

## A NEW SPECIES OF THE GENUS *Calamaria* (SQUAMATA: OPHIDIA: COLUBRIDAE) FROM THUA THIEN-HUE PROVINCE, VIETNAM

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A new species of *Calamaria* is described based on a single specimen collected in the tropical rain forest, Thua Thien – Hue Province, Vietnam. The new species is characterized by the following characters: total length 578 mm; tail length 42 mm, tail tip thick, obtusely rounded, and slightly flattened laterally; maxillary teeth eight, modified; loreals absent; preocular present; supralabials 5/5, second and third entering orbit; infralabials 5/5; paraparietal surrounded by five shields; midbody scales in 13 rows, reducing to 11 rows at the level of single anal plate; ventrals 3 + 209; subcaudals 19, divided; body uniform light brown above and without color pattern; belly cream. This is the ninth species of *Calamaria* recorded from Vietnam.

**Keywords:** Bach Ma National Park, Thua Thien – Hue Province, Vietnam, *Calamaria concolor* sp. nov., morphology, taxonomy.

### INTRODUCTION

*Calamaria* is a diverse genus of colubrid snakes with more than 60 species are currently recognized. Together with other species-rich genera, viz. *Oligodon*, *Lycodon*, *Elaphe sensu lato*, *Sinonatrix*, *Xenochrophis*, *Amphiesma*, *Rhabdophis*, *Dinodon*, *Boiga*, and *Dendrelaphis*, this genus represents the majority of diversity of the South Asian ophidiofauna. A significant contribution to the taxonomy, evolution, and biogeography of the *Calamaria* snakes was completed by Inger and Marx (1965). In their monograph, a number of 50 *Calamaria* species was reported from Oriental Region. According to Inger and Marx (1965), the principal center of evolution and dispersal of *Calamaria* is situated in the Great Sunda Archipelago, namely Borneo-Sumatra area, which houses the majority (more than 60%) of the *Calamaria* species. The most comprehensive analysis of dis-

tribution of the *Calamaria* species in Vietnam was mentioned by Ziegler and Le (2005). This paper also includes the description of a new species, *Calamaria thanhi*, from Annamite Mountain and an identification key for the Vietnamese species. In Vietnam, eight taxa of *Calamaria* are recognized: *C. buchi* Marx et Inger, 1955; *C. lovii ingermarxorum* Darevsky et Orlov, 1992; *C. pavimentata* Duméril et Bibron, 1854; *C. septentrionalis* Boulenger, 1890; *C. thanhi* Ziegler et Le, 2005; *C. sangi* Nguyen, Koch et Ziegler, 2010; *C. gialaiensis* Ziegler, Nguyen et Nguyen, 2009; and *C. abramovi* Orlov, 2009 (Darevsky and Orlov, 1992; Orlov et al., 2000, 2003; Ziegler, 2002; Ziegler et al., 2004; Orlov, 2005; Ziegler and Le, 2005; Nguyen et al., 2009; Orlov, 2009; Ziegler et al., 2009; Nguyen et al., 2010b). We herein describe another new species of *Calamaria* based on the specimen collected in the tropical forest in Thua Thien – Hue Province, Central Vietnam.

### MATERIAL AND METHODS

The specimens examined in this study are deposited in the herpetological collections of IEBR (Institute of Ecology and Biological Resources, Vietnam), ROM (Royal Ontario Museum, Canada), FMNH (Field Museum of Natural History, USA), ZFMK (Zoologisches

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Fig. 1. Holotype of *Calamaria concolor* sp. nov. (IEBR A.2010.02/ZISP 30185), dorsal view.

Forschungsmuseum Alexander Koenig, Bonn, Germany), MVZ (Museum of Vertebrate Zoology, Berkeley, CA, USA), CIB (Chengdu Institute of Biology, China), USNM (National Museum of Natural History, Division of Amphibians and Reptiles, Washington, D.C., USA) and ZISP (Zoological Institute, St. Petersburg, Russia).

The following abbreviations for morphological characters are used: Measurements (in mm): SVL, snout-vent length; Lcd, tail length from vent to tip; TL, total length; BD, body diameter; HL, head length, from anterior part of rostral shield to posterior part of the lower jaw; HW, head width at the widest point; ED, horizontal diameter of eye; EN, eye to nostril, distance from anterior corner of eye to posterior edge of nostril; SL, snout length from the tip of the snout to the anterior edge of the eye; IO, interorbital distance. Scalation: SO, number of supraoculars; PrO, number of preoculars; PtO, number of postoculars; SubO, number of suboculars; PF, prefrontal; F, frontal; P, parietal; R, rostral; N, nasal; L, loreal; T, number of temporals [Ta, anterior temporal; Tp, posterior temporal]; IN, internasal; M, mental or symphyseal; G, genials [Ga, anterior genials or anterior chin shields; Gp, posterior genials or posterior chin shields]; Supralab, number of supralabials; Infralab, number of infralabials; V, number of ventrals; Scd, number of subcaudals; Sq1, Sq2, Sq3, number of body scale rows [1, at the level of the 15<sup>th</sup> ventral scale from the

head; 2, at midbody; 3, at the level of the 15<sup>th</sup> ventral scale from the anal plate]; A, number of anal plates.

All measurements were taken with a caliper to the nearest 0.01 mm; photographs were made with a Nikon D 200 camera using a Nikkor micro 105 mm lens.

## SPECIES DESCRIPTION

### *Calamaria concolor* sp. nov.

**Holotype.** IEBR A.2010.02/ZISP 30185, adult male, collected from Bach Ma Peak, Bach Ma National Park, on the Eco-tourist trail, Thua Thien – Hue Province, Vietnam (16°11'16.7" N 107°50'36.1" E; altitude 1400 m a.s.l.) in April 2009 by Tran Thieu Du (Figs. 1 and 2).

**Diagnosis.** Small-sized, slightly dorso-ventrally flattened colubrid snake, total length 578 mm (SVL 536 mm, Lcd 42 mm); head relatively big, rounded, not distinguished from the neck, distinctly dorso-ventrally depressed, and covered with large regular symmetric shields; maxillary teeth eight, modified; eyes well developed, pupil round; loreals absent; preocular present; paraparietal surrounded by five shields and scales; supralabials five, second and third entering orbit; infralabials five; mental touching anterior chin shield on each side;

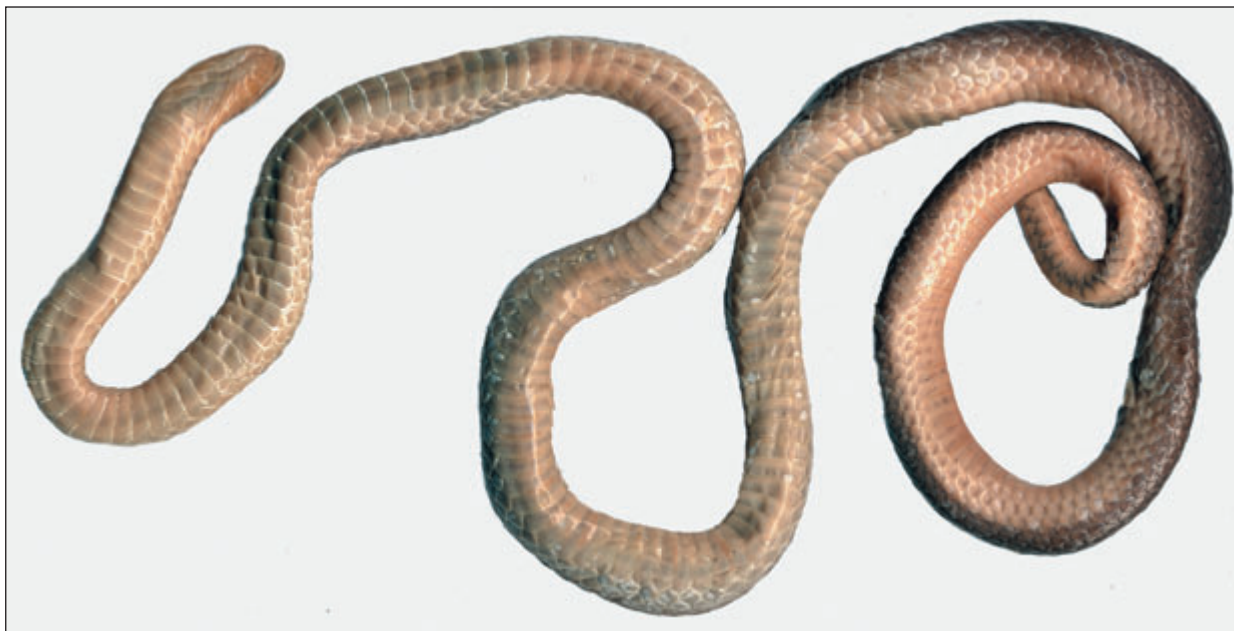


Fig. 2. Holotype of *Calamaria concolor* sp. nov., ventral view.

small shield between mental and anterior chin shield; dorsal scales smooth, Sq1 — 13, Sq2 — 13, Sq3 — 13; anal plate single; tail thick, short, tapering gradually at base, abruptly tapering at tip to a obtuse point; dorsal scales reduce to four rows on tail opposite 19 subcaudals anterior to terminal scutum; body uniform brown above and cream below; small spots forming a diffuse, indistinct band on ventral side of tail.

**Description of holotype.** Head relatively big, rounded, not distinguished from the neck, distinctly dorso-ventrally depressed, covered with large regular symmetric shields; maxillary teeth eight, modified; eyes well developed and visible from above, pupil round, surrounded by 5 shields; horizontal diameter of eye shorter than eye-mouth distance (3.15 vs. 5.22 mm); snout wide and relatively long, HL/SL — 2.86; rostral large, triangular, wider than high, in contact with prefrontals, nasal and first supralabial on each side, distinctly visible from above; tongue groove clearly visible on its ventral side; nasal very small, triangular, in contact with first supralabial, prefrontal, and rostral; nostril large, in center of nasal; loreals absent; supraocular single, large, longer than wide, bordered with frontal, prefrontal, preocular, postocular, and parietal; preocular single; postocular single; internasals absent; prefrontals paired, very large, in hexagonal-shape, longer than wide (3.56 vs. 3.10 mm); frontal very long (4.47 mm in length), in hexagonal-shape; parietals large (6.78 mm in length), suture be-

tween parietals shields 1.82 times longer than that between prefrontals; paraparietal surrounded by five shields and scales; mental triangular, not hidden in mental groove, in contact with anterior chin shield and first infralabial on each side, and the small scale present in anterior chin shields; anterior chin shields large and wide, touching first to third infralabials; posterior chin shields large, in contact with third to fifth infralabials; both pairs of chin shields meeting in midline; three scales in a line from posterior chin shields to first ventral, first gular scale separated posteriorly; supralabials 5, fourth and fifth largest, first supralabial in contact with rostral, nasal, prefrontal, and second supralabial shields; second and third entering orbit; infralabials 5 (Figs. 3 – 5).

Body relatively broad, dorso-ventrally flattened; dorsal scales smooth, rhomboid, equal in size, imbricate, scale rows at body: Sq1 — 13, Sq2 — 13, Sq3 — 13, reducing to 11 rows at the level of anus; vertebral scale row not enlarged; ventrals 3 + 209; anal plate single; subcaudals 19 pairs; tail short, thick and tapering gradually at base, abruptly tapering at tip to a obtuse point (Fig. 6); dorsal scales reducing to four rows on tail opposite 18<sup>th</sup> or 19<sup>th</sup> subcaudals anterior to terminal scutum.

**Coloration in preservative.** Body uniform brown above and cream below; ventral shields and adjacent two outermost rows of dorsal scales light creamy



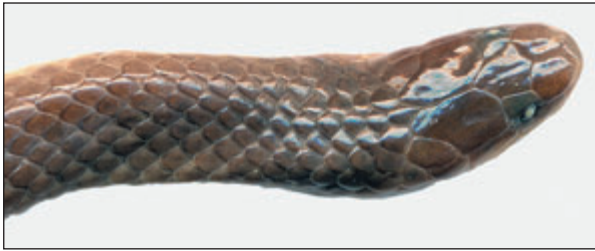


Fig. 3. Head of the holotype of *Calamaria concolor* sp. nov., dorsal view.



Fig. 4. Head of the holotype of *Calamaria concolor* sp. nov., lateral view.

colored; back without color pattern; small spots forming a diffuse and indistinct band on ventral side of tail.

**Measurements** (in mm). TL — 578; SVL — 536; Lcd — 42; BD — 8.41; HL — 14.93; HW — 8.48; ED — 3.15; EN — 2.12; SL — 5.22; IO — 5.12. Proportions (%): SVL/TL — 68.71; Lcd/TL — 7.27%; SVL/Lcd — 12.76; SVL/HL — 35.90; SVL/BD — 63.73; HL/SL — 2.86. PF — length 3.56 mm, width 3.10 mm; F — length 4.47 mm; P — length 6.78 mm; P/SO — 2.13; P/PF — 1.86; P/F — 1.52.

**Etymology.** The specific epithet *concolor* derives from Latin meaning unicolor and it is given due to the uniform body coloration of the species.

**Distribution and natural history.** The species is currently known only from the type locality (Fig. 7). The snake was found on the path in rain polydominant forest in Bach Ma National Park at an elevation of 1400 m a.s.l.

**Comparisons.** *Calamaria concolor* sp. nov. differs from all known species of the genus by combination of pholidosis characters and by uniform coloration of the body. We compare the new species with its congeners from southern China, Indochina region, and Sunda Archipelago based on data from the literature and specimen examination (see *Appendix*)

*Calamaria concolor* sp. nov. can be distinguished from all the Indochinese species by relatively wide and flat head and monochrome coloration. *Calamaria concolor* sp. nov. differs from *C. buchi* by having fewer ventrals (3 + 209 vs. 221 – 236) and more supralabials (5 vs. 4) (Inger and Marx, 1965); from *C. lovii gimletii* by the presence of a preocular (which absence in the latter subspecies), fewer number of ventrals (3 + 209 vs. 215 – 249) and more subcaudals (19 vs. 10 – 12), as well as  $F > PF$  (contrary condition in *C. lovii gimletii*) (Inger and Marx, 1965); from *C. lovii ingermarxorum* by the presence of a preocular and more supralabials (5 vs. 4) (Darevsky and Orlov, 1992); from *C. pavimentata* by having more supralabials (5 vs. 4) and lacking body color pattern (dorsum uniform brown vs. dorsum with narrow,



Fig. 5. Head of the holotype of *Calamaria concolor* sp. nov., ventral view.

dark, longitudinal stripes, and with solid black color immediately behind neck in *C. pavimentata*) (Inger and Marx, 1965; Ziegler and Le, 2005); from *C. septentrionalis* by having more supralabials (5 vs. 4) and mental in contact with anterior chin shields (vs. mental separated from anterior chin shields) (Inger and Marx, 1965); from *C. thanhi* by the presence of a preocular and the absence of color pattern (vs. preocular absent and dorsum dark, with 4 – 6 light body bands in *C. thanhi*) (Ziegler and Le, 2005); from *C. sangi* by having more ventrals and supralabials (V 3 + 209, Supralab 5 vs. V 2 + 190, Supralab 4) (Nguyen et al., 2010b); from *C. gialaiensis* by having more ventrals and supralabials (V 3 + 209, Supralab 5 vs. V 3 + 191, Supralab 4), and color pattern on body (uniform brown above vs. dorsum light grayish brown with few dark blotches along posterior vertebral region) (Ziegler et al., 2009).

*Calamaria concolor* sp. nov. differs from *C. yunnanensis* by the presence of a preocular; from *C. lumbricoidea* in having more ventrals (3 + 209 vs. 144 – 196 in males) (Inger and Marx, 1965), greater body length (SVL 536 mm vs. 144 – 196 in males) (Inger and Marx, 1965), and different type of coloration; from *C. albiventer* by having larger body size (SVL 536 mm vs. 205 in males), more ventrals (3 + 209 vs. 3 + 143 – 144), and second and third supralabials entering orbit (third and



Fig. 6. Tail of the holotype of *Calamaria concolor* sp. nov., ventral view.



Fig. 7. Map showing the type locality of *Calamaria concolor* sp. nov.: ●, Bach Ma National Park, Thua Thien – Hue Province, central Vietnam.

fourth entering orbit in *C. albiventer*) (Inger and Marx, 1965); from *C. schlegeli schlegeli* by having greater body length (SVL 536 mm vs. 125 – 391 in males), more ventrals (3 + 209 vs. 3 – 4 + 129 – 161 in males), and supralabials entering orbit (second and third scales vs. third and fourth), mental in contact with anterior chin shields (contrary condition in *C. schlegeli schlegeli*) (Inger and Marx, 1965); from *C. prakkei* by having larger body length (SVL 536 mm vs. 172 – 245 mm), second and third supralabials entering orbit (vs. third and fourth entering orbit), more ventrals (3 + 209 vs. 3 + 126 – 132 in males), and the difference of coloration (body uniform brown without pattern above vs. scattered mid-dorsal scales with a dark central spots, scales of first row yellow in centers forming longitudinal stripes) (Inger and Marx, 1965); from *C. ingeri* by having second and third supralabials entering orbit (third and fourth entering orbit in latter species), mental in contact with anterior chin shields (separated in *C. ingeri*), and the difference of color pattern on back (uniform brown without pattern above vs. 26 incomplete light transverse bands on body and tail) (Grismer et al., 2004).

## DISCUSSION

The diversity of the snake fauna of Southeast Asia is significantly increased with a series of the new discoveries, especially the fossorial and small-sized colubrids such as *Amphiesma*, *Fimbrios*, *Oligodon*, *Opisthotropis*, *Parahelicops*, and *Paratapinophis* (David et al., 2007, 2008; Grismer et al., 2004; Howard and Gillespie, 2007; Koch et al., 2009; Murphy et al., 2008; Orlov, 1995, 2005; Orlov et al., 2000, 2003; Szyndlar and Nguyen, 1996; Stuart and Chuaynkern, 2007; Tillack et al., 2004; Ziegler and Herrmann, 2000; Ziegler and Le, 2006; Ziegler et al., 2004, 2007, 2008a, 2008b). Our description of *Calamaria concolor* brings the number of *Calamaria* species in Vietnam to ninth. This is also the fourth recently described species of *Calamaria* from Vietnam after *C. abramovi* (Orlov, 2009), *C. gialaiensis* (Ziegler et al., 2009), *C. sangi* (Nguyen et al., 2010b). In Vietnam, beside the new species of *Calamaria* as mentioned above, one new genus and four new taxa have been found after the publication of Nguyen et al. (2009), comprising one new genus and species of *Colubroelaps*, one new subspecies of *Lycodon ruhstrati*, one new species of *Protobothrops*, and one new country record of *Amphiesmoides* (Orlov et al., 2009a, 2009b; Nguyen et al., 2010a; Vogel et al., 2010).

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- Calamaria gialaiensis***: IEBR A.0714 (holotype) from Kon Ka Kinh, K Bang District, Gia Lai Province, Vietnam.
- Calamaria lovii ingermarxorum***: ZISP 20006 (holotype) from Buon Luoi, ca. 20 km NW of Kannack Town, An Khe District, Gia Lai Province, Vietnam.
- Calamaria lumbricoidea***: FMNH 179088, 179089 from Lanao, Mindanao Island, Philippines; FMNH 243924, 248983 from Sipitang District, Sabah, Malaysia.
- Calamaria pavimentata***: ZISP 8823 (syntype of *C. berezowskii* Günther, 1896) from Pingwu County, Sichuan Province, China; MVZ 224163 – 224168, 226521 – 226525 from Tam Dao, Vinh Phuc Province, Vietnam; CIB 142 from Sichuan Province, China; ROM 28383 Sa Pa, Fan Si Pan Mountain, Lao Cai Province, Vietnam; ROM 31013 – 31015 from Tam Dao, Vinh Phuc Province, Vietnam.
- Calamaria sangi***: IEBR 360 (holotype) from Mang Canh Commune (14°41'57" N 108°14'39" E), Kon Plong District, Kon Tum Province, Vietnam; ZISP 25999 from Xa Hieu Commune, Kon Plong District, Kon Tum Province, Vietnam.
- Calamaria septentrionalis***: MVZ 23803, 22275 – 22277 from Lien-Wha-Tung, 5 mi N Kuling, Lushan, Jiangxi Province, China; MVZ 224169, 224170, 226526 from Tam Dao, Vinh Phuc Province, Vietnam; CIB 143 from Leishan County, Guizhou Province, China; ROM 31020 from Tam Dao, Vinh Phuc Province, Vietnam.
- Calamaria schlegeli schlegeli***: FMNH 72596 from Singapore, 148808, 147648 from Bintulu District, Sarawak, Malaysia; 248944 from Ranau Dist, Sarawak, Malaysia.
- Calamaria thanhi***: ZFMK 82920 (holotype) from Phong Nha – Ke Bang National Park, Dan Hoa Commune, Minh Hoa District, Quang Binh Province, Vietnam.
- Calamaria yunnanensis***: ZISP 17073 (holotype) from Jingdong, Yunnan, China.

#### APPENDIX. Specimens examined

***Calamaria abramovi***: ZISP 25569 (holotype), IEBR A.0907 (paratype) from Mang Xang Village, Ngoc Linh Mountain, Dac Glei District, Kon Tum Province, Vietnam.