



Article

A new species of coralsnake of the genus *Calliophis* (Squamata: Elapidae) from the west coast of peninsular India

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Abstract

We describe a new species of coralsnake, *Calliophis castoe*, from western peninsular India. The discovery of this new species comes as a surprise because it is a venomous snake from both lowland and mountainous areas that are accessible and well populated. The new species differs from all other *Calliophis*, the Tropical Asian coralsnakes, in having unicolored and dark body and tail dorsa, an orange head band, a salmon color to scarlet body and tail underside, four maxillary teeth behind the fang (the highest number, except for some individuals of *C. maculiceps*) and, in having the prefrontals touching the third supralabial while having both a preocular and a nasal (except for some *C. beddomei*). *Calliophis castoe* also differs from all other Indian coralsnakes, with the exception of some *Sinomicrurus maccllellandi*, in having an unpatterned body, no dark pigmentation on the last supralabial, and a wide post-temporal band. We also present mitochondrial DNA sequence differences between the new taxon and *C. nigrescens*. The new species is the second species of coralsnake known from the state of Goa (beside *C. nigrescens*), the third known from Maharashtra (beside *C. melanurus* and *C. nigrescens*), and the fifth known from the state of Karnataka (beside *C. beddomei*, *C. bibroni*, *C. melanurus*, and *C. nigrescens*).

Key words: *Calliophis castoe* new species, Goa, Karnataka, Maharashtra, snakes

Introduction

In 1887, in The Journal of the Bombay Natural History Society (BNHS), H. M. Phipson reported on a *Calliophis nigrescens* Günther, 1862 with a dark-dorsum and a unicolored red-venter collected by G. W. Vidal at Carwar [Karwar], Bombay Presidency. Later in 1890, in the same journal, G. W. Vidal published an account on the venomous snakes of North Kanara, now the district of Uttara Kannada of the state of Karnataka, India. Vidal lists nine species of venomous snakes for that region, among them *C. nigrescens*, represented by one specimen deposited at the collection of the BNHS, the same specimen reported by Phipson (1887). We are unaware of any other reference of Uttara Kannada specimens of *C. nigrescens* until Frank Wall's 1913 description of the variety "*khandallensis*" of *C. nigrescens* (*Hemibungarus* in original description). Wall's variety was applied to a dark specimen from Khandalla, in the mountains above Bombay, different from the Karwar variety. In 1928, in his fourth edition of *The Poisonous Terrestrial Snakes of our British Indian Dominions (including Ceylon) and how to recognize them, with symptoms of snake poisoning and treatment*, Wall (1928) describes the color patterns in *C. nigrescens* as being variable and consisting of four varieties, A–D. His variety A is described as having a uniformly brown back to the middle of the second scale row, no chevron on the nape, and some dark color on the upper surface of the head. The ventral color he describes only as "Belly as in Variety D—"uniform coral pink; paler pink or whitish in young specimens." Wall (1928) also mentions that this variety is rare and that he has only seen one specimen, from Karwar. This specimen is the one donated by Vidal to the BNHS collection, and the only one of its kind that we know was available to him (i.e. Vidal). Obviously, Wall had changed his mind in assigning the Karwar specimen to the *khandallensis* variety. Wall's (1928) variety B agrees with what is now *C. beddomei* Smith, 1943.

His color description “Dark purplish brown or blackish brown on the back with three or five longitudinal series of black light-edged spots” matches the adult coloration for *C. beddomei*. The noted rareness and locality given, “from the Shevaroy Hills [Tamil Nadu]”, also agree with what we know about the relative abundance and distribution of *C. beddomei*. Varieties *C* and *D* of Wall (1928) constitute striped forms typical of what is now known as *C. nigrescens*, which vary from having a yellow, red, gray or purple brown background and three to five complete stripes and/or rows of spots along the body (Whitaker & Captain 2004). Interestingly, after Phipson’s (1887), Vidal’s (1890), and Wall’s (1913, 1928) mention of the unicolored and unpatterned *C. nigrescens* there was no other citation for this variety. Boulenger (1890) mentions a locality for *C. nigrescens* as “Bombay Hills (Karwar)” but this does not correspond to the specimen and variety discussed because he does not cite Vidal (1890); his descriptions of *C. nigrescens* varieties does not include a unicolored form, only striped forms, and he allocates the species to highlands, probably following Wall’s 1913 paper. The *Catalogue of Snakes in the British Museum (Natural History)* (Boulenger 1896) and *The Fauna of British India Including Ceylon and Burma. Reptilia and Amphibia Volume III.-Serpentes* (Smith 1943) also do not mention this variety anymore. There is an anonymous report (1988) of a unicolored *C. nigrescens* from the Dang District of Gujarat. This snake is described as being black and the head description coincides with coralsnakes of the *khandallensis* variety of Wall (1913). Unfortunately there is no associated specimen that can be examined to verify this report.

The specimen collected by Vidal (1890; Phipson 1887), now housed in the BNHS collection, clearly represents an undescribed taxon of coralsnake, different from *C. nigrescens* and any other Asian species. The specimen was cut into many pieces at the time of collection, but the head and tail regions stayed intact and useful for taxonomic characterization. Fortunately on 29 July 2009 one of us (HO) found and photographed a live specimen of this undescribed species at Dicholi, Goa and then found and collected a road killed specimen, on 12 September 2009, near Amboli, Maharashtra. On 30 June 2010 a fourth specimen was found by another one of us (VG) in South Goa. With this additional material we describe this new species of coralsnake.

Material and methods

We examined preserved specimens of coralsnakes from the collections of the Bogor Museum (MZB), Bombay Natural History Society (BNHS), the Natural History Museum—London (BMNH), California Academy of Sciences (CAS), National Ilan University—Taiwan (NIU), Kansas University (KU), the Madras Museum (MAD), the Madras Snake Park (MSP), the National Museum of Sri Lanka (NMSL), National Museum of Natural Sciences— Taichung (NMNS), National Taiwan Normal University (NTNU), National Taiwan University (NTUM), Taiwan Museum—Taipei (TM), Taiwan Endemic Species Research Institute (TESRI), Texas Natural History Collection (TNHC), the National Museum of Natural History—Smithsonian Institution (USNM), National Science Museum—Tokyo (NSMT), University of the Ryukyus (MUR), Kyoto University Museum (KUZ), the Wildlife Heritage Trust of Sri Lanka (WHT), and the Zoological Survey of India (ZSI) Kolkata (Calcutta) and Kozhikode (Calicut) collections (see Appendix). Information on some morphological characters were also obtained from written accounts and/or illustrations from Bahir (1999), Boulenger (1890, 1896), Cox (2000), Das and De Silva (2005), Deepak *et al.* (2010), Deraniyagala (1951, 1955), De Silva (1980), Phelps (1981), Slowinski *et al.* (2001), Smith (1943), Somaweera (2006), Taylor (1950), Vogel (2006), Wall (1913, 1921, 1928), and Whitaker and Captain (2004).

Measurements of external morphology were taken from digital images using the software ImageJ (Rasband 2004). Photographs were taken with high resolution digital cameras (> 8 megapixels), placing the subject at right angles with respect to the lens of the camera. For symmetrical paired structures measurements were taken from the right side. External dimensions are given to the nearest 0.1 mm. Measurements of internal features were taken using a stereoscope (40 x) with an ocular micrometer, to the nearest 0.01 mm. Fang length was measured, at each side, from upper lumen to tip. Snout-vent length (SVL), tail length, and total length (TL) were taken to the nearest mm using the imaging software or a measuring ruler or tape.

Terminology for scales follows standard colubroid terminology (e.g., Smith & Campbell 1994). The method of counting ventrals is that of Dowling (1951). The terminal scute (tip) is excluded from the number of subcaudals. A preanal scale is a small single or divided scale present before the anal plate but not associated to dorsal scales or vertebral segments. The numbers of dorsal scale rows are counted at one head length behind the head, at midbody,

and at one head length before the vent. Values for asymmetric head characters are given in left/right order. Sex was determined by observing presence or absence of hemipenes, through dissection of the base of the tail. Our photo-voucher specimen shows a relatively narrow tail-base compared to the middle section, indicative of a male. Geographic coordinates are given in decimal degrees.

The color descriptions of the holotype shortly after death, and the referred specimen in life are based on electronic images. These images are deposited at the Digital Collection of the UTA Amphibian and Reptile Diversity Research Center (UTADC-6724–45, 6831–32). Colors are taken from the Naturalist's Color Guide (Smithe 1975–1981) and numbers in parentheses correspond to the ones in this guide.

Terminology for cephalic glands follows Taub (1966), McDowell (1986), and Slowinski *et al.* (2001); hemipenial terminology follows the works of Dowling and Savage (1960), Savage (2002) and Castoe *et al.* (2007).

Mitochondrial DNA from two coralsnakes was sequenced to compare the new species with the sympatric and related *C. nigrescens* (variety *khandallensis*). Sequences for a segment of the ND4 gene and adjacent tRNAs (His, Ser [AGY] and partial Leu [CUN]) were kindly provided by K. Praveen Karanth and Aparna Lajmi of the *Evolving Phylo-Lab* at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore. Genomic DNA was extracted from tissue samples preserved in 100% ethanol following standard phenol chloroform isoamyl alcohol method described by Sambrook and Russell (2001). Amplification and sequencing chemistry follows Bansal and Karanth (2010), and amplification conditions, including primer sequence, follow Castoe *et al.* (2007). PCR products were purified using QIAquick PCR Purification kit (Qiagen) and sequences were obtained commercially from MWG Biotech Pvt. Ltd. (Bangalore). Sequences are deposited in GenBank under accession numbers (JQ282155–56).

***Calliophis castoe* sp. nov.**

(Figs. 1–7)

Calliophis nigrescens (Phipson 1887: 245, 248, Carwar [Karwar], Bombay Presidency specimen; Vidal 1890: 65–66, in part, North Kanara specimen)

Hemibungarus nigrescens variety *khandallensis* (Wall 1913: 638, in part, Karwar specimen)

Hemibungarus nigrescens (Wall 1928: 22, 35, in part)

Hemibungarus nigrescens variety A (Wall 1928: 36, Karwar specimen)

Holotype. BNHS (Bombay Natural History Society, Bombay, Maharashtra, India) 3461, an adult male from Amboli, Sindhudurg district, Maharashtra, India, [ca. 715 m] (ca. 15.958790° N 73.994686° E), collected 12 September 2009 by Hemant Ogale (Figs. 3–4, 6–7).

Paratypes (2). BNHS 2191, an adult male from Karwar, Karwar [Uttara Kannada district], Karnataka, India, [ca. 15 m] (ca. 14.804947° N 74.133317° E), collected between 1880 and 1887 by G. Vidal (1907 date of collection in BNHS catalogue in error, specimen reported by Phipson in 1887 and Vidal in 1890) (Fig. 5). BNHS 3474, a subadult female from Ambe Ghat, South Goa district, Goa, India, 295 m (15.06400° N 74.16578° E), collected 30 June 2010 by Ravindra Bhambure, Harish Kulkarni, and Varad B. Giri (Fig. 2).

Referred digital photo (1). UTADC (Digital Collection, The University of Texas at Arlington, Arlington, Texas, United States of America) 6738–45, photos of adult male from Dicholi (Bicholim), North Goa district, Goa, India, ca. 10 m (ca. 15.59° N 73.95° E), photographed on 29 July 2009 by Hemant Ogale (Fig. 1).

Diagnosis. A medium (536–540 mm TL, mature males), brownish, terrestrial coralsnake in which the tail comprises 12.4–14.0% of the TL in the two known male vouchered specimens and 12.0% in the known female. The maxilla bears 4 maxillary teeth behind the fang, the dentary 10, the palatine 9 and the pterygoid 2. It has sublabial-chin-shield contact variable, usually 7 supralabials (8 on one side of one specimen), 6/6 infralabials, two postoculars, 240–254 ventrals, a divided anal, 45–53 divided subcaudals, dorsal scale rows arranged in 13 rows along entire body, and a color pattern of a wide parietal orange band, an unpatterned vinaceous-brown dorsum, a white lower lip, and Salmon Color to Flame Scarlet ventral and lateral areas (from neck to tail).

The new species can be distinguished from all Asian and American coralsnakes, except for *Sinomicrurus japonicus* (*S. j. boettgeri* [Fritze, 1894], *S. j. japonicus* [Günther, 1868], *S. j. takarai* [Ota, Ito & Lin, 1999]) and some *Calliophis maculiceps* (Günther, 1868), in having the highest number of maxillary teeth behind the fang, four on each side. The species of coralsnakes with the next highest counts are *C. beddomei* Smith, 1943 and *C.*

nigrescens Günther, 1862 with two or three, *S. hatori* (Takahashi, 1930) and *S. sauteri* (Steindachner, 1913) with two, *C. maculiceps* with one, two and rarely four, and some populations of *S. maccllellandii* (Reinhardt, 1844) with none, one, or two teeth. *Sinomicrurus japonicus* can have from 3 to 5 maxillary teeth behind the fang. The new species can additionally be distinguished from all species of Asian coralsnakes (*Calliophis* Gray, 1835 [*Maticora* Gray, 1835] and *Sinomicrurus* Slowinski, Boundy & Lawson 2001), except some *C. beddomei*, in lacking contact between the preocular and nasal, allowing the prefrontal and third supralabial to touch. *Calliophis bibroni* (Jan, 1858) also has the prefrontals touching the supralabials but lacks preoculars and has a banded body pattern. *Calliophis castoe* also differs from all other Indian coralsnakes, including *C. beddomei* and with the exception of some individuals of *S. maccllelandii*, in having an unpatterned body, no dark pigmentation on the last supralabial, and a wide post-temporal light band. *Calliophis beddomei* has a pattern of dorsal spots adjacent to a middorsal stripe, never being dorsally unicolored. *Calliophis nigrescens* usually has a striped pattern but occasionally (variety *C. n. khandallensis* [Wall, 1913]) has an obscured pattern that seems unicolored black. Nevertheless, these always have a dark stripe or spot covering part of the last supralabial and a dark nuchal band fused or very close to the head cap, both never the case in *C. castoe*. The underside of the tail differs between *C. castoe* and *C. nigrescens*, being uniformly orange in the former and red with white-bordered scales in the later. Some specimens of *C. melanurus* (Shaw, 1802) have a nearly unicolored dorsal pattern, but always possess two tail bands, absent in the new species, and the nuchal band and the head cap are broadly fused (widely separated in the new species).



FIGURE 1. *Calliophis castoe*, dorsum of live adult male specimen (not collected) from Dicholi, Goa, India, elevation ca. 10 m. Photo by H. Ogale (UTADC-6738).



FIGURE 2. *Calliophis castoe*, venter of subadult female paratype (BNHS 3474), 313 mm TL, from Ambe Ghat, South Goa district, Goa, India, elevation 295 m. Photo by V. Giri (UTADC-6832).

The new species can be further distinguished from other coralsnakes. From species in the *C. melanurus* group, according to Smith *et al.* (2008) (*C. haematoetron* Smith, Manamendra-Arachchi & Somaweera, 2008, *C. melanurus*, and *C. maculiceps*), the new species differs in lacking a bluish ventral tail color and melanized tail base muscles and associated tissues. It can also be distinguished from *C. melanurus*, in having more supralabials (6 vs. 7 or 8) and subcaudal scales (24–37 vs. 45–53). From *C. maculiceps* it can also be distinguished by its high number of ventrals (240–254 vs. 169–222) and subcaudals (45–53 vs. 20–31). From *C. bibrioni* it can be distinguished by having a preocular (vs. no preocular), two postoculars (vs. 1), no tail bands (vs. 3–9), a divided anal (vs. single), and higher ventral (240–254 vs. 220–234) and subcaudal counts (45–53 vs. 26–37). Besides differing in dentition, color pattern and head scalation the new species differs from *C. nigrescens* in having relatively higher subcaudal counts (45–53 vs. 29–48) and fewer pterygoid teeth (2 vs. 5–8). *Calliophis beddomei* also has more pterygoid teeth (2 vs. 4). *Calliophis castoe* differs from *C. gracilis* Gray, 1835 in possessing fewer ventral scales (240–254 vs. 303–320), more subcaudal scales (45–53 vs. 21–23), a unicolored dorsal pattern (vs. large and paired paravertebral spots and 5–7 well-defined stripes), and a venter with no bands (vs. numerous regularly spaced wide bands).

From the long-glanded coralsnakes *Calliophis bivirgata* (Boie, 1827) and *C. intestinalis* (Laurenti 1768), previously in the genus *Maticora* (see Slowinski *et al.* 2001), the new species differs in having a venom gland that is confined to the temporal region (vs. extending behind the head), a Harderian gland with a moderately developed posterior extension (vs. enlarged posterior extension, larger than the eyeball), and a unicolored dorsum (vs. striped).

From species in the genus *Sinomicrurus*, i.e., *S. hatori*, *S. japonicus*, *S. kelloggi* (Pope, 1928), *S. macclellandi*, and *S. sauteri* (*sensu* Slowinski *et al.* 2001), the new taxon differs in possessing no protuberant sclerified tail tip, and a Harderian gland with a moderately developed posterior extension (vs. no extension). It can further be distinguished from *S. hatori*, *S. japonicus*, and *S. sauteri* in having no pattern of stripes, and from *S. kelloggi* and *S. macclellandi* in having no white band anterior to the nuchal band.

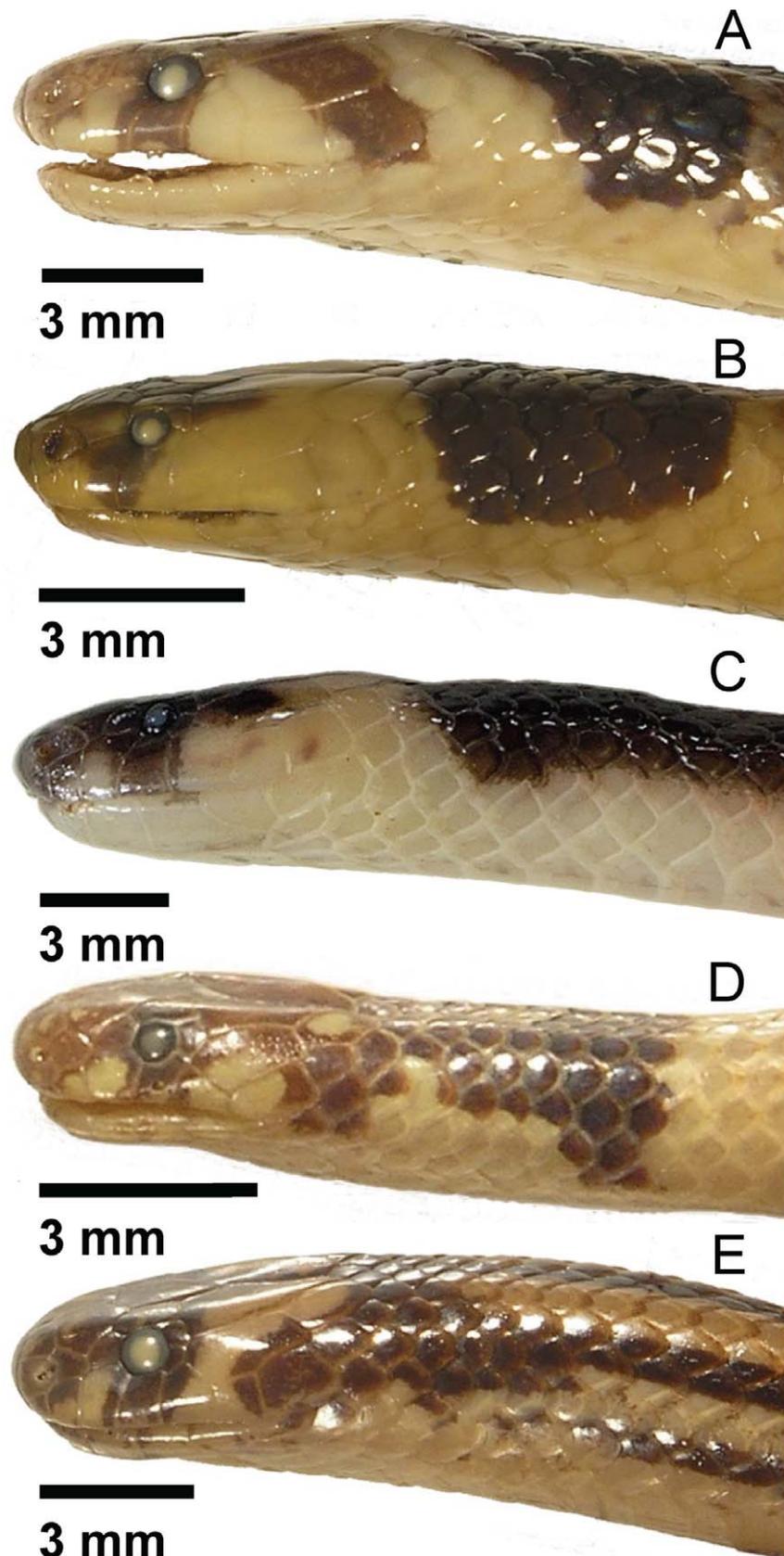


FIGURE 3. Comparison of left lateral aspects of heads of species of *Calliophis* from India. A. *C. beddomei*, subadult female holotype, BMNH 1946.1.17.99. B. *C. bibrioni*, subadult male, BMNH 1946.1.17.93 (*C. cerasinus* holotype). C. *C. castoe*, adult male holotype, BNHS 3461. D. *C. melanurus*, adult female, BMNH 74.4.29.45. E. *C. nigrescens*, subadult male, BMNH.74.4.29.239.

Etymology. It is a pleasure for us to name this beautiful coralsnake after Todd A. Castoe, a talented and prolific scientist, and a partner in the study of coralsnake and pitviper systematics. The first author has worked on venomous snakes with him and shared “coralsnake trips” to Colombia, México and India. During a trip to India, we first examined and realized the uniqueness of the species herein described. Because the Latin word *castus* means pure, the specific epithet is also reminiscent of the unmarked dorsum characteristic of the species.

Suggested English name. Castoe’s coralsnake

Description of holotype and variation. Features of the adult male holotype are followed in parentheses by variation of the adult male and subadult female paratypes. Total length 536 mm (540, 313); tail length 75 mm (67, 38); head length 8.0 mm (10.0, 6.5) from anterior edge of rostral to posterior end of mandible; head width 6.1 mm (5.6, 3.7) at broadest point; head slightly distinct from neck; snout 3.4 mm (3.4, 2.3) from front of rostral to anterior edge of eye; eye 0.2 (0.2, 0.2) times length of snout; pupil round; rostral 1.3 (1.4, 1.2) times wider than high; internasals 1.1 (1.1, 1.4) times wider than long, contacting only the nasals laterally; length of internasal suture 1.1 times diameter of eye (1.3, 0.9); prefrontals slightly wider than long (as wide as long, slightly wider than long), in contact laterally with nasal, third supralabial, preocular, and supraocular; prefrontal suture 1.8 (2.0, 1.5) times diameter of eye; frontal 1.6 (1.5, 1.4) times longer than wide; supraoculars 1.6 (1.4, 1.6) times longer than wide; parietals 2.1 (2.1, 2.3) times longer than wide; parietal suture 0.6 (0.7, 0.6) times length of parietals, 0.9 (1.1, 1.1) times longer than frontal; 1+0 temporals and one posttemporal, shields touching parietal laterally, large and elongated; temporal 2.3 (2.1, 2.5) times longer than wide; single preocular, 1.0 (1.4, 1.2) times longer than wide, lanceolate (rhomboidal), with apex rostrally, located mostly above line between center of eye and posterior border of naris; two postoculars, of about the same size, upper and lower, reaching beyond upper (or just reaching) and lower borders of eye, respectively; no loreal, preocular and nasal not in contact, prefrontal touching third supralabial; 7/7 (8/7 [higher count due to what appears to be a scale split due to injury], 7/7) supralabials, seventh largest and longest, first in contact with anterior nasal, second in contact with both nasal plates; third in contact with posterior nasal, prefrontal, preocular, and fraction of orbit; fourth below orbit and contacting lower postocular, fifth in contact with lower postocular and temporal, sixth in contact with temporal, and seventh in contact with temporal and posttemporal; mental 1.5 (1.4, 1.2) times as broad as long; anterior chin-shields 2.0 (2.1, 1.8) times longer than wide; posterior chin-shields 2.0 (2.6, 2.6) times longer than wide; 6/6 infralabials, first pair in contact behind mental, second small, second and third touching anterior chin-shields, fourth largest and contacting anterior and posterior chin-shields and first sublabial, fifth and sixth contacting sublabials; first sublabial touching chin-shields (or not, in adult paratype); 2 (2, 2) gulars and 1 (1, 2) preventrals at midline between posterior chin-shields and first ventral; with few tubercles on head scales, concentrated anteriorly; dorsals in 13 rows, smooth, unreduced; apical pits absent; ventrals 240 (254, 254); anal divided; preanal single; subcaudals 53 (45, 46), paired; tail complete, tip round; no anal ridges or tubercles; no umbilical scar noticeable.

Dentition of paratype BNHS 2191 examined in detail: maxillae bearing one fang 1.1 mm long, arising below supralabials 2 and 3, slanted backward; four posterior maxillary teeth on each side, first at about one fang length behind fang and largest, caudally smaller, slanted backward, below supralabials 3–5; 9/9 palatine teeth; 2/2 pterygoid teeth; 10/10 dentary teeth, decreasing in size from front to rear. Holotype also with four posterior maxillary teeth on right side, other teeth bearing bones not examined.

Head glands examined on right side of holotype by reflecting head skin (UTADC 6733–34, Fig. 6): granular gland situated under rostral shield; salivary gland developed under supralabials 1–3; nasal gland occupying area below prefrontal shields (prefrontal shields, posterior nasal, and preocular), 1.18 mm wide, 1.93 mm long, rhomboid; Harderian gland under anterolateral portion of parietal (and posterior of supraocular, upper postocular, and anterior area of temporal), 1.41 mm long, 0.80 mm wide, triangular, apex caudal, with a moderate posterior extension; venom gland triangular (rounded anteriorly and posteriorly), corners at middle of border between fourth and fifth supralabial, middle and back of sixth supralabial, and middle of temporal at level of middle of eye, 1.45 mm wide, 2.70 mm long, not inflected ventrally and confined to head; venom duct 2.73 mm in length; infralabial gland bordering mouth under lateral tips of mental to middle of fifth infralabial, with two areas differentiated, one anterior and longer, and one posterior under the fourth and fifth infralabials; the anterior infralabial area is 3.11 mm in length, overlapping with the posterior infralabial area of 1.59 mm in length; salivary, nasal, Harderian and infralabial glands yellowish and of irregular texture (granular), venom gland whitish and smooth; *m. adductor mandibulae externus superficialis* (AES) forming a continuous loop, from upper parietal surface above and behind Harderian gland to insertion on compound bone.

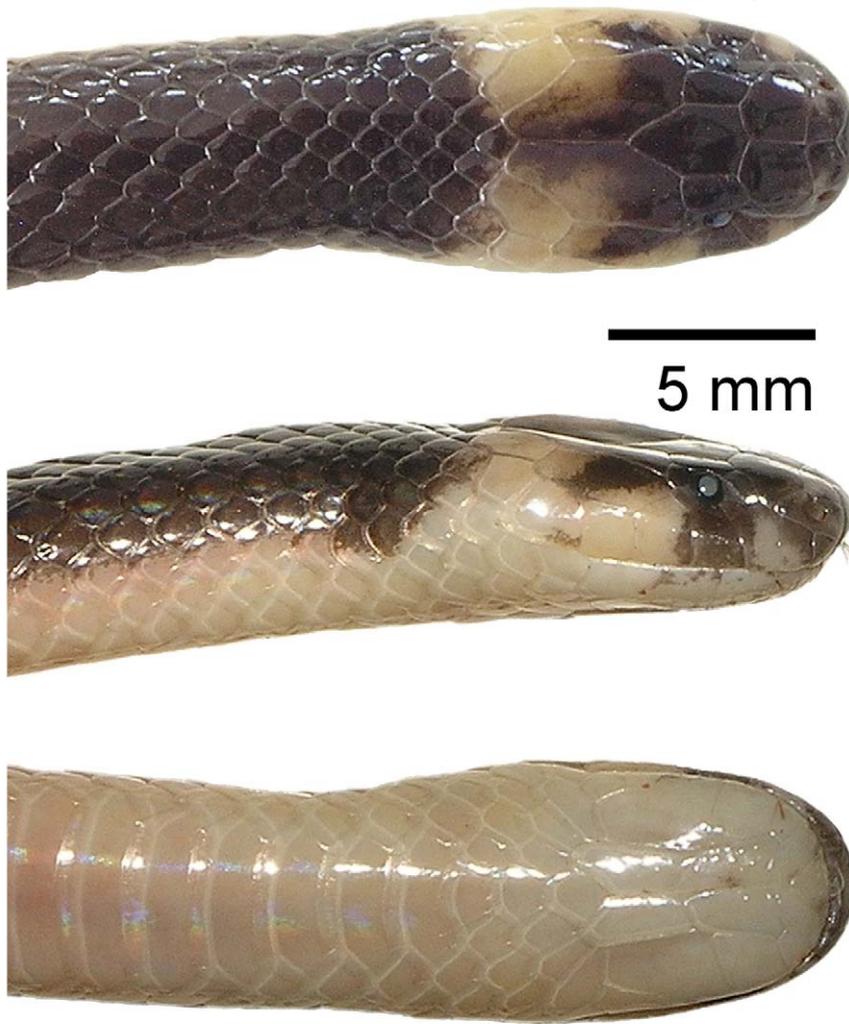


FIGURE 4. Dorsal (top), right-lateral (middle), and ventral (bottom) aspects of the head of *Calliophis castoe*, adult male holotype, BNHS 3461, showing distinct color pattern of long and medially broken nuchal band, bicolored lateral body pattern, and immaculate chin and throat area.



FIGURE 5. Left-lateral aspect of head of *Calliophis castoe*, adult male paratype, from Karwar, Karnataka, India, elevation ca. 15 m, BNHS 2191, showing contact between prefrontal and second supralabial, anterior preocular and small supralabial 7. Maxillary fang is visible, arising between supralabials 2 and 3.

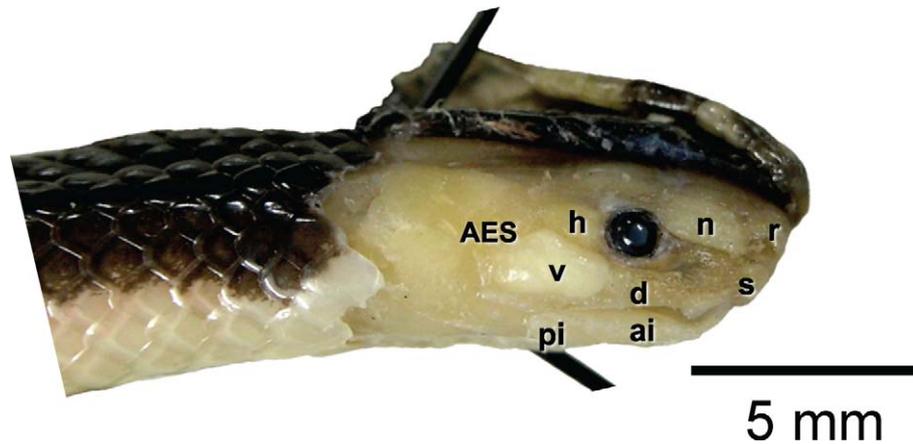


FIGURE 6. Right-lateral aspect of head of *Calliophis castoe*, adult male holotype, BNHS 3461, showing head glands and associated structures after skin reflection: rostral gland (r); salivary gland (s); nasal gland (n); Harderian gland (h); venom gland (v); venom duct (d); infralabial gland, with two areas differentiated, anterior (ai) and posterior (pi); *m. adductor mandibulae externus superficialis* (AES).

Left hemipenis of holotype exposed *in situ*, slightly bifurcated, spinous, reaching level of subcaudal 6; hemipenis and associated muscles (*m. retractor penis magnus*, *m. propulsor*, and subvertebral and medial hypaxial musculature) and *m. constrictor sacculi ani* not covered by melanic *epymisium*; spines numerous, present throughout the length of the organ, from base (level of subcaudal 1) to tip, spines slightly larger at level of third and fourth subcaudal; cloacal scent glands oval, ending at level of subcaudal 2.

Right hemipenis of holotype, removed, fully everted and partially expanded (Fig. 7, UTADC 6733–34), is bilobed, about 6.2 mm in length, and 1.3 mm in width, at apices. The organ includes a pedicel with tiny spines for the first 1.5–2 mm. Between 1.5 mm and the tips of the lobes there are spines all around the hemipenis. At mid-hemipenis there are 17 spines around the organ. Spines diminish in size distally, from about 0.4 mm at about 2 mm from the base to about 0.1 mm near the tips. The hemipenis bifurcates 0.3 mm before the terminus and the *sulcus spermaticus* bifurcates approximately 0.1 mm before the hemipenial furcation. The *sulcus spermaticus* is bordered at the base (sinistrally) by a flap-like fold, is centripetal, and terminates distally on each lobe. There are no grooves, flounces, papillae, or calyces.

Hemipenes of male paratype BNHS 2191 exposed *in situ* and dissected, differ from those of holotype in being relatively larger, reaching level of subcaudal 7 and also bifurcating at this level; also without any melanic *epymisium*; level of insertion of *m. retractor penis magnus* not examined; spines also numerous, throughout the length of the organ; cloacal scent glands slender and dessicated, difficult to examine.

Color (Figs. 1–5). Holotype, coloration of recently killed specimen as recorded with a Nikon D90 digital camera, UTADC 6724–31: Dorsum of head and body Dusky Brown (19), turning Burnt Sienna (132) towards sides of body, with no dorsal bands or blotches over body; dark color extending to upper half of scale row 2, on body, and one half scale more in neck area; Dusky Brown (19) color on top of head extends as suborbital and temporal markings, restricted to rostronasal, circumorbital, frontal, and anterior and medial parietal surfaces; small dark markings covering part of lower edge of seventh supralabial, on right side, and upper edge of fourth infralabials; chin and area between supralabials 2 and 3 Pale Horn Color (92); subtemporal surface Chamois (123D) to Yellow Ocher (123C), turning whitish Pale Horn ventrally; head band interrupted by interparietal Dusky Brown (19) coloration, band occupying posterolateral surface of parietal, posttemporal, posterior labials, and first two rows of lower neck scales, Spectrum Orange (17) above, Chamois (123D) to Yellow Ocher (123C) laterally, whitish Pale Horn ventrally; body flanks, first two scale rows, Salmon Color (106) anteriorly to Flame Scarlet (15) posteriorly; no spots on ventral scales; body venter Salmon Color (106), anteriorly, to Flame Scarlet (15), towards anal plate; underside of tail and first row of dorsal scales on tail Burnt Orange (116), slightly darker near vent.

Referred specimen, in life, as recorded with a Nikon D90 digital camera, UTADC 6738–45 (Fig. 1): Similar to holotype; Dorsum of head, neck, and tail Dusky Brown (19) to Warm Sepia (221A); dorsum of body Deep Vinaceous (4), slightly darker and brownish middorsally, with no dorsal bands or blotches; dark color extending to upper half of scale row 2, on body, and one more scale on tail area; Warm Sepia (221A) color on top of head

extends as suborbital and temporal markings, restricted to rostronasal, circumorbital, frontal, and anterior and medial parietal surfaces; chin and area between supralabials 2 and 3 pale Flesh Color (5); Dusky Brown (19) interparietal mark not interrupting posterior half of head band; subtemporal and posttemporal surfaces Spectrum Orange (17), turning Vinaceous (3) ventrally; body flanks, first two scale rows, Vinaceous (3) anteriorly to Flame Scarlet (15) posteriorly; no spots on ventral scales; first row of dorsal scales on tail Burnt Orange (110), slightly darker near vent.



FIGURE 7. Right hemipenis of *Calliophis castoe*, adult male holotype, BNHS 3461. Sulcate (left) and asulcate (right) views showing spinulated body from base to tips and *sulcus spermaticus* dividing towards lobes.

Subadult female paratype (BNHS 3474) coloration, in life, as recorded with a Nikon D300S digital camera, UTADC 6831–32 (Fig. 2): Dorsum of head and body Burnt Sienna (132), turning Raw Umber (223) towards sides of body, with no dorsal bands or blotches over body; dark color extending to upper half of scale row 2, on body, and

one half scale more in neck area; Burnt Sienna (132) color on top of head extends as suborbital and temporal markings, restricted to rostronasal, circumorbital, frontal, and anterior and medial parietal surfaces; small dark markings covering part of upper edge of third and fourth infralabials, on right side; underside of head Pink (7); subtemporal and middle of third infralabial surface Chamois (123D), turning Pale Horn ventrally; head band interrupted partially by interparietal Burnt Sienna (132) coloration, band occupying posterolateral surface of parietal, posterior surface of temporal, posttemporal, posterior labials, and first two rows of lower neck scales, Chamois (123D) above, Pale Horn ventrally; body flanks, first two scale rows, Warm Buff (118) to Vinaceous (3), towards venter; no spots on ventral scales; body venter Vinaceous (3) anteriorly, Deep Vinaceous (4) at midbody, Salmon Color (106) at posterior third of body, to Spectrum Orange (17), before anal plate; anal plate Pale Horn Color (92); tail venter Spectrum Orange (17).

Holotype in preservative (Figs. 3–4): Dorsum Sepia (119), with Pale Horn Color (92) markings on head; chin Pearl Gray (81); body venter Beige (219D) anteriorly, turning Vinaceous Pink (221C) posteriorly; underside of tail Vinaceous Pink (221C), anal plates slightly lighter.

Male paratype, after more than 100 years in preservative (Fig. 5): Dorsum Antique Brown (37), darker above, with Pale Horn Color (92) markings on head; chin Pearl Gray (81); body venter Drab-Gray (119D) anteriorly, turning Pale Horn Color (92) posteriorly and under tail.

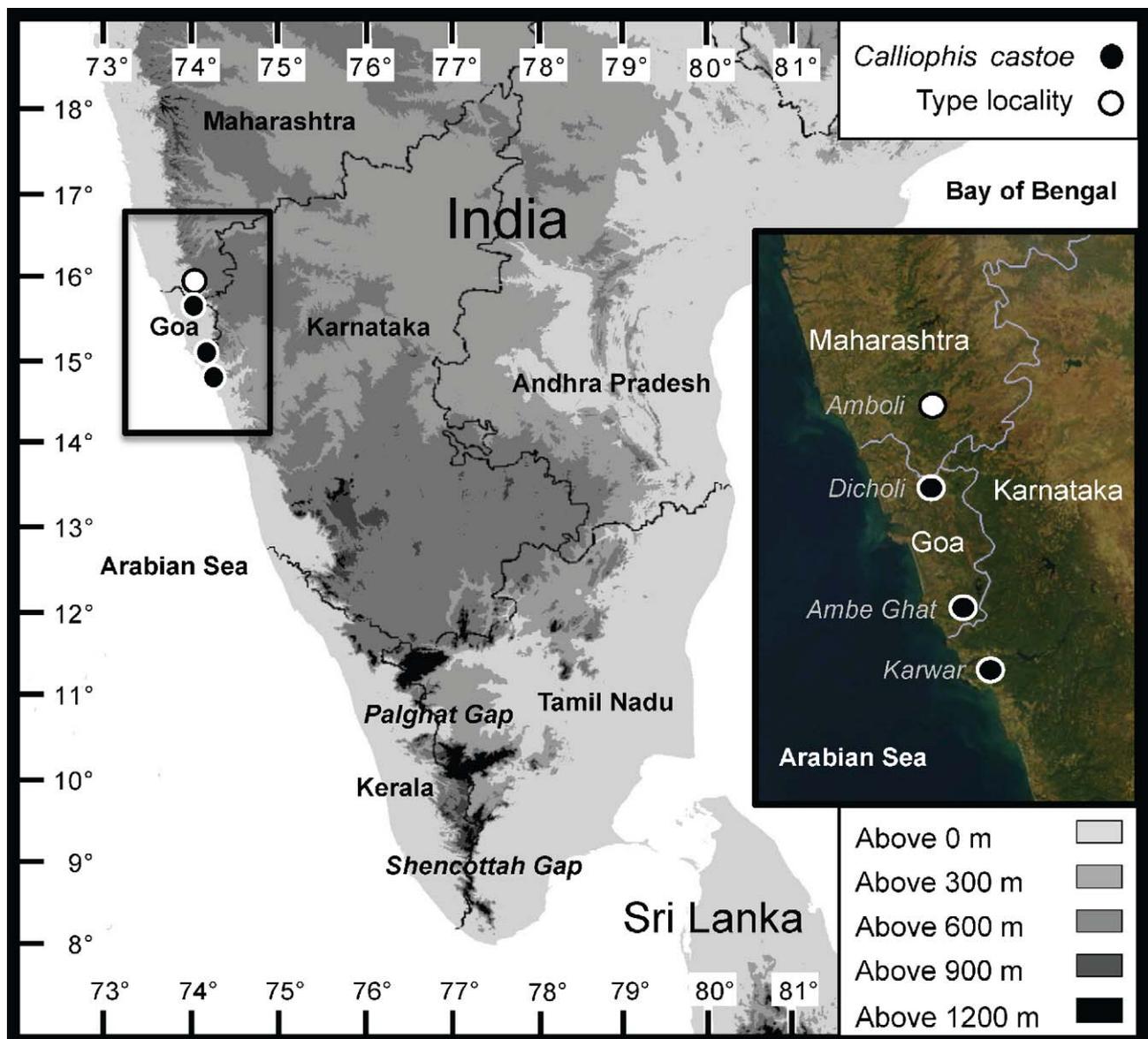


FIGURE 8. Distribution of *Calliophis castoe* in India.



FIGURE 9. Type locality of *Calliophis castoe*, Amboli, Sindhudurg district, Maharashtra, India, elevation ca. 750 m, 1 July 2005. Image shows leaf litter and moss covered tree trunks. Photo by E. N. Smith (UTADC-6735).

Habitat, distribution and natural history (Figs. 8–11). The four known localities for *Calliophis castoe* lie in three different states along the Malabar Coast and adjacent Western Ghats of India, in Goa, Karnataka and Maharashtra. The altitudinal range for *C. castoe* is from near sea level (ca. 10–15 m) in Goa and Karnataka to about 715 m in southern Maharashtra. The mean annual precipitation near the lowland localities has been recorded between 2900 and 3500 mm, and at the type locality of Amboli it is known to reach 7445 mm (Yadav & Sardesai 2002; Jog 2009). The region experiences precipitation between 215 and 265 days per year (Champion & Seth 1968), with most rain (about 80%) falling between June and August (India Meteorological Department 2010). According to the forest type classifications by Champion (1936) and Champion and Seth (1968) the two lowland sites are within Tropical Semi-Evergreen Forest and the upland locality within Tropical Wet Evergreen Forest. Presently the Amboli and Karwar localities support dense forests and/or secondary growth, but the Goa locality of the referred specimen lies in the periphery of the heavily populated town of Dicholi and is only covered by subsistence crops dominated by coconut groves. The referred specimen from Goa was found at the house of Amrut S. Singh, a local from the Animal Rescue Squad of Dicholi, who reported to us that this distinctive species is very common in the area. The holotype was found freshly killed on a road, at 1815 h. The small female paratype comes from Ambe Ghat, Goa, a locality near the south border of the state. This specimen was found at a distance of less than 4 m from a specimen of *C. nigrescens* (BNHS 3475).

Relationships. *Calliophis castoe* is probably closely related to highland *Calliophis* with longitudinal stripes or stripes and spots that also inhabit wet forests in peninsular India, namely, *C. nigrescens* and *C. beddomei*. These species share a small and spinous hemipenis with only slight terminal bilobation, short *sulcus* furcation, and no associated basal pocket. Some *C. beddomei* specimens share with *C. castoe* a contact between the prefrontal and third supralabial, but *C. castoe* has an unpatterned body, no dark pigmentation on the last supralabial, and a wide post-temporal light band. *Calliophis beddomei* has a pattern of dorsal spots adjacent to a middorsal stripe, never being dorsally unicolored, and has lower ventral (Males 228–242 vs. 240–254; Females 216–222 vs. 254) and subcaudal (Males 41–46 vs. 45–53; Females 34 vs. 46) scale counts. When compared to *C. castoe*, *C. nigrescens*

has a pattern of stripes or stripes and spots along the body (no patterns in *C. castoe*) and lower subcaudal counts (Males 33–48 vs. 45–53; Females 29–39 vs. 46). In life, specimens of *C. nigrescens* we have seen, have bright-red or coral-red subcaudal scales with white borders. These white borders are more prominent at the midline suture, forming a zigzag midventral white stripe. The underside of the tail of *C. castoe* is uniformly orange, with no white borders. As mentioned above, *Calliophis castoe* has more maxillary teeth behind the fang and less pterygoid teeth than either *C. beddomei* or *C. nigrescens*. Hemipenial morphology clearly relates the new species to *C. beddomei* and *C. nigrescens*, but no exclusive sister relationship between any two of these species is clear from the characters presented.

Comparison of the DNA sequences obtained for one specimen of *C. castoe* (Paratype BNHS 3474, Genbank accession number JQ282155) and the specimen of *C. nigrescens* (var. *khandallensis*) found in close proximity to the first (BNHS 3475, Genbank accession number JQ282156) shows high genetic differentiation, supporting our new species description. The sequences were 12% different, having 705 bp of identical sequence on an 807 bp alignment. The ND4 protein-coding segment (666 bp) showed no indels between the two taxa, and differed in 14 non-synonymous and 76 synonymous substitutions. The *C. nigrescens* sequence had five deletions and seven other changes in its tRNA coding segment, as compared to that of *C. castoe*. One deletion is in the D-loop of the tRNA-His and four occur in the Acceptor-stem (two 1-bp deletions) and contiguous D-Arm (2 bp, probable adjacent 2-bp deletion) of the tRNA-Ser(AGY). The striped coralsnakes of peninsular India exhibit remarkable variation in color pattern and lepidosis, deserving a more thorough analysis comparing morphology and molecules when more material becomes available.



FIGURE 10. Type locality of *Calliophis castoe*, Amboli, Sindhudurg district, Maharashtra, India, elevation ca. 750 m, 2 July 2005. Image of a herpetological field party searching for snakes along a forest road, during monsoon season. Photo by E. N. Smith (UTADC-6736).



FIGURE 11. Photographs taken near one of the known localities for *Calliophis castoe*, in the town of Karwar, Uttara Kannada district, Karnataka, India, 9–10 July 2005. A. Mountains flanking Karwar to the southeast, near road to Shirwad. B. Southeastern valley of Karwar, 10 m, photo taken from hill above town. C–D. Forest near National Highway 63, between Ramanguli and Idgundi, elevation ca. 250 m, 14.863686° N, 74.654489° E. Photos by E. N. Smith (UTADC-6746–49).

Acknowledgements

This paper is based in part upon work supported by the National Science Foundation (grant no. DEB-0416160 to ENS) and the Instituto Bioclon (grant to ENS). Roy W. McDiarmid and S. W. Gotte, USNM, kindly facilitated examining material under their care. Colin McCarthy and D. Gower kindly provided space and material to ENS for nearly one month at BMNH. A. Captain provided valuable information, photos, assistance and discussions about Indian coralsnakes at the BNHS and in Pune. At the Reptilia Section of the Zoological Survey of India in Kolkata B. H. Channakesava Murthy kindly provided logistical support while examining specimens for several days. T. LaDuc (TNHC), R. Brown (KU), R. Murphy (ROM), R. Inger and H. Voris (FMNH), and J. Vindum (CAS) provided several loans of specimens. Sushil K. Dutta (North Orissa University, India) kindly facilitated specimens and locality data. Information and photographs from Indian species of coralsnakes were kindly provided by N. Khaire (Katraj Animal Rescue Centre, Pune), I. Das (Universiti Malaysia), Harikrishnan S. (Wildlife Institute of India), I. Agarwal (Centre for Ecological Sciences, Bangalore), A. Das and M. Firoz Ahmad (Utkal University, Orissa), A. S. Lobo (Goa), K. Vasudevan (Wildlife Institute of India), A. Zacharia (Kalpeta), I. Simpson (Bangalore), A. Padhye (Abasaheb Garware College), J. Palot (ZSI-Western Ghats Field Research Station), P. Jawahar (Madras Museum), V. Kalaiarasan and P. Kannan (Chennai [Madras] Snake Park), A. Rajendran (St. John's College, Tirunelveli), H.T. Lalremsanga and C. Lalrinchhana (Department of Zoology, Mizoram University), R. Whitaker (Agumbe Rainforest Research Station), T. S. N. Murthy (ZSI, Madras), and S. D. Biju (University of Delhi). G. Thirumalai, R. Aengals and P. Mukhopadhyay provided valuable assistance at the ZSI-Southern Regional Station. Permission to examine material at the stations of the Zoological Survey of India was kindly provided by J. R. B. Alfred. Todd Castoe kindly took measurement data on specimens housed at Indian

Museums. In Sri Lanka, information and original photographs of the holotype of *C. haematoetron* were taken by M. Bahir and provided by the WHT's managing trustee, R. Pethiyagoda. From Bhutan, information and photos have been facilitated by J. T Wangyal (Bumdeling Wildlife Sanctuary, Bhutan). Coralsnakes in Taiwan have been studied thanks to M. Tu (National Taiwan Normal University, National Ilan University), T. Lin (Taiwan Endemic Species Research Institute), W.-S. Huang and N.-H. Jang-Liaw (National Museum of Natural Sciences, Taichung), J.-T. Lin (Taiwan Museum, Taipei) and S. Cheng and H.-Y. Ou (National Taiwan University). In Japan specimen examination was possible thanks to the efforts of H. Ota (University of the Ryukyus and Kyoto University Museum Zoological Collection) and S. Kawada (National Science Museum, Tokyo). Access to Thai specimens has been provided by K. Thirakupt (Chulalongkorn University, Thailand), and J. Nabhitabhata and T. Chan-Ard (Thailand Natural History Museum, Pathum Thani). Specimens of *Calliophis* from Indonesia have been studied thanks to the courtesy of I. Sidik (Bogor Museum, Indonesia). For help with translations we thank V. Philip Cyriac, U. Smart, Veena P.G., and R. Abhaya Simha. We are grateful to K. Praveen Karanth and A. Lajmi of the *Evolving Phylo-Lab* at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore, for kindly providing us with DNA sequences of species compared.

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APPENDIX. Specimens examined.

Specimens for which dentition was examined are marked with an asterisk.

- Calliophis beddomei* (4). INDIA: **Karnataka**: Chikmagalur: Koppa, Mysore, ZSI (Calcutta) 13559; **Tamil Nadu**: Nilgiris, Nilgherries, CAS 17266; Salem: Shevaroys, CAS 17262; Salem: Shevaroys, 4000 ft, BMNH 1946.1.17.99* (74.4.29.49, Holotype of *C. beddomei*).
- Calliophis bibrioni* (17). INDIA: **Karnataka**: Kodagu: Coorg, BNHS 2119*, BMNH 1937.4.3.15; **Kerala**: Kannur: Thottada, ZSI (Calicut) 18-viii-1996; Kasaragod: Cherupuzha, ZSI (Calicut) 12-vi-1996; Trivandrum: Chathankode, BNHS 3460; Wayanad: Wynad, BMNH 72.1.2.7; CAS 17268; MAD (no number); Manantody, Malabar, 3000 ft, BMNH 1946.1.17.93* (74.4.29.52, Type of *C. cerasinus*); **South India**: Unknown, ZSI (Calcutta) 11376; **Tamil Nadu**: Nilgiris: Mudumallays, BMNH 74.4.29.51*, BMNH 74.4.29.53*; Pollachi: Anamalai Tiger Reserve, Karuneerppallam, ZSI-Calicut 2123; Anamalai Tiger Reserve, Topslip, Road near Erumapara ZSI (Calcutta) 25638; Anamalai Tiger Reserve, Topslip, Karian Shola main trail ZSI (Calcutta) 25639; Rockwood Estate, BMNH 1922.5.25.58; **Western Ghats**: Unknown, MNHN 5070 (Holotype of *C. bibrioni*).
- Calliophis bivirgatus* (15). INDONESIA: **Kalimantan Tengah**: Boentok, C. Borneo [Buntok], BMNH 1910.1.12.18; Kemanen, MZB 1447*; **Kalimantan Timur**: Balakpapan [Balikpapan], Dutch Borneo, BMNH 1912.6.26.23; **Sumatera Utara**: Sumatra: Deli [Delitua], BMNH 89.12.26.14; **Unknown**: Unknown, MZB 3183*; MALAYSIA: **Johor**: Gunong, Pulai, Johore [Gunung Pulai],

BMNH 97.12.28.27; Johore Bahru, W Malaysia [Johor Baharu], BMNH 97.12.28.57; **Kedah**: Kedah, Malaya, BMNH 95.10.7.23; **Kelantan**: Kelantan N.E. W Malaysia, BMNH 1912.2.22.25–27; **Perak**: Sungkai, BMNH 1969.334; **Sabah**: Bongon, N. Borneo: (6 33': 116 58 Sabah), BMNH 93.5.30.13; SINGAPORE, BMNH 1930.12.2.12–13.

Calliophis castoe (3). See species description.

Calliophis gracilis (9). INDONESIA: **Aceh**: Paru (= Parue, Paroe) [original: Moluccas: Ceram: "Piroe (= Piru)"], USNM 103517*; MALAYSIA: **Johore**: Johore [Johor Baharu], ZSI (Calcutta) 13323; **Pulau Pinang**: Pinang [Georgetown], BMNH 1946.1.19.17* (94.6.25.13, Holotype of *C. nigromaculatus*), BMNH 60.3.19.1255 (2 specimens); **Selangor**: Batang Padang, Malaya [Batang Berjuntai], BMNH 1903.4.13.96; SINGAPORE: (Bangkok) Singapore, BMNH 98.4.2.27*; UNKNOWN: R.R.*, 55.10.16.387.

Calliophis haematoetron (3). SRI LANKA: [Central Province]: Wasgomuwa National Park, ca. 90 m, WHT 1621 (Holotype); Matale, Rattota, Clodagh Estate, ca. 570 m, USNM 120334–120335 (Paratypes).

Calliophis intestinalis (58). INDONESIA: Java, BMNH 96.9.28.11*; **Banter**: Cikaniki, TNGH Resort, MZB 2660*; **Jawa Barat**: Ciluar, Kadung Halang, Bogor, MZB 2209*; Kabupaten Sukabumi (?), KU 64364; **Jawa Timur**: Willis Mk, Kediri, Java: 5000 ft, BMNH 85.12.31.30*; Prizan, E. Java [Prigen], BMNH 96.9.28.11*; **Kalimantan Barat**: Sintang, Borneo, BMNH 1946.1.17.96* (Holotype of *E. thepassi*), BMNH 1946.1.19.19 (Holotype of *Elaps tetrataenia*); **Kalimantan Selatan**: Tandjong, S.E. Borneo [Tanjung], BMNH 96.2.17.14; **Lampung**: Tn. Bukit Barisan Selatan, Lampung, MZB 2176*; **Sulawesi Utara**: Manado, Celebes, BMNH 71.7.20.205; **Sumatera Barat**: Fort de Kok [Kock], W. Sumatra, BMNH 1928.2.18.45; Siberut, Mentawai Islands, BMNH 1946.1.3.65* (1926.3.18.18, Holotype of *Calamaria klossi*); P. Siberut, Kep. Mentawai, Sumatera Barat, MZB 2228*; **Sumatera Utara**: Labuen [Deli], BMNH 64.9.2.27*; Nias: Unknown, BMNH 84.12.31.10; MALAYSIA: **Johore**: Gungong [Gunong] Pulau, S. Johore, BMNH 1971.1521; Gunong Pulau catchment area, S. Johore, 300 ft., BMNH 1971.793; **Kelantan**: Kelantan, Malaya, BMNH 1905.2.7.12*, 1911.6.29.6–8; **Kuala Lumpur Federal Territory**: Kuala Lumpur, Selangor, BMNH 98.9.22.59; **Negeri Sembilan**: Repoh Est., Negri Sembilan, Malaya [Tampin], BMNH 1931.5.14.10*–11; **Pahang**: Fraser's Hill, Red Cross Guest House, BMNH 1977.2026*; Pahang, Malaya: 400 ft, BMNH 1936.6.10.6; **Perak**: Batang, Padang [Daerah Batang Padang], BMNH 1903.4.13.93; **Pulau Pinang**: Pinang [Georgetown], BMNH 1946.1.18.2 (Holotype of *M. lineata*), 60.3.19.1270; Prov. Wellesley [Seberang Perai], Malaya, BMNH 96.6.25.30*–31; **Sabah**: Kina Balu, N. Borneo, BMNH 95.11.7.30–31 (Syntypes of *M. i. everetti*); **Sarawak**: Kichi District, BMNH 1911.1.30.27*; Matang, BMNH 72.2.19.48, 60.3.19.1168*; Mt. Dulit, BMNH 91.8.29.32 (2); Unknown, BMNH No number*; PHILIPPINES: **Unknown**, BMNH 1946.1.19.22* (Holotype of *Doliophis philippinus*); **MIMAROPA**: Palawan: Balabac, BMNH 1894.6.30.59; Palawan: Puerto Princesa, BMNH 79.4.16.13; Palawan: Quezon: Poblacion Quezon, National Museum Complex, KU 309511; Palawan: Rizal: Mt Mantalingahan peak 2, KU 311415; **Mindanao**, BMNH 72.8.20.55–56; **Northern Mindanao**: Camiguin: Mambajao, Barangay Pandan, Sito Pamahawan, KU 310369; **Zamboanga Peninsula**: Zamboanga City Prov.: Zamboanga City, Barangay Pasanonca, Sitio canucutan, Pasanonca Natural Park, KU 314913; SINGAPORE: **Singapore**, BMNH 80.9.10.15–16*, 80.9.10.17, 94.6.25.12*, 95.1.8.10; THAILAND: **Nakhon Si Thammarat**: N. Sritamarat [Nakhon Si Thammarat], S. Thailand, BMNH 1968.831*; **Pattani**: Bukit Besar, Malaya [Sai Kao Waterfall], BMNH 1903.4.13.94; UNKNOWN, BMNH 56.12.26, 72.2.19.48, 89.11.8.3; VIET NAM: **Lang Son**: Mam-Son Mts. Tonkin: 3–4000 ft [Mau Son Mts], BMNH 1903.7.2.25*.

Calliophis maculiceps (39). MYANMAR: **Mon**: Moulmein, BNHS 2177; **Tanintharyi**: Amherst, Tenasserim [Tanintharyi], ZSI (Calcutta) 2940; **Yangoon**: Rangoon, BNHS 68.4.3.33, 2175–76, ZSI (Calcutta) 2937, 2939, ZSI (Calcutta) 2948; THAILAND: **Chiang Mai**: Amphoe [District] Mae Wang: N. Siam, Mae Wang Forest [Mae Wang Forest], BMNH 1938.8.7.57; Chiangmai (Chiang Mai), USNM 101519*; **Chon Buri**: Gulf of Siam: Koh-Si-Chang [Ko Si Chang], BMNH 1938.8.7.45; Hup Bon [Hup Baun], BMNH 1968.827–29 1974.5195; Nong Khor [Ban Nong Kho], USNM 70331*; Nong Khor, Siam [Ban Nong Kho], BMNH 1968.821; Sriracha [Si Racha], BMNH 1968.822; **Chumphon**: Lang Suan, BMNH 1968.823; **Kanchanaburi**: Kamburi [Kanchanaburi] BMNH 1914.1.27.2; Sai Yok Camp: BMNH 1987.1152; **Krung Thep Mahanakhon**: Bangkok, BNHS 2174*; Bangkok, Siam, BNHS 2174 (2) [260-2]; **Lop Buri**: Lopburi [Lop Buri], BMNH 1914.1.27.3; **Nakhon Si Thammarat**: Khao Ronpilun [Khao Ron Phibun], 1000 ft, BMNH 1974.5196; **No other data**, BMNH 58.4.20.6* (Holotype); **Nong Bua Lamphu**: Nong Kai Ploi, Thailand, BMNH 1946.1.17.81 (1937.2.1.23, Holotype of *C. m. univirgatus*); **Phrae**: Prae, Siam [Phrae], BMNH 1968.824; **Phuket**: Phuket Town (suburbs), Phuket Island, S. Thailand, BMNH 1976.22.82; **S. Thailand**, BMNH 1987.1153; **S.W. Siam**, BMNH 1968.825*–26; **Siam**, BMNH 1968.820; **Nakhon Nayok**: Umper Sarika water fall, BMNH 1987.1154; VIET NAM: **Cochin China**: No other data, BMNH 1920.1.20.269* (2, large examined for dentition), 85.3.3.10; **Ho Chi Minh City**: French Cochin China, Saigon [Thành Pho Ho Chi Minh], BMNH 1938.8.7.58.

Calliophis melanurus melanurus (18). INDIA: **Andhra Pradesh**: Putlegudem Village, Nagarjumakonda valley: Alt: 360–370', Lat: 16deg, 29minN, Long 79deg, 14minE, ZSI (Calcutta) 21460; **West Bengal** [?]: Bengal, Nerva, BMNH 1946.1.17.86 (Holotype of *C. trimaculatus*); **Karnataka**: Dharwad: Dharwar: Gadag, BNHS 2171; **Maharashtra**: Dhulia: [Dhule], BNHS 2173; Mumbai: J.J. Hospital ground, Bombay city, BNHS 2172; Nasik: Deolali, Bombay, BNHS 2170; Pune: Pune, BNHS No Number (1–2); Ratnagiri, BNHS No Number (3); **Tamil Nadu**: Anamallies: [Anaimalai], BMNH 74.4.29.44*–45; Chennai: Madras, MAD 1948/10; Kanchipuram: Chingleput, MAD No Number; Tiruchchirappalli: Trichinopoly [Tiruchchirappalli], BMNH 82.8.26.1; Unknown, MSP No Number, **Unknown**: Unknown, BMNH 52.10.4.60.

Calliophis melanurus sinhaleyus (8). SRI LANKA: **North Central Province**: Anuradhapura, BMNH 1915.5.3.12; **North Western Province**: Puttalam, 5 m, NSMT-H 3786*; **Sabaragamuwa Province**: Balangoda: S. Sri Lanka, BMNH 1937.8.1.3; **Southern Province**: Between Thangalla and Kahandamodara: Diyawaragama, To be deposited at NMSL (3); Hambanthota District: Between Sooriyawewa and Mirijjawela, To be deposited at NMSL (1–2); Kirinda, WHT 1753.

Calliophis nigrescens (42). INDIA: **Goa**: South Goa: Ambe Ghat, 295 m, 15.06400° N 74.16578° E, BNHS 3475; **Karnataka**: Chickmagalur: Banakal [Kannada], BNHS 3157; Kodagu: Mercara, Coorg, BNHS 2186*; **Kerala**: Ernakulam: Cochin Hills, West India, USNM 42467*; Palakkad: Palagapanday, S. India, BNHS 2196*; Unknown: N. Travancore Hills, BMNH 72.1.2.8*; Unknown: Punakanaad, Travancore, BMNH 1924.10.13.24; Wayanad: Nilgiri, Wynad, BMNH 1955.1.3.63–65; Wayanad: Wynad, BMNH 74.4.29.48, 82.8.26.2–3, 82.8.26.7; **Maharashtra**: Pune: Bhimashankar, BNHS 3181; Satara: Mahabaleshwar, BNHS

- 2192, BNHS 2754; Satara: Mahableshwar, Pauchgari, Bombay, BMNH 1937.3.1.4–5; Satara: Panchgani, BNHS 2193; Sindhudurg: Amboli [Village], BNHS 3348; **Tamil Nadu**: Coimbatore: Anamallays: 4700 ft, BMNH 85.3.21.10*, 88.1.27.62–63; Coimbatore: Anamallays: 4701 ft, BMNH 85.3.21.11; Coimbatore: Anamallays, BMNH 82.8.26.4–6, 1955.1.3.66–68; Nilgiris: Coonoor, Madras, BNHS 2179 ½*; Nilgiris: Kotagiri, Madras, BNHS 2182 1/3*; Nilgiris: Kotagiri, Nilgherries, BMNH 91.11.27.11; Nilgiris: Near Coonoor, BNHS 2188*; Nilgiris: Nilgherries, BMNH 68.4.3.32* (2, male examined for dentition), 74.4.29.40*; Nilgiris: Nilgherries: 6000 ft, BMNH 64.3.9.7; Tirunelveli: Tinnevely Hills, BMNH 74.4.29.239, 74.4.29.47; **Unknown**: BMNH 1946.1.17.78 (61.11.7.21–22, Holotype).
- Hemibungarus calligaster** (7). PHILIPPINES: Albay, S.E. Luzon, BMNH 95.1.11.9; **Unknown**: BMNH 72.10.11.13–14, 72.10.11.18*, R.R.*; NSMT-H 3785*; **Negros Oriental**: N.E. Slope Cuernos de Negros, 2600 ft, BMNH 1964.664.
- Sinomicrurus hatori** (6). TAIWAN: **Hsinchu**: Jianshih Township [Lat 24.596332, Long 121.282109, 1520 m], NTNUB 241513 (CH-1)*; **Taipei**: [Wugu Township]: Guanyin Mountain [Kuan-yin Shan, Lat 25.128772, Long 121.424046, 360 m], NTUM 371*; **Unknown**, NTUM 85*, 462*; **Yilan**: Dongshan Township [Lat 24.629526, Long 121.757188, 30 m], TESRI-R 132*; Datong Township, Taiping Mountain [Lat 24.498807, Long 121.532566, 1942 m], NTUM 176*.
- Sinomicrurus japonicus boettgeri** (7). JAPAN: **Okinawa**: Great Loo Choo [Okinawa Shima], BMNH 92.9.3.14*; Okinawa [Okinawa Shima], BMNH 1906.8.16.12–14; **Unknown** [Probably Okinawa Island], KUZ R-29938*, 56069*; UTA R-58837*.
- Sinomicrurus japonicus japonicus** (11). JAPAN: **Okinawa** [Previously as Kagoshima Prefecture], Amami-oshima Island, MUR (RUMFZH) 740*; **Kagoshima**: Anami-Oshima [Amami O Shima], BMNH 1906.8.16.16*–17*, 1906.8.16.18–19; Oo Sima [Amami O Shima], BMNH 95.9.9.2–3; Nagasaki (?) [Amami O Shima], BMNH 1946.1.17.97* [Holotype]; **Unknown**, KUZ R-30403*, 47777*, 52588*.
- Sinomicrurus japonicus takarai** (1). JAPAN: **Unknown**, KUZ R-52851*.
- Sinomicrurus kellogi** (1). CHINA: **Fujian**: Kuantun, NW Yokien, BMNH 99.4.24.58*.
- Sinomicrurus maccllellandi iwasaki** (2). JAPAN: **Unknown**, KUZ (Ref. tag) 1031 (red tag)*, KUZ R-28453*.
- Sinomicrurus maccllellandi univirgatus** (10). INDIA: **Himachal Pradesh**: Kasauli, Punjab, BMNH 1948.1.7.7*; Kasuli [Kasauli], Punjab, BMNH 1946.1.17.82 (1937.4.3.14, Holotype of *C. m. nigriventer*); **West Bengal**: Darjeeling, BMNH 1940.3.4.42, 91.9.11.24*; Darjeeling, Darjeeling, Phubesering Tea Estate, BNHS 2218*; NEPAL: **Bagmati**: Katmandu, ZSI (Calcutta) 8771; **Nepal**, BMNH 1946.1.17.84* (Syntype of *E. univirgatus*), 1946.1.17.90* (Syntype of *E. univirgatus*); UNKNOWN, BMNH 80.11.10.143 (2).
- Sinomicrurus maccllellandi maccllellandi** (43). CHINA: **Guangxi**: Bose [Baize], Leye County, Panhung [Banhongcun, Lat 24.657242, Long 106.500665, 1171 m], NMNS 3838*; **Hainan**: Nodou [Nadou], BMNH 1913.9.3.9; **Hong Kong**: Hong Kong, ZSI (Calcutta) 12698; May road/ Peak district & Tai Moshan N.T. 865 m (approx.), BMNH 1983.267–69; Pok Fulam y Pok Fulam reservoir road, BMNH 1983.265*–66*; **Jiangxi**: Mts. N of Kiu Kiang [Jiujiang Shi], BMNH 88.1.30.66*; **South China**, BMNH 1948.1.18.3* (61.8.12.41, Holotype of *C. annularis*); INDIA: **Arunachal Pradesh**: No other data, BNHS 3099; **Assam**: Jaipur, Assam, BMNH 1908.6.23.92, BNHS 2211; Margherita, near Ledo, USNM 118038*; Sibsagar, Assam, BNHS 2212*; **Meghalaya**: East Khasi Hills: Shillong, Khasi Hills, BMNH 1907.12.16.22*–23*; West Garo Hills: Tura Garo Hills, Assam [Tura], BMNH 1937.4.3.16*; **Unknown**: Assam, BMNH 67.7.22.2*, ZSI (Calcutta) 2933; **West Bengal**: Darjeeling, BMNH 91.9.11.24*; Darjeeling, Mungpoo, W. Darjeeling, BMNH 1920.7.7.1*; MYANMAR: **Bago**: Pegu [Pegu Yoma], BMNH 68.4.3.34–36; Pegu Hills [Pegu Yoma], BMNH 1908.6.23.93; **Kachin**: Hutong, Bhamo [not Maymyo] District, Upper Burma [Hutong], BMNH 1925.12.22.6*; Hutong, Bhamo District, Upper Burma [Hutong], BMNH 1946.1.19.8–9 (Syntypes of *C. m. concolor*); Myitkyina: 25 23 00 N 97 24 00 E, USNM 122200*; **Mandalay**: Maymo, Burma, BMNH 1926.3.17.5*–6*, 1926.3.17.7, 1975.459*, BNHS 2194, 2200; Maymyo, Upper Burma, BNHS 2204*; Mogok, Upper Burma [Magok], BMNH 1901.4.26.5* [1907.4.26.5 on label]; **Unknown**: Burma, BMNH 1908.6.23.91*, ZSI (Calcutta) 18707; UNKNOWN, BMNH 67.7.22.2, ZSI (Calcutta) No number; VIETNAM: **Bac Khan**: Bac-Kan, Tonkin, BMNH 1928.10.26.25*; **Cao Bang**: Cao Bang, Upper Tonkin, BMNH 96.4.21.4.
- Sinomicrurus maccllellandi swinhoi** (13). TAIWAN: [**Keelung City**]: Jhongjheng, 4 km NE Chilung, National Taiwan Ocean University, Chilung City [Lat 25.148741, Long 121.773925, 30 m], NMNS 3025*; **Pingtung**: [Majia Township]: Makazayazaya [Lat 22.674693, Long 120.670506, 1100 m], NTUM 459*; **Taipei**: Nangang, Nangang: Academia Rd., NTUM 2001.5.22*; Shihding Township, Sihkanshuei [Lat 24.911349, Long 121.610413, 312 m], NTNUB 241518 (CM-4)*; Sindian City, Pingguang [Lat 24.912089, Long 121.53604, ca 87 m], NTNUB 241516 (CM-2)*; [Wugu Township], Guanyin Mountain [Kuan-yin Shan, Lat 25.128772, Long 121.424046, 360 m], NTUM 426*; **Unknown**: Formosa, BMNH 66.6.8.72*; Jhulin Rd., TM-RS 353*; **Unknown**: NMNS 4354*, 4358*, NTNUB 241511 (E899)*, 241512 (E523)*, TM-RS 84*.
- Sinomicrurus sauteri** (5). TAIWAN: **Nantou**: Puli Township, [Lat 23.97058, Long 120.984571, 530 m], TM-RS 145*; Ren-ai Township, 8 km N Wushe, Meifeng, 24 05' 51", 121 10' 15" [Lat 24.093285, Long 121.176392, 2100 m], NMNS 1508*; **Taitung**: Taitung, Taitung City, [Lat 22.790238, Long 121.11516, 50 m], NIU 71001*; **Unknown**, NMNS 4359*; NTNUB 241510 (B853)*.