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A new species of the genus *Opisthotropis* Günther, 1872 (Squamata: Colubridae: Natricinae) from Guangdong Province, China

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Abstract

A new natricid snake of the genus *Opisthotropis* Günther, 1872, *Opisthotropis laui* **sp. nov.**, is described from Mt. Gudou, Jiangmen City, Guangdong Province, China. The new species can be distinguished from other congeners by the combination of the following characters: dorsal scales weakly keeled throughout, in 25:23:23 rows; 10 supralabials; 11 infralabials; two internasals, longer than wide, not touching the loreal; one loreal, not touching the eye; one preocular; two postoculars; one anterior temporal scale; 152 ventrals; 53 subcaudals; body and tail dark olive above, with light yellow crossbars.

Key words: Natricinae, *Opisthotropis laui* **sp. nov.**, snake, taxonomy, China

Introduction

The Oriental snakes of the genus *Opisthotropis* Günther 1872, currently containing about 20 species, are distributed across southern China and mainland Southeast Asia extending to Sumatra (Indonesia), the Philippines and northward to the Ryukyu Archipelago of Japan (David *et al.* 2011; Yang *et al.* 2011). *Opisthotropis* live in flowing streams and some species may occasionally occur in nearby terrestrial habitats in mountain areas, and most are strictly nocturnal. Most of the species are known only from very few specimens, often described based on single specimens due to their secretive habits (Stuart & Chuaynkern 2007; Ziegler *et al.* 2008; David *et al.* 2011; Yang *et al.* 2011). However, three new species of the genus have been described in the last few years, indicating that the diversity of this genus is still not fully revealed (Stuart & Chuaynkern 2007; Ziegler *et al.* 2008; David *et al.* 2011).

In 2002, an aquatic natricid snake was collected from the coastal mountain Mt. Gudou, Jiangmen City, Guangdong Province, China. This single specimen is referred to the genus *Opisthotropis* based upon the following morphological characters: head depressed, indistinct from neck; eye moderate, with rounded pupil; nostril in the nasal, directly upwards and outwards; prefrontal single, very broad, forming a long suture with the frontal; body cylindrical; dorsal scales weakly keeled; anterior supralabials higher than long; ventrals rounded; cloacal scale divided; subcaudals paired (Smith, 1943; Ziegler *et al.* 2008). However, it also presents some morphological characteristics making it unique among recognized *Opisthotropis* species. Thus, we describe this specimen as a new species below.

Material and methods

Measurements were taken with a digital caliper to the nearest 0.1 mm: snout-vent length (SVL) from the tip of the snout to the anterior margin of the opening of the cloaca; tail length (TL) from the posterior margin of the opening of the cloaca to the tip of tail; head length (HL) from the tip of the snout to the posterior margin of the mandible. Scale counts were taken as follows: internasals (IN); number of preoculars (PrO); number of postoculars (PtO);

lorels (L); prefrontals (PrF); number of supralabials (SL); number of infralabials (IL); number of temporals; number of ventral scales (V, following Dowling 1951); number of subcaudals (SC); dorsal scale rows (DSR) were counted at anterior neck (Sq1, at the level of the 15th ventral scale from the head), mid-body (Sq2, halfway between rear of head and opening of cloaca), and anterior to cloaca (Sq3, at the level of the 15th ventral scale anterior to the opening of the cloaca).

Data for other species of the genus *Opisthotropis*, and the related genera, i.e., *Paratapinophis praemaxillaris* and *Parahelicops annamensis* were obtained from literature (Günther 1872; Boulenger 1888; Boulenger 1914; Pope 1935; Smith 1943; Taylor & Elbel 1958; Orlov *et al.* 1998; Zhao *et al.* 1998; Stuart 2006; Zhao 2006; Stuart & Chuaynkern 2007; Murphy *et al.* 2008; Ziegler *et al.* 2008; Iskandar & Kamsi 2009; Li *et al.* 2010; David *et al.* 2011; Yang *et al.* 2011) and from examined *Opisthotropis* specimens (see Appendix).

Results

Opisthotropis laui sp. nov.

Holotype. KIZ 060100, female from Beifengshan Forest Park, Mt. Gudou, Jiangmen City, Guangdong Province, China (22°14'20" N, 112°55'05" E, ca. 300 m above sea level), collected by Bosco P.L. Chan and Michael W.N. Lau on 26 July 2002, preserved in 80% alcohol and deposited at Kunming Institute of Zoology, Chinese Academy of Sciences, Kunming, China (KIZ),

Diagnosis. *Opisthotropis laui* sp. nov. differs from other species of *Opisthotropis* by the combination of the following characters: dorsal scales weakly keeled throughout, in 25:23:23 rows; 10 supralabials; 11 infralabials; two internasals, longer than wide, not touching with the loreal; one loreal, not touching with the eye; one preocular; two postoculars; one anterior temporal scale; 152 ventrals; 53 subcaudals; body and tail dark olive above, with light yellow cross bars. See Table 1 for the detailed morphological comparison of the new species with other congeners.

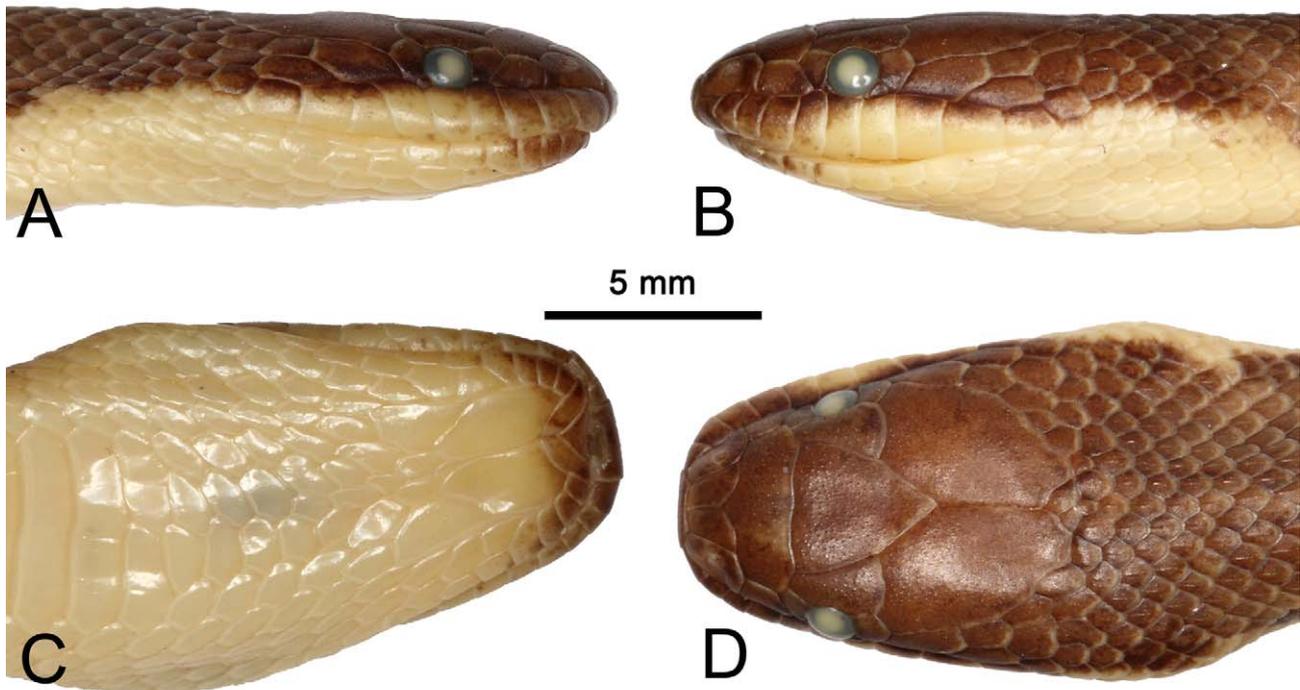


FIGURE 1. Head of the holotype of *Opisthotropis laui* sp. nov.: (A) right side, (B) left side, (C) dorsal view, (D) ventral view. Photographs by Jian-Huan Yang.



FIGURE 2. Holotype of *Opisthotropis laui* sp. nov.: (A) lateral view of mid-body, (B) dorsal view, (C) ventral view. Photographs by Jian-Huan Yang.



FIGURE 3. (A) General aspect in life of the holotype of *Opisthotropis laui* **sp. nov.**, (B) General aspect in life of *O. cheni* (from Mangshan National Nature Reserve, Hunan Province, China), (C) General aspect in life of *O. guangxiensis* (from Dawuling Nature Reserve, Guangdong Province, China). Photographs by Michael W.N. Lau (A), Jian-Huan Yang (B) and Lee Kwok Shing (C).

TABLE 1. Morphological comparison of all known species of *Opisthotropis*, and *Parahelicops annamensis* and *Paratapatropis praemaxillaris* (based on literature and examined specimens).

	IN	contact	L	PrF	PrO	SL	IL	Temporals	Sq1 : Sq2 : Sq3	Keel	DSR* V	SC	Dorsal colour pattern
<i>Opisthotropis alcalai</i>	yes	2	2	?	12-13	?	1+?	?:19:?	0	195	?	195	Uniformly dark
<i>Opisthotropis andersonii</i>	not	1	1	2	8	9	1+2	17:17:17	+	149-169	53-60	149-169	Uniformly dark olive with pale-edged scales
<i>Opisthotropis atra</i>	yes	1	1	2	7	?	1+?	?:17:?	0/+	170	65	170	Uniformly dark
<i>Opisthotropis balteata</i>	not	1	1	2-4	8-10	9-10	1+3/2/4	19:19:17	0/+	190-205	56-86	190-205	Dark with broad, dark, pale-centered crossbars
<i>Opisthotropis boonsongi</i>	not	1	1	2-3	9	10	2+3	19:19:17	+++	141	33+	141	Uniformly grey-brown
<i>Opisthotropis cheni</i>	not	1	0	2	7-9	8-10	1+1/2	17:17:17	+	146-167	47-64	146-167	Dark olive with or without light yellow crossbars
<i>Opisthotropis cucae</i>	yes	1	1	2	7	9-10	1+1	23:19:19	0	191	44	191	Uniformly dark greyish-brown
<i>Opisthotropis daovantieni</i>	yes	1	1	2	8	10	1+1	17:17:17	0	189-194	39-47	189-194	Uniformly grey-olive
<i>Opisthotropis guangxiensis</i>	not	1	1-2	2	9-10	8-9	1+2	17:15:15	0	166-174	51-58	166-174	Dark with light orange-yellow crossbars
<i>Opisthotropis jacobi</i>	not	1	1	1	8-9	8	1+1	15:15:15	0	159-179	60-90	159-179	Uniformly dark
<i>Opisthotropis kikazatoi</i>	not	1	2	?	6	?	2+	?:15:?	0/+	180-198	?	180-198	Dark with dorsolateral orange spots
<i>Opisthotropis kuatunensis</i>	not	1	2-3	2-4	13-16	?	1+2/3/4	19:19:19	+++	151-177	63-66	151-177	Black lines on uniform dark brown background
<i>Opisthotropis laui</i> sp. nov.	not	1	1	2	10	11	1+2	25:23:23	+	152	53	152	Dark olive with light yellow bars
<i>Opisthotropis lateralis</i>	not	1	2	2	9-11	10	1+2	17:17:17	+	152-173	42-57	152-173	Uniformly dark brown with a black lateral stripe
<i>Opisthotropis latouchii</i>	not	1	0-1	2	8-10	9	1+1/2	17:17:17	+	142-164	49-73	142-164	Dorsum with black and yellow striped pattern
<i>Opisthotropis maculosa</i>	not	1	1	1-2	7-8	8-9	1+1	15:15:15	0	166-188	67-97	166-188	Glossy black with single yellow spot on each scale
<i>Opisthotropis maxwelli</i>	not	1	1-2	2	7-8	8	1+1/2	17:17:17	0/+	147-155	53-62	147-155	Uniformly dark
<i>Opisthotropis rugosa</i>	yes	2	1	1-2	12-13	10-11	1+2	19:17:15	+++	170-174	76-84	170-174	purplish-brown to dirty black
<i>Opisthotropis spenceri</i>	yes	1	1	2	7-8	?	1/2+2	17:17:17	0	183	33+	183	Uniformly grey-brown
<i>Opisthotropis tamdaoensis</i>	not	1	1	2	8-9	9-10	2+3/4	19:17:17	0/+	171	49+	171	Uniformly dark olive grey
<i>Opisthotropis typica</i>	yes	2	1-2	1-2	11-12	8-9	1+1/2	?:19:?	+	155-184	82-95	155-184	Uniformly dark
<i>Parahelicops annamensis</i>	yes	1-2	1-2	2-3	8-9	8-10	1+1/2/3	17:15/17:15	+ / ++	163-172	117-123	163-172	Iridescent purplish-brown, with orange bars and spots
<i>Paratapatropis praemaxillaris</i>	not	1	1	2	8-9	9-10	2+2/3	19:19:17	0	145-155	58-67	145-155	Narrow faint dark crossbands or large blotches

*: 0: smooth; +: weakly keeled; ++: distinctly keeled; +++: strongly keeled (when necessary, the keeling is given at mid-body/posterior body).

In the appearance, *Opisthotropis laui* **sp. nov.** greatly resembles *O. cheni* and *O. guangxiensis* since all three species present narrow light cross bars on dorsum (Zhao *et al.*, 2006; David *et al.*, 2011; Fig. 3). *Opisthotropis laui* **sp. nov.** differs from *O. cheni* by having dorsal scale rows 25:23:23 (vs. 17:17:17 in *O. cheni*), weakly keeled throughout (vs. all but the outer one weakly keeled in *O. cheni*); one preocular (vs. absent in *O. cheni*); more supralabials (10 vs. 7–9 in *O. cheni*); more infralabials (11 vs. 8–10 in *O. cheni*); loreal not touching the eye (vs. touching in *O. cheni*). *Opisthotropis laui* **sp. nov.** differs from *O. guangxiensis* by having dorsal scale rows 25:23:23 (vs. 17:17:17 in *O. guangxiensis*), weakly keeled throughout (vs. smooth throughout in *O. guangxiensis*); more infralabials (11 vs. 8–9 in *O. guangxiensis*); fewer ventral scales (152 vs. 166–174 in *O. guangxiensis*).

Description of holotype. Specimen KIZ 060100, female, SVL 241.8 mm, TL 56.9 mm; HL 12.4 mm. Head small, indistinct from neck; eye small, pupil round; nostril directed dorsally; rostral broader than high, just visible from above; nasal not divided below nostril, surrounded by the first three supralabials, rostral, internasal, prefrontal and loreal on both sides; two narrow internasals, nearly twice as long as broad, in contact with rostral anteriorly, and not in contact with loreal; one prefrontal, about 2.2 times as width as long, pentagonal and tapering anteriorly; one frontal, length about 1.1 times as width, about equal to its distance from snout tip, nearly triangular and tapering posteriorly; one paired parietals, about 1.3 times longer than the frontal; one loreal, not in contact with eye, and surrounded by third – fifth supralabials, nasal, prefrontal and preocular on both sides; one preocular, in normal size, not in contact with frontal; two postoculars, lower one much smaller than upper one; one extremely small pre-subocular present on left side, absent on right side; 10/10 (left/right, hereafter) supralabials, only the sixth supralabial touching the eye on left side, and the 5–6 supralabials touching the eye on right side; 11/11 infralabials, the first one touching each other behind the mental; two pairs of chin shields, anterior pair of chin shields longer than posterior pair; anterior pair of chin shields in contact with the first five infralabials on both sides, posterior pair separated from each other by two scales; 1+2 temporal scales on both sides; rear-head region weakly keeled; temporal region smooth; dorsal scale rows in 25:23:23 (Sq1: Sq2: Sq3), weakly keeled throughout; ventrals 152, last two divided; 53 pairs of subcaudals.

Coloration. Eye black; body and tail dark olive above with 42 (28 at dorsal body, 14 at dorsal tail) complete or incomplete light yellow crossbars edged with black; anterior four supralabials dark olive, posterior ones light yellow with dark upper margin; anterior five infralabials dark olive, posterior ones light yellow; chin shields and ventrals uniformly light yellow; subcaudals light yellow with dark margins.

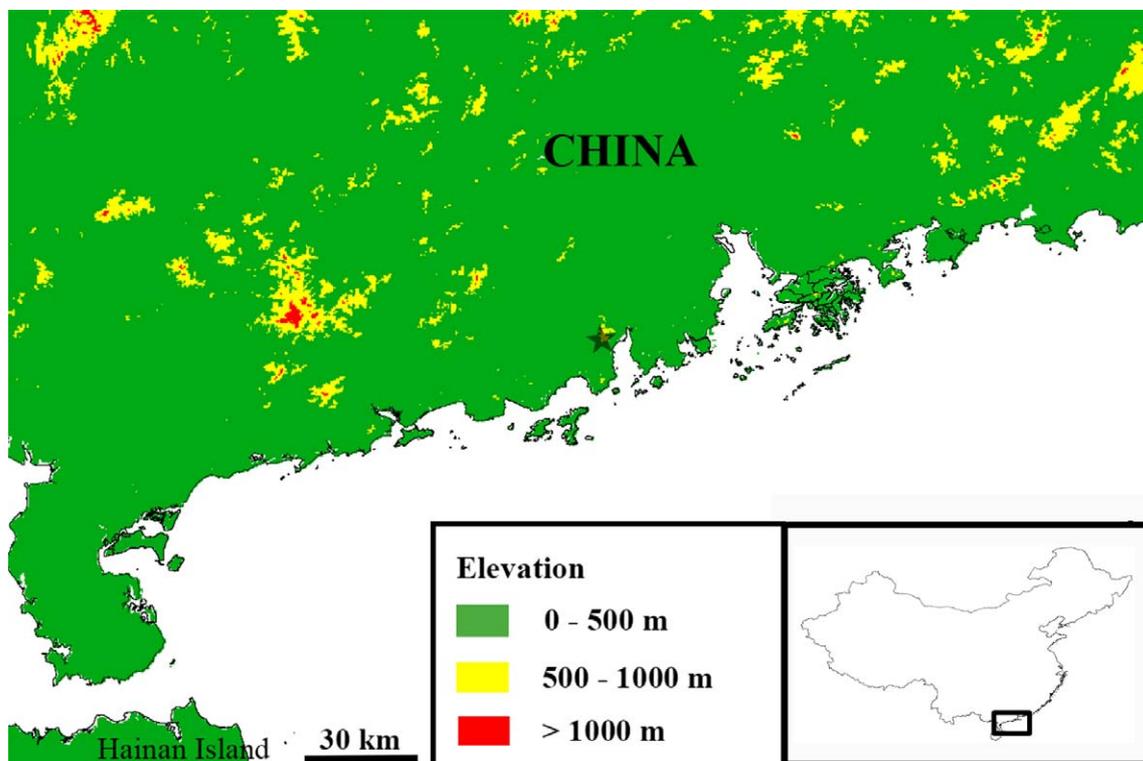


FIGURE 4. Map of Southern China showing the type locality of *Opisthotropis laui* **sp. nov.**, Mt. Gudou, Jiangmen City, Guangdong Province, China (star).

Etymology. We name this new species, “*loui*”, in honor of Michael Wai-Neng Lau from Hong Kong, in recognition of his long-term contribution to biodiversity, in particular herpetological research and conservation in Southern China. As common names we suggest “Lau’s Mountain Stream Snake” (English name), and “Liu Shi Hou Leng She” (Chinese name).

Distribution and natural history. Currently, *Opisthotropis loui* **sp. nov.** is only known from its type locality at Beifengshan Forest Park in Mt. Gudou, Jiangmen City, Guangdong Province, China (Fig. 4). Mt. Gudou is an isolated mountain range situated along the coastline at the western side of the Pearl River Estuary, and has been protected as a nature reserve since 2001. The summit, known as Shizitou, is 982 m a.s.l.. Original vegetation of the mountain range has been largely destroyed in the past. Currently it supports secondary forest at various successional stages, as well as shrubland and grassland; the stream valleys generally support more mature natural forest. The only specimen of the new species was found swimming in a small stream at night ca. 2145h, which is shallow, rocky, and ca. 3 m wide, with young but closed-canopy natural forest. The stream drains past Taishan City, Guangdong Province, before emptying into the Pearl River Delta.

Discussion

Species in the genus *Opisthotropis* were previously defined by 15–19 dorsal scale rows at mid-body (Smith 1943; Ziegler *et al.* 2008; David *et al.* 2011). The number of dorsal scale rows of *Opisthotropis loui* **sp. nov.** (25:23:23) is significantly different than other recognized species of *Opisthotropis*. However, the new species shares other key characters of the genus as mentioned above. Thus, the key diagnostic character of the genus needs to be revised accordingly. Given the variation found in the genus *Opisthotropis* (see Table 2), it seems probably that the genus is polyphyletic.

With the description of *O. loui* **sp. nov.** in this paper, the number of *Opisthotropis* known from China raises up to eleven, i.e., *O. andersonii* (Boulenger, 1888), *O. balteata* (Cope, 1895), *O. cheni* Zhao, 1999, *O. guangxiensis* Zhao, Jiang & Huang, 1978, *O. jacobi* Angel & Bourret, 1933, *O. kuantunensis* Pope, 1928, *O. lateralis* Boulenger, 1903, *O. latouchii* (Boulenger, 1899), *O. loui* **sp. nov.**, *O. maculosa* Stuart & Chuaynkern, 2007 and *O. maxwelli* Boulenger, 1914 (Zhao, 2006; Yang *et al.*, 2011). Yang *et al.* (2011) pointed out the importance of the Fujian-Guangdong Coast Subregion of South China in the research of natricid assemblages, as seven species of *Opisthotropis* were recorded from this region [*O. maculosa*, *O. andersonii*, *O. balteata*, *O. kuantunensis*, *O. lateralis*, *O. latouchii* and *O. maxwelli*]. The discovery of *O. loui* **sp. nov.** from Mt. Gudou of Guangdong Province, reiterates the significance of this region in the study of natricid snakes in China, and further research in this region requires additional attention.

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APPENDIX. List of examined specimens.

- Institutional abbreviations: **KFBG**, Kadoorie Farm and Botanic Garden, Hong Kong SAR, China; **KIZ**, Kunming Institute of Zoology, Chinese Academy of Sciences, Kunming, China; **SYS**, Sun Yat-sen University, Guangzhou, China.
- Opisthotropis andersoni* (n = 1). CHINA. KFBG 00472, Hong Kong.
- Opisthotropis balteata* (n = 1). CHINA. KFBG 00303, Hong Kong.
- Opisthotropis cheni* (n = 1). CHINA. KFBG 00129, Mt. Babaoshan, Guangdong Province.
- Opisthotropis guangxiensis* (n = 3). CHINA. KIZ 057737, Yongzhou City, Hunan Province. KIZ 057684-057685, Jinxiu County, Guangxi Zhuang Autonomous Region.
- Opisthotropis kuatunensis* (n = 1). CHINA. KFBG 00204, Hong Kong.
- Opisthotropis lateralis* (n = 2). CHINA. KFBG 00283, Mt. Damingshan, Guangxi Zhuang Autonomous Region. KFBG 00237, Heishiding Nature Reserve, Guangdong Province.
- Opisthotropis maculosa* (n = 3). CHINA. SYS r000537-0538, Guangxi Zhuang Autonomous Region. KFBG 2002.01, Mt. Dawuling, Guangdong Province.