh Hoa provinces, Vietnam, and on intervening karst areas between Van Ho and Cuc Phuong. Given that several Vietnamese *Achalinus* remain known from only one or a few specimens, the identification key below should be regarded as provisional and interpreted in the context of the limited morphological and sex-specific data currently available.

Identification key to the species of *Achalinus* recorded from Vietnam

The following key covers the nine species currently recorded from Vietnam and is based on published diagnoses and subsequently documented morphological variation (Ziegler et al. 2019; Li et al. 2020; Luu et al. 2020; Miller et al. 2020; Ha et al. 2022; Pham et al. 2023; Nguyen and David 2024; Liu et al. 2025; this study). Because several species remain known from extremely limited material, the meristic values used below represent only the variation documented to date. Sex-specific ventral and subcaudal counts should therefore be used in combination with head scalation and dorsal scale-row formulae rather than as independent diagnostic characters.

1 Loreal fused with prefrontal 2
– Loreal present, distinct from prefrontal 5
2 Dorsal scale rows 23–23–23; internasal and prefrontal sutures approximately equal in length; seven supralabials ..... *Achalinus pingbianensis*
– Dorsal scale rows beginning with 25; internasal suture distinctly longer than prefrontal suture 3
3 Dorsal scale rows 25–25–23 ..... *Achalinus timi*
– Dorsal scale rows 25–23–23 4
4 Outermost dorsal scale row smooth; male with 84 subcaudals; female with 202 ventrals and 74 subcaudals ..... *Achalinus vanhoensis*
– Outermost dorsal scale row keeled; male with 70 subcaudals; female with 170 ventrals and 61 subcaudals ..... *Achalinus zugorum*
5 Five infralabials 6
– Six or seven infralabials 7
6 Larger (SVL 360–424.4 mm); TAL/TL 0.18–0.20; dorsum yellowish brown with dark vertebral stripe; females with 157–161 ventrals and 63–65 subcaudals ..... *Achalinus emilyae*
– Smaller (SVL 207.9–295.0 mm); TAL/TL 0.22–0.30; dorsum uniformly reddish brown; females with 141–154 ventrals and 69 subcaudals ..... *Achalinus quangi*

7 Anterior dorsal scale rows 23 (rarely 21) ..... *Achalinus ater*
– Anterior dorsal scale rows 25 8
8 Known female with 179 ventrals ..... *Achalinus juliani*
– Known female with 171 ventrals ..... *Achalinus tranganensis*

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References

Akaike H (1973) Information theory and an extension of the maximum likelihood principle. In: Petrov BN, Csáki F (Eds) Second International Symposium on Information Theory, Tsahkadsor, Armenia, USSR. Akadémiai Kiadó, Budapest, 267–281.

Akaike H (1974) A new look at the statistical model identification. IEEE Transactions on Automatic Control 19(6): 716–723. https://doi.org/10.1109/TAC.1974.1100705

Burland TG (2000) DNASTAR's Lasergene sequence analysis software. Methods in Molecular Biology 132: 71–91. https://doi.org/10.1385/1-59259-192-2:71

Che J, Chen HM, Yang JX, Jin JQ, Jiang K, Yuan ZY, Murphy RW, Zhang YP (2012) Universal COI primers for DNA barcoding amphibians. Molecular Ecology Resources 12(2): 247–258. https://doi.org/10.1111/j.1755-0998.2011.03090.x

Dowling HG (1951) A proposed standard system of counting ventrals in snakes. British Journal of Herpetology 1: 97–99.

Ha NV, Ziegler T, Dinh TS, Le MD, Nguyen TQ, Luu VQ (2022) A new species of the genus *Achalinus* (Squamata: Xenodermidae) from Son La Province, Vietnam. Zootaxa 5168(3): 375–387. https://doi.org/10.11646/zootaxa.5168.3.8

Hillis DM, Moritz C, Mable BK [Eds] (1996) Molecular Systematics. 2nd edn. Sinauer Associates, Sunderland, Massachusetts, 655 pp.

Hoang DT, Chernomor O, Haeseler AV, Minh BQ, Vinh LS (2018) UFBoot2: Improving the ultrafast bootstrap approximation. Molecular Biology and Evolution 35(2): 518–522. https://doi.org/10.1093/molbev/msx281

Hoang NT, Nguyen TV, Nguyen VT, Nguyen DT, Poyarkov NA, Orlov NL (2026) New distributional records and natural history data on three poorly known snakes of the genera *Gongylosoma* and *Liopeltis* (Serpentes: Colubridae) from Vietnam. Russian Journal of Herpetology 33(1): 39–50. https://doi.org/10.30906/1026-2296-2026-33-1-39-50

Huelsenbeck JP, Ronquist F (2001) MRBAYES: Bayesian inference of phylogenetic trees. Bioinformatics 17(8): 754–755. https://doi.org/10.1093/bioinformatics/17.8.754

IUCN Standards and Petitions Committee (2024) Guidelines for Using the IUCN Red List Categories and Criteria. Version 16. Prepared by the Standards and Petitions Committee. https://www.iucnredlist.org/documents/RedListGuidelines.pdf

Kalyaanamoorthy S, Minh BQ, Wong TK, Haeseler A, Jermiin LS (2017) ModelFinder: Fast model selection for accurate phylogenetic estimates. Nature Methods 14: 587–589. https://doi.org/10.1038/nmeth.4285

Katoh K, Standley DM (2013) MAFFT multiple sequence alignment software version 7: improvements in performance and usability. Molecular Biology and Evolution 30(4): 772–780. https://doi.org/10.1093/molbev/mst010

Korolev AM, Bragin AM, Gorin VA, Le SX, Idiiatullina SS, Xu YH, Zhang T, Bos C, David P, Nguyen TV, Poyarkov NA (2026) Rediscovery and revalidation of *Calamaria annamensis* Bourret, 1937 (Squamata: Calamariidae), a rare reed snake restricted to the Truong Son Range of central Vietnam. Zootaxa 5752(1): 105–133. https://doi.org/10.11646/zootaxa.5752.1.5

Kumar S, Stecher G, Li M, Knyaz C, Tamura K (2018) MEGA X: Molecular evolutionary genetics analysis across computing platforms. Molecular Biology and Evolution 35: 1547–1549. https://doi.org/10.1093/molbev/msy096

Li K, Yu M, Wu YY, Liao LH, Tang K, Liu Q, Guo P (2020) A new species of the genus *Achalinus* (Squamata: Xenodermatidae) from southeastern Yunnan Province, China. Zootaxa 4860(1): 116–128. https://doi.org/10.11646/zootaxa.4860.1.6

Liu S, Wang J, Hou M, Wang M, Rao DQ (2025) First record of *Achalinus zugorum* Miller, Davis, Luong, Do, Pham, Ziegler, Lee, De Queiroz, Reynolds & Nguyen, 2020 from China (Serpentes, Xenodermidae), with updated diagnosis of this species. Biodiversity Data Journal 13: e161176. https://doi.org/10.3897/BDJ.13.e161176

Luu VQ, Ziegler T, Ha NV, Lo OV, Hoang TT, Ngo HT, Le MD, Tran DH, Nguyen TQ (2020) A new species of *Achalinus* (Squamata: Xenodermidae) from Trang An Landscape Complex, Ninh Binh Province, Vietnam. Zootaxa 4877(1): 174–184. https://doi.org/10.11646/zootaxa.4877.1.8

Miller AH, Davis HR, Luong AM, Do QH, Pham CT, Ziegler T, Lee JL, De Queiroz K, Reynolds RG, Nguyen TQ (2020) Discovery of a new species of enigmatic odd-scaled snake (Serpentes: Xenodermidae: *Achalinus*) from Ha Giang Province, Vietnam. Copeia 108(4): 796–808. https://doi.org/10.1643/CH2020060

Ngo TV, Chan KO (2011) A new karstic cave-dwelling *Cyrtodactylus* Gray (Squamata: Gekkonidae) from northern Vietnam. Zootaxa 3125(1): 51–63. https://doi.org/10.11646/zootaxa.3125.1.4

Nguyen LT, Schmidt HA, Haeseler AV, Minh BQ (2015) IQ-TREE: A fast and effective stochastic algorithm for estimating maximum likelihood phylogenies. Molecular Biology and Evolution 32(1): 268–274. https://doi.org/10.1093/molbev/msu300

Nguyen TV, David P (2024) First record of *Achalinus pingbianensis* Li et al., 2020 (Serpentes, Xenodermidae) from Vietnam, with the first description of a female specimen and an expanded diagnosis. Russian Journal of Herpetology 31(3): 157–167. https://doi.org/10.30906/1026-2296-2024-31-3-157-167

Nguyen TV, Li ML, Huang JJ, Han BY, Nguyen DT, Poyarkov NA, David P, Ren JL (2025a) Taxonomic reassessment of *Hebius optatus* (Hu & Zhao, 1966) (Squamata: Natricidae), with the description of a new species from Vietnam and China. Asian Herpetological Research 16(4): 377–391. https://doi.org/10.3724/ahr.2095-0357.2025.0026

Nguyen TV, Poyarkov NA, Vogel G (2025b) Taxonomic reassessment of the *Lycodon rufozonatus* species complex (Serpentes, Colubridae), with re-evaluation of *Dinodon rufozonatum walli*, and description of

a new species from north-central Vietnam. ZooKeys 1251: 293–322. https://doi.org/10.3897/zookeys.1251.157817

Pham AV, Pham CT, Le MD, Ngo HT, Ong AV, Ziegler T, Nguyen TQ (2023) *Achalinus quangi*, a new odd-scaled snake species from Vietnam. Zootaxa 5270(1): 48–66. https://doi.org/10.11646/zootaxa.5270.1.2

Poyarkov NA, Nguyen TV, Duong TV, Gorin VA, Yang JH (2018) A new limestone-dwelling species of *Micryletta* (Amphibia: Anura: Microhylidae) from northern Vietnam. PeerJ 6: e5771. https://doi.org/10.7717/peerj.5771

Poyarkov NA, Nguyen TV, Popov ES, Geissler P, Pawangkhanant P, Neang T, Suwannapoom C, Orlov NL (2021) Recent progress in taxonomic studies, biogeographic analysis and revised checklist of amphibians in Indochina. Russian Journal of Herpetology 28(3A): 1–110. https://doi.org/10.30906/1026-2296-2021-28-3A-1-110

Poyarkov NA, Nguyen TV, Popov ES, Geissler P, Pawangkhanant P, Neang T, Suwannapoom C, Orlov NL (2023) Recent progress in taxonomic studies, biogeographic analysis and revised checklist of reptiles in Indochina. Russian Journal of Herpetology 30(5): 255–476. https://doi.org/10.30906/1026-2296-2023-30-5-255-476

Rambaut A (2018) FigTree v1.4.4. http://tree.bio.ed.ac.uk/software/figtree/ [Accessed 10 April 2025]

Ronquist F, Teslenko M, Van Der Mark P, Ayres DL, Darling A, Höhna S, Larget B, Liu L, Suchard MA, Huelsenbeck JP (2012) MrBayes 3.2: Efficient Bayesian phylogenetic inference and model choice across a large model space. Systematic Biology 61: 539–542. https://doi.org/10.1093/sysbio/sys029

Tamura K, Stecher G, Kumar S (2021) MEGA11: Molecular evolutionary genetics analysis version 11. Molecular Biology and Evolution 38(7): 3022–3027. https://doi.org/10.1093/molbev/msab120

Uetz P, Freed P, Aguilar R, Reyes F, Kudera J, Hošek J [Eds] (2026) The Reptile Database. http://www.reptile-database.org/ [Accessed 1 August 2026]

Xu YH, Ma S, Cai B, Yang D, Zhang T, Gu T, Zhu F, Huang S, Peng L (2024a) Taxonomic revision of *Achalinus ningshanensis* (Serpentes, Xenodermidae), with description of a new subspecies from western China. Animals 14: 3425. https://doi.org/10.3390/ani14233425

Xu YH, Wang S, Ma S, Burbrink FT, Peng LF, Huang S (2024b) First report of albinism for *Achalinus sheni* (Serpentes, Xenodermidae), with extended diagnosis of the species. ZooKeys 1209: 1–17. https://doi.org/10.3897/zookeys.1209.128944

Xu YH, Chen MC, Ma S, Shi SC, Zhang TR, Weng SY, Peng LF (2025) First description of the female and morphological variation of *Achalinus hunanensis* Ma, Shi, Xiang, Shu & Jiang, 2023 (Serpentes, Xenodermidae), with range extension of this species and *A. yunkaiensis* Wang, Li & Wang, 2019. Biodiversity Data Journal 13: e138423. https://doi.org/10.3897/BDJ.13.e138423

Xu YH, Hu JH, Qi S, Ma S, Chen HJ, Zhang TR, Zhang YF, Sun FY, Zhou JJ, Xu JN, Wang YY, Peng LF (2026a) Taxonomic reassessment of *Achalinus jinggangensis* (Zong & Ma, 1983) (Serpentes, Xenodermidae), with description of a new species from Zhejiang Province, China. Zoosystematics and Evolution 102(2): 387–409. https://doi.org/10.3897/zse.102.183453

Xu YH, Semenova AA, Hu YC, Qi S, Pawangkhanant P, Lin ZG, Daowrueng P, Aksornneam A, Suwannapoom C, Deng JD, Nguyen TV, Poyarkov NA, Peng LF (2026b) Revisiting the morphology of the bearded snake genus *Parafimbrios* (Squamata: Xenodermidae), with new distribution records from China and Thailand. Zootaxa. [in press]

Zhang D, Gao FL, Jakovlić I, Zou H, Zhang J, Li WX, Wang GT (2020) PhyloSuite: An integrated and scalable desktop platform for streamlined molecular sequence data management and evolutionary phylogenetics studies. Molecular Ecology Resources 20(1): 348–355. https://doi.org/10.1111/1755-0998.13096

Ziegler T, Nguyen TQ, Pham CT, Nguyen TT, Pham AV, Van Schingen M, Nguyen TT, Le MD (2019) Three new species of the snake genus *Achalinus* from Vietnam (Squamata: Xenodermatidae). Zootaxa 4590(2): 249–269. https://doi.org/10.11646/zootaxa.4590.2.3

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No animal was captured, experimentally manipulated, or euthanized for this study. The examined specimen was found mortally injured following an accidental vehicle collision and died shortly after discovery without intervention. Tissue sampling and preservation were conducted only after its death. Therefore, no animal ethics approval was required.

Artificial Intelligence (AI) use

Generative artificial intelligence tools were used solely to assist with language editing and improving the clarity and organization of the manuscript. No artificial intelligence tools were used to generate or analyze data, identify specimens, or formulate the scientific interpretations and conclusions. The authors reviewed and verified the final text and accept full responsibility for the content of the manuscript.

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Data availability

The newly generated COI sequence is available in GenBank under accession number PZ878901. All morphological data supporting the findings of this study are provided in the main text.

Supplementary material 1

GenBank accession numbers, localities, voucher numbers, and references for specimens included in the phylogenetic analyses

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Data type: pdf

Explanation note: **table S1.** GenBank accession numbers, localities, and voucher information for all specimens used in this study. **fig. S1.** Photographs of the head of *Achalinus vanhoensis* (DTU 521) in preservative: (A) dorsal view; (B) ventral view; (C) left lateral view; (D) right lateral view. Photographs by T.V. Nguyen.

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