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## A new species of the genus *Opisthotropis* Günther, 1872 from northern Laos (Squamata: Natricidae)

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### Abstract

Two specimens, a male and a female, of the genus *Opisthotropis* Günther, 1872 were collected in a karst formation of northern Louangphabang (or Luang Prabang) Province, North Laos. These specimens are assigned to the genus *Opisthotropis* on the basis of their morphology, dentition and cephalic scalation. However, they differ from all other known species of *Opisthotropis* by a combination of the following characters: (1) 21–19 scale rows on the fore part of the body, (2) 17 scale rows at midbody, (3) 22/23 maxillary teeth, (4) 177–181 ventrals, (5) 1 loreal on each side, in contact with internasal, (6) 7 supralabials, 4<sup>th</sup> entering orbit, (7) dorsum dark bronze-brown, with upper part of dorsum darker than lateral sides, without bands or crossbars, and (8) chin and throat blackish-brown with a sharp, transversal limit with the ventral colour crossing the posterior part of the throat. As a consequence, these specimens are here referred to a new species, *Opisthotropis durandi* spec. nov. The new species is compared with other species of the genus, especially the most similar species *O. spenceri* Smith, 1918 and *O. atra* Günther, 1872, the type species of the genus. An updated key to the genera *Opisthotropis* is provided. *Opisthotropis durandi* spec. nov. represents the first confirmed record of a species of *Opisthotropis* sensu stricto from Laos and it is the 108<sup>th</sup> snake species currently recorded from the Lao People's Democratic Republic.

**Key words:** *Opisthotropis durandi* spec. nov., morphology, taxonomy, distribution.

### Introduction

Members of the genus *Opisthotropis* Günther, 1872 are highly aquatic snakes inhabiting mostly fast-flowing streams of hills and mountains of tropical and subtropical Asia. The genus is distributed across the mainland of Southeast Asia eastwards to the Philippines and the Ryukyu Archipelago of Japan (see Ziegler *et al.* 2008; David *et al.* 2011). According to Boulenger (1893), Smith (1943), Stuart and Chuaynkern (2007), Murphy *et al.* (2008), Ziegler *et al.* (2008), David *et al.* (2011), and Yang *et al.* (2011, 2013), this rather homogeneous genus is defined by a series of the following characters: (1) head depressed, not or scarcely distinct from neck, (2) body rather stout, (3) eye moderate or small, with rounded or vertically elliptical pupil, (4) nostril directed upwards and outwards, piercing in the nasal placed in dorsal position on the snout, (5) prefrontal very broad, usually single, forming a long suture with the frontal, (6) scales smooth or keeled, without apical pits, in 15 to 19 dorsal rows at midbody (23 in *O. laui* Yang, Sung & Chan, 2013), (7) cloacal scale divided, (8) subcaudals paired, and (9) 20–40 upper maxillary teeth, small, and subequal.

This genus is still imperfectly known. Not only the biology and ecology of numerous species are poorly

known, if not unknown at all, but also not less than six species were described in the past 20 years (see Orlov *et al.* 1998; Zhao 1999, 2004; Stuart & Chuaynkern 2007; Ziegler *et al.* 2008; David *et al.* 2011; Yang *et al.* 2011; as well as Yang *et al.* 2013 for a summary). Currently, the genus *Opisthotropis* contains 20 species. This number excludes three species formerly placed in this genus. Murphy *et al.* (2008) showed that the genus *Paratapinophis* Angel, 1929 is valid. *Paratapinophis praemaxillaris* Angel, 1929, long referred to the genus *Opisthotropis* since Pope (1935), is thus removed from the list of species of this latter genus. Furthermore, *Parahelicops annamensis* Bourret, 1934, considered a member of the genus *Opisthotropis* by Smith (1943), seems to be referable to the genus *Amphiesma* Duméril, Bibron & Duméril, 1854 on the basis of our unpublished morphological and molecular data (David *et al.*, in prep.). However, pending additional molecular analyses, we adopt a conservative position in retaining this species in the genus *Parahelicops*. Lastly, *Parahelicops boonsongi* Taylor & Elbel, 1958 belongs to another genus (David *et al.*, in prep.). Due to their peculiar biotope and rather secretive habits, the content of this genus is far from being fully revealed. Of special interest is the fact that several species are still known from their holotype only or a handful of specimens.

Although several species of *Opisthotropis* have been recorded from Thailand, China and Vietnam, no member of the genus had been definitely recorded from Laos, in spite of the numerous hills and mountains covering this country, although *Paratapinophis praemaxillaris* was once placed in this genus. Deuve (1970) cited two species likely present in Laos, *O. spenceri* Smith, 1918 and *O. bedoti* (Peracca, 1904), a taxon now considered a junior synonym of *O. balteata* (Cope, 1895), but neither has ever been confirmed from Laos.

In September 2012, the first two authors of the present paper obtained a specimen in the north of Louangphabang Province (or Luang Prabang; we here follow the spelling of Laotian provinces adopted by McCoy 2003 and Anonymous 2012), in northern Lao People's Democratic Republic (referred to below as Laos). Another specimen, morphologically similar, was collected in the same region in May 2013. On the basis of their dentition, habitus, and head and body scalation characters, these specimens obviously belong to the genus *Opisthotropis*. They constitute the first definite records of this genus from Laos. These specimens share some scalation characters with *O. spenceri* and *O. atra* but cannot be assigned to any of the known species. Thus we refer these adult specimens, a male and a female, to a new species which is herein described. We also provide an updated key to all known species of the genus, including the three species formerly regarded as belonging to the genus *Opisthotropis* as discussed above.

## Material and methods

The description is based on the dentition and external morphological characters regarded as taxonomically significant by Smith (1943), Stuart and Chuaynkern (2007), Murphy *et al.* (2008), Ziegler *et al.* (2008), David *et al.* (2011), and Yang *et al.* (2011, 2013). Measurements, except body and tail lengths, were taken after preservation with a slide-calliper. The number of ventral scales was counted according to Dowling (1951). The numbers of dorsal scale rows are given at one head length behind head, at midbody, and at one head length before vent, respectively. Maxillary teeth were counted by removing the gums of the both maxilla of the holotype. Values for symmetric head characters are given in left / right order.

Abbreviations of measures and other meristic characters used in the text.—*Measures and ratios*: HL: head length (from the tip of the snout to angles of the jaws); SVL: snout-vent length; TaL: tail length; TL: total length; TaL/TL: ratio tail length/total length. *Meristic characters*: Ate: anterior temporal; DSR: dorsal scale rows; IL: infralabial scales; InN: internasal scale; Lor: loreal scale; Pref: prefrontal scale; PreOc: preocular scale; SC: subcaudal scales; SL: supralabial scales; VEN: ventral scales.

Museum abbreviations are: AMNH: American Museum of Natural History, New York, USA.—BMNH: Natural History Museum (formerly the British Museum (Natural History)), London, UK.—CAS: California Academy of Sciences, San Francisco, USA.—CIB: Chengdu Institute of Biology, Chengdu, People's Republic of China.—FMNH: Field Museum, Chicago, USA.—EBR: Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, Hanoi, Vietnam.—MNHN: Muséum National d'Histoire Naturelle, Paris, France.—NMW: Naturhistorisches Museum Wien, Austria.—RMNH: Nationaal Natuurhistorisch Museum (Naturalis), Leyden, The Netherlands.—VNUH: Zoological Museum, Vietnam National University, Hanoi, Vietnam.—ZFMK: Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany.—ZISP: Zoological Institute (ZISP), Russian Academy of Sciences, St. Petersburg, Russia.

## Results

The dentition of the maxilla, the morphology and pholidosis of these specimens from Louangphabang Province are typical of the genus *Opisthotropis*. However, they differ from the other known species in that genus with respect to scalation of the body, especially the formula of the dorsal scale rows, scalation of head and colour pattern. Differences with other species are noteworthy enough to consider these two specimens to belong to an undescribed species, which we describe as:

### *Opisthotropis durandi* spec. nov.

(Figs. 1–4)

**Holotype.**—MNHN 2013.1001, an adult female, from the vicinity of Muang Ngoi (20°42'10"N, 102°41'21"E), Ngoi District, Louangphabang Province, Lao People's Democratic Republic (Laos), at an elevation of about 370 m a.s.l.; collected by Alexandre Teynié and Anne Lottier on 18 September 2012.

**Paratype.**—IEBR A.2013.26, an adult male, from Mork or Mok Waterfall (20°39'N, 102°42'E), at about 4 km east of Ban Sopkhong or Ban Sop Keng, a village on Nam Ou River located between Nuang Kiea and Muang Ngoi, Ngoi District, Louangphabang Province, Lao People's Democratic Republic (Laos), at an elevation of about 700 m a.s.l.; collected by Alexandre Teynié and Anne Lottier on 20 May 2013.

The locality of the paratype is at about 5.3 km south-southeast from the type locality.

**Diagnosis.**—A species of the genus *Opisthotropis*, characterized by a combination of the following characters: (1) 21–19 DSR at neck and 17 DSR at midbody, all smooth; (2) nostril narrow, long and strongly oblique, dividing the whole length of the nasal; (3) internasals triangular and strongly curved, in contact with the loreal; (4) 1 prefrontal; (5) frontal wider than long; (6) loreal large, longer than high; (7) 6/7 supralabials, 4<sup>th</sup> SL entering orbit on both sides; (8) 1 preocular; (9) 1 anterior and 2 posterior temporals; (10) at least 88 subcaudals; (11) about 22/23 subequal maxillary teeth; (12) upper dorsal surface above the 5<sup>th</sup> dorsal scale row uniformly dark greyish-brown with bronze tints, contrasting faintly with sides more bronze-brown, with scales broadly edged posteriorly with yellowish-ochre, this pigmentation extending downwards up to the 1<sup>st</sup> dorsal scale row; (13) venter pinkish-ochre brown; (14) head dark greyish-brown; and (15) chin, throat and 1<sup>st</sup> preventral largely blackish-brown with scales irregularly dotted or edged with ochre yellow.

A detailed comparison with the other known species of the genus *Opisthotropis*, especially the 10 species that have 17 dorsal scale rows at midbody, plus *Parahelicops annamensis*, is given below in “Comparison”. Nevertheless, the combination of a high number of dorsal scale rows at neck for a species with 17 DSR at midbody, internasal in contact with loreal, a high number of subcaudals, the uniform dorsal pattern, and the dark pigmentation of the throat abruptly contrasting with the pale colour of the venter, distinguish *Opisthotropis durandi* spec. nov. from all other species of the genus *Opisthotropis*.

**Etymology.**—This species is named in honour of Mr Frédéric Durand, president of the naturalist association “Société d’Histoire Naturelle Alcide d’Orbigny” (Clermont-Ferrand, France), who supported our field trips and researches of the two first authors in Laos, and thus contributed to the better understanding of the herpetology of Laos.

Suggested common names. Durand’s Mountain Stream Snake (English); *Opisthotropis de Durand* (French).

**Description of holotype.**—Body stout, cylindrical; head short (3.3 % of SVL), barely distinct from the thick neck, depressed, flat anterior to eyes, dorsally covered with large shields; snout long, 31.1% of HL or 3.2 times longer than diameter of eye, blunt, relatively subrectangular seen from above and in profile, depressed; nostrils in dorsal position and directed forwards, crescentic and very narrow, nearly reduced to the shape of a slit, strongly oblique, piercing the middle and nearly dividing the whole of nasal; eye small, its diameter about 0.7 times of the distance between eye and lip, with a vertically elliptic pupil; tail long and tapering progressively.

**Measurements.**—SVL: 408 mm; TaL: 130 mm; TL: 538 mm; ratio TaL/TL: 0.242; HL: 13.28 mm; SnL: 4.15 mm.

**Dentition.**—Maxillary teeth: right maxilla with 22 small but relatively thick, curved subequal teeth, without any diastema; left maxilla with 23 teeth.

**Body scalation.**—DSR: (21)19–17–17 scales, relatively large, imbricate scales, smooth throughout the body; DSR 1–2 slightly enlarged.

Dorsal scale row reductions:

6+7 → 6 (VEN 6) (left)	4+3 → 3 (VEN 15) (left)
21 ————— 19	————— 17
6+7 → 6 (VEN 6) (right)	4+3 → 3 (VEN 21) (right)

177 VEN (+ 2 preventrals); 88 SC, all paired; cloacal plate divided.

*Head scalation.*—Rostral pentagonal, 1.5 times wider than high, visible from above; nasals large, distinctly directed forwards, subtriangular, much wider than high, obliquely divided by the long, narrow nostril and a short furrow below the nostril; internasals 2, narrow, triangular, strongly curved with its apex directed outwards and widely divergent each from the other, maximum width about 1.6 times greater than the suture between internasals or 1.2 times greater than maximum length; each internasal in contact with rostral, nasal, loreal and prefrontal; prefrontal single, broad but relatively narrow, subrectangular, much broader than long, in contact with the preocular and the loreal on each side; frontal hexagonal with its apex directed posteriorly, 1.5 times longer than prefrontal and 1.4 times wider than long; parietals long and wide, in contact for 1.1 times length of frontal; supraocular 1 / 1, small, about 0.25 times as wide as the frontal; loreal 1 / 1, subrectangular, large and entire, about 1.2 times longer than high, both broadly in contact with internasal on each side; preocular 1 / 1, large, about 0.8 times as high as eye diameter, not reaching frontal, in broad contact with prefrontal; postoculars 2 / 2, similar in size; at left, another scale, considered a “post postocular”, inserted between the lower postocular, anterior temporal, and 5<sup>th</sup> and 6<sup>th</sup> supralabials; subocular absent; supralabials 6 / 7, followed on each side, below the lower posterior temporal, by an enlarged, elongate scale that not border the lip; 1<sup>st</sup>–3<sup>rd</sup> SL distinctly higher than long (diagnostic characters of *Opisthotropis*), 4<sup>th</sup> SL largest, 1.1 times higher than long, 5<sup>th</sup>–6<sup>th</sup> or 7<sup>th</sup> SL longer than high; 1<sup>st</sup> SL distinctly directed forwards; 1<sup>st</sup> and 2<sup>nd</sup> SL in contact with nasal, 2<sup>nd</sup> and 3<sup>rd</sup> SL in contact with loreal, 4<sup>th</sup> SL, large, entering orbit on both sides, 5<sup>th</sup> slightly shorter than 4<sup>th</sup> one but large, separated from orbit by the lower postocular, 6<sup>th</sup> SL at left, 6<sup>th</sup> and 7<sup>th</sup> SL at right distinctly shorter than 4<sup>th</sup> SL; temporals 1+2+3 / 1+2+3, anterior one largest and elongate, in broad contact with 5<sup>th</sup> and 6<sup>th</sup> SL and anterior part of parietal, middle temporals smaller, posterior temporals poorly differentiated from scales of the neck; infralabials 8 / 8, first pair in contact behind small mental, 1<sup>st</sup>–5<sup>th</sup> / 1<sup>st</sup>–4<sup>th</sup> IL in contact with anterior chin shields, 4<sup>th</sup> and 5<sup>th</sup> IL largest; posterior chin shields about 0.8 times as long as anterior ones, separated from each other by 3 scales.

*Coloration.*—In life, the upper dorsal surface above the 5<sup>th</sup> dorsal scale row dark greyish-brown with bronze tints; the whole of the neck and the sides of the body up to the vent rather pale bronze-brown or greenish-yellowish-brown, paler than the dorsum, with scales broadly edged posteriorly with yellowish-ochre; the faint but sharp limit between the dark, upper and paler, lateral colourations, running on the centre of the 5<sup>th</sup> dorsal row; scales of the 1<sup>st</sup> dorsal scale row bronze-brown heavily mixed with the pale ochre-brown pigmentation of the venter. The dorsal surface of the tail is entirely dark greyish-brown as the dorsum, with some yellowish-ochre areas.

Head uniformly pale bronze-brown as the sides of the body, turning to dark greyish-brown on the snout and much of the frontal; parietals variegated with dark brown; four anterior supralabials dark greyish-brown, posteriors supralabials irregularly dotted or variegated with yellowish-ochre. Chin, throat and first preventral very dark greyish-brown, with some faint paler brown dots; this dark colour contrasts sharply with the pale ventral colour at the level of the 2<sup>nd</sup> preventral, nearly entirely pale; infralabials with traces of paler yellowish-ochre.

Venter pale pinkish brown or pinkish-ochre yellow, depending on lighting conditions, irregularly scattered with dark brown dots, especially present near their outer margins; cloacal scale with dark brown dots. Under surface of the tail strongly clouded with dark greyish-brown anteriorly, this pigmentation covering progressively the subcaudals; posterior part of the tail entirely dark greyish-brown, with some paler areas.

In preservative, the pattern and pigmentation are similar, although somewhat darker, but the limit between the dark dorsal and the paler lateral pigmentations is more or less visible and depends on the lighting condition.

**Variation.**—The paratype, an adult male (Fig. 4), agrees in overall morphological characters, habitus, scalation, coloration and pattern with those given for the holotype. Differences are given below.

In taking into account the scalation data of the paratype, an adult male, main variation of *Opisthotropis durandi* spec. nov. are as follows:

*Body.* Ratio TaL/TL: 0.242 (female holotype); 0.255 (male paratype); (21)19–17–17 or 19–17–17 DSR; 177–181 VEN (+ 2 precentrals); 88–90 SC, all paired.

*Head scalation.* Nasal large, obliquely divided by the long nostril in both specimens; 6 or 7 supralabials, 4<sup>th</sup> SL entering orbit on both sides in the holotype, 4<sup>th</sup> at right and 4<sup>th</sup> and tip of 5<sup>th</sup> at left in the paratype; 1 large preocular, 2 postoculars, equal in size; 1+2+3 / 1+2+3 temporals in both specimens; infralabials 8 / 8 in the holotype, 7 / 7 in the paratype; 1<sup>st</sup>–4<sup>th</sup> or 1<sup>st</sup>–5<sup>th</sup> IL in contact with anterior chin shields, 4<sup>th</sup> and 5<sup>th</sup> or 5<sup>th</sup> IL largest.

**Comparison.**—The comparison of *Opisthotropis durandi* spec. nov. with other species of the genera *Opisthotropis* and *Paratapia* and two species previously placed in the genus *Opisthotropis*, i.e. *Parahelicops annamensis* and “*Opisthotropis*” *boonsongi*, is based on examined specimens listed in Appendix and on the following references: Boulenger (1893), Pope (1935), Smith (1943), Brown and Leviton (1961), Taylor (1965), Toyama (1983), Ota and Mori (1985), Alcalá (1986), Manthey and Grossmann (1997), Orlov *et al.* (1998), Zhao *et al.* (1998), Malkmus *et al.* (2002), Zhao (2004, 2006), Stuart and Chuaynkern (2007), Murphy *et al.* (2008), Ziegler *et al.* (2008), Iskandar and Kamsi (2009), David *et al.* (2011), and Yang *et al.* (2011, 2013).

*Opisthotropis durandi* spec. nov. differs by its number of dorsal scale rows at midbody (17) from following species with 19 rows: *O. alcalai* Brown & Leviton, 1961, *O. balteata* (Cope, 1895), “*Opisthotropis boonsongi*” (Taylor & Elbel, 1958), *O. cucae* David, Pham, Nguyen & Ziegler, 2011, *O. kuatunensis* Pope, 1928, *O. typica* (Mocquard, 1890), *Paratapia praemaxillaris* Angel, 1929, and from *O. laui* with 23 rows.

Furthermore, *Opisthotropis durandi* spec. nov. differs from these species, at the exception of *O. cucae*, in having 21 dorsal scale rows on the neck vs. only 19 in the aforementioned species; *O. cucae* has 23 then 21 rows on the neck. Other noteworthy differences are as follows: *Opisthotropis durandi* spec. nov. differs from *O. alcalai* and *O. typica* in having a single prefrontal vs. 2 in these two species. *Opisthotropis durandi* spec. nov. differs from *O. balteata*, *O. boonsongi*, *O. kuatunensis*, and *O. typica* by its dorsal scales entirely smooth vs. keeled throughout or at least posteriorly in these species. *Opisthotropis durandi* spec. nov. differs from *O. balteata*, “*O. boonsongi*”, *O. kuatunensis*, and *P. praemaxillaris* in having internasals in contact with loreal vs. separated in these species. With 177–180 ventrals, *Opisthotropis durandi* spec. nov. differs from *O. boonsongi* (136–140 VEN) and *Paratapia praemaxillaris* (145–155). Lastly, *O. durandi* spec. nov. differs from *O. balteata* and *P. praemaxillaris* by its uniform pattern vs. crossbars in *O. balteata* and crossbands or large blotches in *P. praemaxillaris*. Other characters are given in Table 1.

With 17 dorsal scale rows at midbody, *Opisthotropis durandi* spec. nov. is readily distinguished from the group of five species with 15 scale rows which currently includes *O. guangxiensis* Zhao, Jiang & Huang, 1978, *O. jacobi* Angel & Bourret, 1933, *O. kikuzatoi* Okada & Takara, 1958, *O. maculosa* Stuart & Chuaynkern, 2007 and *Parahelicops annamensis* Bourret, 1934. However, *P. annamensis* may also rarely have 17 DSR at midbody.

Furthermore, *Opisthotropis durandi* spec. nov. differs from *O. kikuzatoi* and especially *Parahelicops annamensis* by its dorsal scales entirely smooth vs. moderately keeled posteriorly in *O. kikuzatoi* and strongly keeled throughout in *P. annamensis*. *Opisthotropis durandi* spec. nov. differs from *O. guangxiensis*, *O. jacobi*, *O. kikuzatoi*, and *O. maculosa* in having internasals in contact with loreal vs. separated in these four species. With 6 or 7 supralabials, *Opisthotropis durandi* spec. nov. differs from *O. guangxiensis*, *O. maculosa* and *P. annamensis* which have at least 8 SL. Lastly, by its uniform pattern *O. durandi* spec. nov. differs from *O. guangxiensis*, *O. kikuzatoi*, and *O. maculosa* which have either crossbars or blotches. Other characters are given in Table 1.

*Parahelicops annamensis* may have 17 dorsal scale rows at midbody but it differs from *Opisthotropis durandi* spec. nov. by (1) a more slender body, (2) scales weakly keeled at midbody, strongly keeled posteriorly and around the base of the tail, (3) 28–34 maxillary teeth, the last two moderately enlarged, (4) at least 115 subcaudals, (5) ratio of TaL / TL at least 0.30, and (6) a dorsal pattern made of isolated orange or rusty blotches on a blackish-brown background.

*Opisthotropis durandi* spec. nov. shares the number of 17 dorsal scale rows at mid-body with 10 other species of the genus (excluding *Parahelicops annamensis*), viz. *O. andersonii* (Boulenger, 1888), *O. atra* Günther, 1872, *O. cheni* Zhao, 1999, *O. daovantieni* Orlov, Darevsky & Murphy, 1998, *O. lateralis* Boulenger, 1903, *O. latouchii* (Boulenger, 1899), *O. maxwelli* Boulenger, 1914, *O. rugosa* (Van Lidth de Jeude, 1890), *O. spenceri* Smith, 1918, and *O. tamdaoensis* Ziegler, David & Vu, 2008. Additional differences between these species are summarized in Table 1.

**TABLE 1.** A comparison of selected morphological characters of species the genus *Opisthotropis*, and *Parahelicops annamensis* and *Paratapinophis praemaxillaris*. This table is based on examined specimens and the references cited above in the Comparison. Values of rare occurrence are placed in brackets. See Materials and Methods for abbreviations, except: **Keel DSR**: keeling of dorsal scales: 0: smooth; +: weakly keeled; ++: distinctly keeled; +++: strongly keeled (when necessary, the keeling is given at midbody / on the posterior part of the body); **C InN / Lor**: contact between loreal and corresponding internasal.

	DSR neck	DSR midbody	Keel DSR	Pref	C- InN / Lor	VEN	SC	ATe	SL	PreOc	Dorsal colour pattern
<i>O. guangxiensis</i>	17	15	0	1	no	166-174	51-60	1	9	1	Dark with pale crossbars
<i>O. jacobii</i>	15	15	0	1	no	155-179	60-90	1	7-8	1	Uniformly dark
<i>O. kikuzatoi</i>	15	15	0 / ++	1	no	180-183	58-73	1	6	2	Dark with dorsolateral orange spots
<i>O. maculosa</i>	15	15	0	1	no	182	75-97	1	8	1	Yellow dots on a dark background
<i>O. andersonii</i>	17	17	+	1	no	149-169	53-61	1	8 (9)	1-2	Uniformly dark with pale-edged scales
<i>O. atra</i>	19	17	0 / ++	1	yes	170	65	1	7	1	Uniformly dark
<i>O. cheni</i>	17	17	0	1	no	159-167	55-59	1	8-9	0	Greyish-olive or dark with yellow crossbars
<i>O. daovanitani</i>	17	17	0	1	yes	189-194	39-47	1	8	1	Uniformly greyish-olive
<i>O. durandi</i> spec. nov.	21-19	17	0	1	yes	177-181	88-90	1	6-7	1	Uniformly bronze brown
<i>O. lateralis</i>	17	17	+	1	no	159-186	42-56	1	(9)10-11	1	Uniformly dark with a black lateral stripe
<i>O. latouchii</i>	17	17	++	1	no	140-168	49-73	1	9	0	Broad yellow, narrow black lateral stripes
<i>O. maxwelli</i>	17	17	0 or + / ++	1	no	147-155	53-63	1	(6) 7 (8)	2	Uniformly dark
<i>O. spenceri</i>	17	17	0	1	yes	183	90-96	1-2	7-8	1	Uniformly grey-brown
<i>O. rugosa</i>	19	17	+++ / +++	2	yes	170-174	76-84	1	12-13	1	Uniformly dark
<i>O. tamdaoensis</i>	19	17	0 / +	1	no	163-176	46-51	2	8-9	1	Uniformly grey with a black lateral stripe
<i>O. alcalai</i>	21	19	0	2	yes	195	53	1	12-13	2	Uniformly dark
<i>O. balteata</i>	19	19	0 / +	1	no	190-205	69-99	1-2	8-10	1	Dark with broad, dark, pale-centered crossbars
<i>O. cucae</i>	23-19	19	0	1	yes	191	?	1	7	1	Uniformly grey-brown
<i>O. kuatunensis</i>	19	19	++ / +++	1	no	146-175	61-69	1-2	13-16	2	Black lines on uniform dark background
<i>O. typica</i>	21-19	19	+++ / +++	2	yes	146-185	75-96	1	11-12	2	Uniformly dark
" <i>O.</i> " <i>boonsongi</i>	19	19	+++ / +++	1	no	136-140	60	2	8-9	1	Uniformly grey-brown
<i>P. annamensis</i>	17-19	15-17	+ / ++	1-2	yes	163-172	116-146	1	8-9	2	Dark with orange bars and spots
<i>P. praemaxillaris</i>	19	19	0	1	no	145-155	63-67	2	9	1	Narrow faint dark crossbands or large blotches

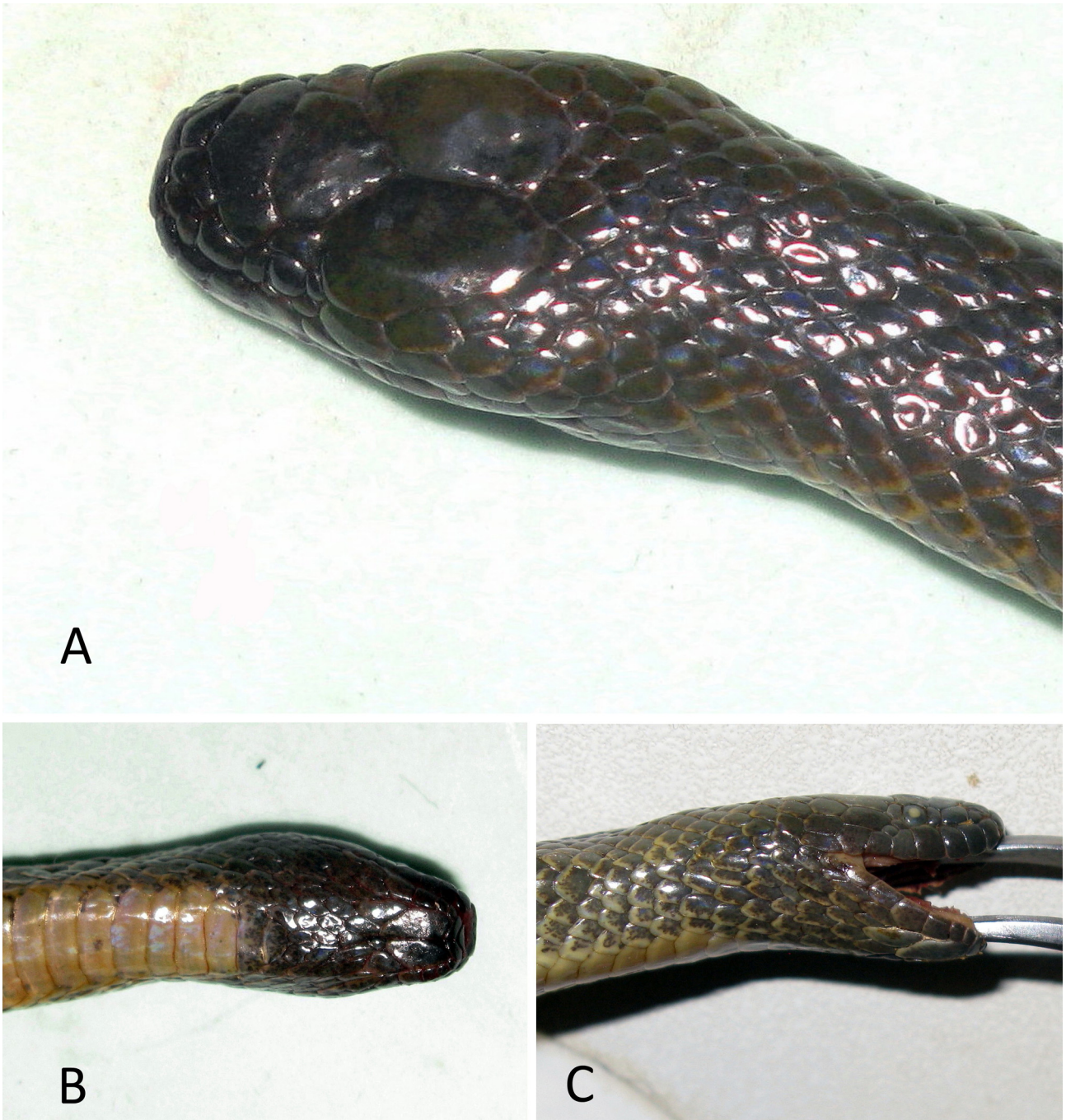


**FIGURE 1.** *Opisthotropis durandi* spec. nov., preserved holotype (MNHN 2013.1001). A. Dorsal view.—B. Ventral view.—C. Lateral view of the head and neck, left side.—D. Ventral view of the tail. Photographs by Alexandre Teynié.

In details, *Opisthotropis durandi* spec. nov. differs from *O. andersonii* by its number of dorsal scales on the neck (21–19 vs. 17), its smooth dorsal scales throughout (vs. keeled throughout in *O. andersonii*), a higher number of ventrals (177–180 vs. 149–169), internasal in contact with loreal (vs. separated), 6–7 SL (vs. 8–9), and its uniformly olive brown dorsal pattern (vs. uniformly dark with pale-edged scales).

*Opisthotropis durandi* spec. nov. differs from the holotype and sole known specimen of *O. atra* by its smooth dorsal scales throughout (vs. weakly keeled at midbody and strongly keeled posteriorly in *O. atra*), a higher number of subcaudals (88–90 vs. 65 in the male holotype), 6–7 supralabials (vs. 8), 4<sup>th</sup> SL entering orbit (vs. 5<sup>th</sup> SL), 7<sup>th</sup> SL longer than high but not elongated (vs. much elongated), anterior chin shields distinctly longer than posterior ones (vs. subequal), and its uniformly olive brown dorsal pattern (vs. uniformly blackish-brown). Using the key provided by Yang *et al.* (2011) would lead to the identification of the type specimens of *Opisthotropis durandi* spec. nov. as *O. atra*. This flaw in the key points out the need to consider, in Natricidae, a combination of characters, even those often considered trivial, rather than a few “major” characters. *O. durandi* spec. nov. shares with *O. atra* the number of 19 dorsal scales on the neck, the long tail (ratio TaL/TL 0.220 in *O. atra*) and other characters listed in Table 1.

*Opisthotropis durandi* spec. nov. differs from *O. cheni* by its number of dorsal scales on the neck (21–19 vs. 17), the loreal in contact with internasal (vs. not in contact), a higher number of ventrals (177–180 vs. 159–167), preocular present (vs. absent, loreal entering orbit), 6–7 SL (vs. 8–9), and its uniformly olive brown dorsal pattern (vs. dark with yellow crossbars).



**FIGURE 2.** *Opisthotropis durandi* spec. nov., preserved holotype (MNHN 2013.1001), views of the head. A. Dorsal side.—B. Ventral side.—C. Right side. Photographs by Alexandre Teynié.





**FIGURE 3.** *Opisthotropis durandi* spec. nov., holotype (MNHN 2013.1001), alive in its natural biotope, vicinity of Muang Ngoi, Ngoi District, Louangphabang Province, Laos. A. General view.—B. Close-up view of head. Photographs by Alexandre Teynié.

*Opisthotropis durandi* spec. nov. can be separated from *O. daovantieni* in having 19 DSR on the neck (vs. 17), a much longer tail (ratio of Tal / TL 0.242–0.255 vs. 0.117–0.146), a lower number of ventrals (177–180 vs. 189–194), a much higher number of subcaudals (88–90 vs. 39–47), 6–7 SL (vs. 8), and its uniformly olive brown dorsal pattern (vs. rather grey).

*Opisthotropis durandi* spec. nov. differs from *O. lateralis* in having 19 DSR on the neck (vs. 17), by its smooth dorsal scales throughout (vs. keeled throughout in *O. lateralis*), the loreal in contact with internasal (vs. not in contact), 6–7 supralabials (vs. [rarely 9]10–11), 1 preocular (vs. 2), and the uniformly brown dorsal pattern (vs. dark with a conspicuous black lateral stripe that sharply contrasts with the pale coloration of the venter).

*Opisthotropis durandi* spec. nov. differs from *O. latouchii* by its number of dorsal scales on the neck (21–19 vs. 17), its smooth dorsal scales throughout (vs. keeled throughout in *O. latouchii*), the loreal in contact with internasal (vs. not in contact), a higher number of ventrals (177–180 vs. 140–168), 6–7 supralabials (vs. 9), 1 preocular (absent in *O. latouchii*), and the uniformly olive-brown dorsal pattern (vs. dark with broad yellow and narrow black lateral stripes).

*Opisthotropis durandi* spec. nov. can be separated from *O. maxwelli* in having 21–19 DSR on the neck (vs. 17), its smooth dorsal scales throughout (vs. keeled posteriorly in *O. maxwelli*), the loreal in contact with internasal (vs. not in contact), a higher number of ventrals (177–180 vs. 147–158), and 1 preocular (vs. 2).

*Opisthotropis durandi* spec. nov. can be separated from *O. rugosa* by its smooth dorsal scales throughout (vs. strongly keeled throughout in *O. rugosa*), 1 prefrontal (vs. 2 in three known specimens), and 6–7 supralabials (vs. 12–13).

*Opisthotropis durandi* spec. nov. can be separated from *O. tamdaoensis* by its smooth dorsal scales throughout (vs. keeled posteriorly), the loreal in contact with internasal (vs. not in contact), 6–7 supralabials (vs. 8–9), 1 anterior loreal (vs. 2), and the uniformly olive-brown dorsal pattern (vs. the presence of a black lateral stripe).

Lastly, *Opisthotropis durandi* spec. nov. is most similar to *Opisthotropis spenceri*, a species still endemic to Lampang Province, northern Thailand. Both species share most external characters, including the numbers of subcaudals (88–90 vs. 90–96 SC) and the numbers of supralabials, 6–7 in *O. durandi* spec. nov. vs. 7–8 (with 4<sup>th</sup> entering orbit in *O. durandi* vs. 4 or 4<sup>th</sup>–5<sup>th</sup> in *O. spenceri*). Nevertheless, these species can be separated from each other by (1) the number of dorsal scales on the neck, 21–19 vs. 17 in *O. spenceri*; (2) a different dorsal pattern, the dark dorsal reaching the 1<sup>st</sup> dorsal scale row along the limit of ventrals in *O. durandi* spec. nov., whereas the dark and pale ventral pigmentations mingle on 2<sup>nd</sup> or 3<sup>rd</sup> scale rows and cover entirely 3<sup>rd</sup> and 4<sup>th</sup> and upper dorsal scale rows; (3) chin, throat and 1<sup>st</sup> preventral dark brown, with a sharp transversal limit in *O. durandi* spec. nov., vs. chin, throat and 1<sup>st</sup> preventral pale greyish- or pinkish-brown with some dark brown dots in *O. spenceri*; (4) under surface of tail largely dark brown in *O. durandi* spec. nov. vs. pale coloured as the venter, with dark brown dots, in *O. spenceri*, and (5) frontal 1.4 times wider than long in *O. durandi* spec. nov. vs. as long as wide in the three available specimens of *O. spenceri*.

**Distribution (Fig. 5).** Laos. Louangphabang Province. Vicinity of Muang Ngoi in Muang Ngoi District, at an elevation of 370 and 700 m a.s.l. *Opisthotropis durandi* is known only from the type locality and its vicinity, a hilly region located in the north of Louangphabang Province.

**Natural history.** The general biotope of the holotype is a secondary evergreen forest growing over a steep slope at the foot of a karst formation (Fig. 6). The snake was lying under a half-immersed rock at the bottom of a small waterfall in the course of a fast-running forest stream, with an average width of one meter. This stream runs across the forest just before it enters a cultivated valley. The snake was found at 11.00 h during a period of hot, sunny weather. A few water holes of various depths, some man-made, are present along the banks of the stream. These water holes are alternately or simultaneously inhabited by fish, tadpoles, and soft water shrimps and crabs, more rarely by larva of Odonata. The paratype was staying motionless, seemingly in ambush, at the beginning of the night, in the still, shallow (at most 40 cm deep) pool at the foot of Mok Waterfall (Fig. 7). The bottom of this piece of water is covered with sand and pebbles. Shrimps were observed in this pool. Another female specimen was seen 45 minutes later at about 400 m downstream of the pool. It was also staying motionless in a still part of the stream. Shrimps were also present.

The diet of *O. durandi* is unknown. The literature brings limited data on the diet of two species of the genus, *O. andersonii* and *O. alcalai* (Das 2010). Possible preys present in the biotope of *O. durandi* include earthworms, tadpoles, small fish and especially fresh-water shrimps. It is interesting to note that the local vernacular name of this snake is Ngou Koung or Ngou Kung, meaning “Shrimp snake”.

Amphibian observed in or near the stream bed at the type locality include: *Bufo (Duttaphrynus) melanostictus* Schneider, *Leptobrachium smithi* Matsui, Nabhitabhata & Panha, *Ophryophryne pachyproctus* Kou, *Xenophrys major* (Boulenger), *Microhyla berdmorei* (Blyth), *Microhyla fissipes* (Boulenger), *Micryletta inornata* (Boulenger), *Hoplobatrachus rugulosus* (Wiegmann), and *Fejervarja limnocharis* (Gravenhorst). Reptile species observed *Calotes emma* Gray, *Eutropis multifaciatus* (Kuhl), *Tropidophorus berdmorei* (Blyth), *Enhydris plumbea* (Boie in Boie), *Lycodon subcinctus* Boie, *Pareas carinatus* (Boie), and *Trimeresurus albolabris* Gray. The broad range of species with different requirements result from the heterogeneous nature of the habitat that ranges from forest to rice fields.



**FIGURE 4.** *Opisthotropis durandi* spec. nov., paratype (IEBR A.2013.26), alive in its natural biotope, Mok Waterfall, at about 4 km east of Ban Sopkhong, Ngoi District, Louangphabang Province, Laos. Photograph by Alexandre Teynié.

## Discussion

*O. durandi* is mostly similar to *Opisthotropis spenceri* Smith, 1918. This species was described on the basis of a single specimen (Smith 1918: 13, Pl. 2), an adult female (BMNH 1946.1.15.31) from “Muang Ngow, N. Siam”, at present Ngao, Lampang Province, in northern Thailand. Since its discovery in September 1917, only three specimens of *O. spenceri* have been recorded, all from the type locality (Nabhitabhata *et al.* 2004). These specimens all present the same dorsal pattern and rather conservative as far as dorsal and cephalic scalations are concerned. As a consequence, in spite of the availability of only two specimens from northern Laos and of its similarities with those referred to *O. spenceri*, we refer it to an undescribed species. Our position is mainly based on the fact that the number of dorsal scale rows is conservative in the genus *Opisthotropis* as currently defined. As the three known specimens of *O. spenceri* have 17–17–17 dorsal scale rows, we consider the differences in the scale row formula to be of taxonomic significance.



FIGURE 5. Map showing the type locality (black circle) of *Opisthotropis durandi* in Louangphabang Province, Laos.



**FIGURE 6.** Biotope of the holotype (A) and paratype (B) of *Opisthotropis durandi*. Photograph by Alexandre Teynié.

We present below a new key to the genus *Opisthotropis*, adapted from Yang *et al.* (2011), plus three species formerly assigned to this genus, *Parahelicops annamensis*, *Paratapinophis praemaxillaris* and “*Opisthotropis*” *boonsongi* and the recently described *O. laui*. This key is based on specimens examined by us and the references listed above.

1	15 scale rows at midbody . . . . .	2
-	17 or 19 scale rows at midbody . . . . .	6
2	Posterior upper maxillary teeth distinctly enlarged; dorsolateral nostrils rounded, directed laterally, first supralabials distinctly longer than high; more than 115 subcaudals . . . . .	<i>Amphiesma annamense</i>
-	Upper maxillary teeth subequal; dorsolateral nostrils crescentic, directed upwards; first supralabials distinctly higher than long; less than 100 subcaudals . . . . .	3
3	Posterior dorsal scales strongly keeled; 6 supralabials; endemic to Kumejima Island, Ryukyu Archipelago . . . . .	<i>O. kikuzatoi</i>
-	Dorsal scales smooth throughout; at least 7 supralabials; present on Asian mainland . . . . .	4
4	17 scale rows on the neck; 1+2 temporals; dorsum with pale crossbars . . . . .	<i>O. guangxiensis</i>
-	15 scale rows on the neck; 1+1 temporals; dorsum with another pattern . . . . .	5
5	Dorsum uniformly dark with dorsal scales pale-edged posteriorly . . . . .	<i>O. jacobi</i>
-	A yellow spot on each dorsal scale . . . . .	<i>O. maculosa</i>
6	17 scale rows at midbody . . . . .	7
-	19 scale rows at midbody . . . . .	18
7	Posterior upper maxillary teeth distinctly enlarged; dorsolateral nostrils rounded, directed laterally, first supralabials distinctly longer than high; more than 115 subcaudals . . . . .	<i>Amphiesma annamense</i>
-	Upper maxillary teeth subequal; dorsolateral nostrils crescentic, directed upwards; first supralabials distinctly higher than long; less than 100 subcaudals . . . . .	8
8	17 scale rows on the neck . . . . .	9
-	19–23 scale rows on the neck . . . . .	15
9	Internasals in contact with loreals . . . . .	10
-	Internasals not in contact with loreals . . . . .	11
10	Subcaudals 39–47 . . . . .	<i>O. daovantieni</i>
-	Subcaudals 90–96 . . . . .	<i>O. spenceri</i>
11	Preoculars absent, loreals entering orbit . . . . .	12
-	1 or 2 preoculars . . . . .	13
12	Dorsal scales smooth throughout the body; dorsum greyish-olive or dark with yellow crossbars . . . . .	<i>O. cheni</i>
-	Dorsal scales distinctly keeled throughout the body; broad yellow and narrow black lateral stripes . . . . .	<i>O. latouchii</i>
13	10–11 (exceptionally 9) supralabials; body with a dark lateral stripe that sharply contrasts with the pale coloration of the venter . . . . .	<i>O. lateralis</i>
-	7–9 (rarely 6) supralabials; body without a dark lateral stripe . . . . .	14
14	Dorsal scales weakly keeled throughout the body (above the 2 <sup>nd</sup> row); dorsum uniformly dark with all scales pale-edged; usually 8 (rarely 9) supralabials . . . . .	<i>O. andersonii</i>
-	Dorsal scales smooth on the nape, weakly keeled on the body but distinctly keeled towards the tail; dorsum uniformly dark; usually 7 supralabials (rarely 6 or 8) . . . . .	<i>O. maxwelli</i>
15	2 anterior temporals; a black lateral stripe; 8–9 supralabials . . . . .	<i>O. tamdaoensis</i>
-	1 anterior temporal; no black lateral stripe; less than 8 or more than 11 supralabials . . . . .	16
16	Dorsal scales smooth at least on the anterior half of the body; prefrontal single . . . . .	17
-	Dorsal scales strongly keeled throughout the body; prefrontal divided . . . . .	<i>O. rugosa</i>
17	Dorsal scales smooth throughout the body; 88–90 subcaudals; dorsum uniformly bronze brown; lower surface of head much darker than venter . . . . .	<i>O. durandi spec. nov.</i>
-	Dorsal scales strongly keeled on the posterior part of the body; 65 subcaudals in holotype; dorsum uniformly dark brown; lower surface of head not darker than venter . . . . .	<i>O. atra</i>
18	Internasals in contract with loreals . . . . .	19
-	Internasals not in contract with loreals . . . . .	21
19	Dorsal scales smooth throughout the body . . . . .	20
-	Dorsal scales strongly keeled throughout the body . . . . .	<i>O. typica</i>
20	21 dorsal scale rows on the anterior part of body; 2 prefrontals; 12–13 supralabials; 2 preoculars . . . . .	<i>O. alcalai</i>
-	23 then 21 dorsal scale rows on the anterior part of body; 1 prefrontal; 7 supralabials; 1 preocular . . . . .	<i>O. cucae</i>
21	Dorsal scales smooth at least on the anterior part of body . . . . .	22
-	Dorsal scales strongly keeled throughout the body . . . . .	23
22	Dorsal scales smooth throughout the body; 145–155 ventral scales; dorsum with faint dark crossbands or large blotches . . . . .	<i>Paratapinophis praemaxillaris</i>
-	Dorsal scales keeled on the posterior part of body; 190–205 ventral scales; dorsum with conspicuous dark, pale-centered crossbands . . . . .	<i>O. balteata</i>
23	Dorsal scales moderately keeled anteriorly, strongly keeled posteriorly with a narrow keel; 19 dorsal scale rows on the posterior part of the body; 13–16 supralabials; 146–175 ventral scales; dorsum dark with black lines . . . . .	<i>O. kuatunensis</i>
-	Dorsal scales very strongly keeled throughout the body with a thick keel; 17 dorsal scale rows on the posterior part of the body; 8–9 supralabials; 136–140 ventral scales; dorsum uniformly brown . . . . .	“ <i>Opisthotropis</i> ” <i>boonsongi</i>

## Conclusion

*Opisthotropis durandi* is currently known only from a small area around its type locality, like several other species of the genus (*O. cucae*, *O. kikuzatoi*, *O. smithi*, *O. laui*). Although it may well have a restricted distribution, we suspect that *Opisthotropis durandi* will be discovered in other rugged or hilly areas. With a type locality situated between 370 and 700 m a.s.l., this species is obviously not restricted to mountain ranges. *Opisthotropis durandi* is the first species of the genus *Opisthotropis* reported from Laos. However, in the future other species of the genus will certainly be found in the country, as, for example, *O. maculosa*. This species has been described from a locality in Thailand close to the border with Laos and has been recently discovered in the provinces of Guangxi and Guangdong in southern China (Yang *et al.* 2011). Its occurrence in Laos is very likely. In contrast, the type locality of *O. durandi* is located in the northern part of Louangphabang Province, at about 47 km from the nearest point of the Laotian-Vietnamese border. This species may be present in this latter country.

Furthermore, in Vietnam, Ziegler *et al.* (2008) had recorded a specimen of *O. lateralis* from Kon Tum Plateau (IEBR 83, Mt. Ngoc Linh). This species was formerly known only from northern Vietnam. Subsequently, David *et al.* (2011) described *O. cucae* from Kon Tum Highlands. Another species, *O. daovantieni*, was described by Orlov *et al.* (1998) from Buon Luoi, in Gia Lai Province, a locality only ca. 130 km distant. Both localities belong to the same mountainous system. The lack of records of the genus *Opisthotropis* in Laos is obviously the result of a lack of adequate investigations in hilly and mountainous areas. However, the description of *O. durandi* stresses the importance of surveying also the snake fauna of rugged areas and low hills. A review of the reptile fauna of comparatively low karst formations in Laos (Teynié and David 2014) has shown the richness of these areas.

On the basis of Teynié and David (2010), modified by David *et al.* (2012), Vogel *et al.* (2012), and Teynié and David (2014), *Opisthotropis durandi* is the 108<sup>th</sup> snake species currently recorded from the Lao People's Democratic Republic, including a new genus and species of the family Xenodermatidae (see Teynié *et al.*, submitted).

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## References

- Alcala, A.C. (1986) *Guide to Philippine flora and fauna. Vol. X. Amphibians and reptiles*. Natural Resources Management Center, Ministry of Natural Resources and University of the Philippines, Manila, xiv + 195 pp.
- Angel, F. (1929) Liste des Reptiles et Batraciens du Haut-Laos recueillis par M. Delacour. Description d'un genre, de deux espèces et d'une variété d'Ophidiens. *Bulletin du Muséum d'Histoire Naturelle*, Paris, (2), 1 (1), 75–81.
- Angel, F. & Bourret, R. (1933) Sur une petite collection de serpents du Tonkin. Descriptions d'espèces nouvelles. *Bulletin de la Société Zoologique de France*, 58 (3–4), 129–140.
- Anonymous (Central Intelligence Agency) (2012) *The CIA World Factbook 2013*. Skyhorse Publishing, New York, xxxi + 922.
- Boulenger, G.A. (1888) Description of two new snakes from Hongkong, and note on the dentition of *Hydrophis viperina*. *Annals and Magazine of Natural History*, (6), 2 (7), 43–44.
- Boulenger, G.A. (1893) *Catalogue of the snakes in the British Museum (Natural History), Vol. I., containing the families Typhlopidae, Glauconiidae, Boidae, Ilysiidae, Uropeltidae, Xenopeltidae, and Colubridae Aglyphae, part*. British Museum of Natural History, London, xiii + 448 pp., Pls. 1–28.
- Boulenger, G.A. (1899) On a collection of reptiles and batrachians made by Mr. J.D. La Touche in N.W. Fokien, China. *Proceedings of the Zoological Society of London*, 1899, 159–172, Pls. 16–19.
- Boulenger, G.A. (1903) Descriptions of new snakes in the collection of the British Museum. *Annals and Magazine of Natural History*, (7), 12 (69), 350–354.
- Boulenger, G.A. (1914) Descriptions of new species of snakes in the collection of the British Museum. *Annals and Magazine of Natural History*, (8), 14 (84), 482–485.
- Bourret, R. (1934) Notes herpétologiques sur l'Indochine française. III. Ophidiens d'Annam et du Moyen Laos. *Bulletin général de l'Instruction Publique*, 13<sup>e</sup> Année (9, Mai), 167–176. [Separate reprint: 3–12].
- Brown, W.C. & Leviton, A.E. (1961) Discovery of the snake genus *Opisthotropis* in the Philippine Islands, with description of a new species. *Occasional Papers of the Natural History Museum of Stanford University*, 8, 1–5.
- Cope, E.D. (1895) On a collection of Batrachia and Reptilia from the Island of Hainan. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 46 [1894], 423–428.
- David, P., Pham, C.T., Nguyen, T.Q. & Ziegler, T. (2011) A new species of the genus *Opisthotropis* Günther, 1872 (Squamata: Natricidae) from the highlands of Kon Tum Province, Vietnam. *Zootaxa*, 2758, 43–56.
- David, P., Nguyen, T.Q., Nguyen, T.T., Ke, J., Chen, T., Teynié, A. & Ziegler, T. (2012) A new species of the genus *Oligodon* Fitzinger, 1826 (Squamata: Colubridae) from northern Vietnam, southern China and central Laos. *Zootaxa*, 3498, 45–62.
- Deuve, J. (1970) Serpents du Laos. *Mémoires de l'ORSTOM*, 39, Paris, 1–251.
- Dowling, H.G. (1951) A proposed standard system of counting ventrals in snakes. *British Journal of Herpetology*, 1 (5), 97–99.
- Günther, A.C.L.G. (1872) Seventh account of new species of snakes in the collection of the British Museum. *Annals and Magazine of Natural History*, (4), 9 (1), 13–37, Pls. 3–6.
- Iskandar, D.T. & Kamsi, K. (2009) On the second specimen of *Opisthotropis rugosus* (van Lidth de Jeude, 1890) (Colubridae, Natricinae). *Hamadryad*, 34 (1), 107–110.
- Malkmus, R., Manthey, U., Vogel, G., Hoffmann, P. & Kosuch, J. (2002) *Amphibians and reptiles of Mount Kinabalu (North Borneo)*. A.R.G. Gantner Verlag K.G., Ruggell, 424 pp.
- Manthey, U. & Grossmann, W. (1997) *Amphibien & Reptilien Südasiens*. Natur und Tier-Verlag, Münster, 512 pp.
- McCoy, J.F. (2003) *Geo-Data: The World Geographical Encyclopedia. Third Edition*. Gale Group, Farmington Hills (Michigan, USA), xi + 704.
- Mocquard, F. (1890) Recherches sur la faune herpétologique des îles de Bornéo et de Palawan. *Nouvelles Archives du Muséum d'Histoire Naturelle de Paris*, 3 (2), 115–168.
- Murphy, J.C., Chan-ard, T., Mekchai, S., Cota, M. & Voris, H.K. (2008) The rediscovery of Angel's stream snake, *Paratapinophis praemaxillaris* Angel, 1929 (Reptilia: Serpentes: Natricidae). *The Natural History Journal of Chulalongkorn University*, 8 (2), 169–183.
- Okada, Y. & Takara, T. (1958) A new species of *Liopeltis* (Ophidia, Colubridae) from Ryukyu Islands. *Bulletin of the Biogeographical Society of Japan*, 20 (3), 1–3.
- Orlov, N., Darevsky, I.S. & Murphy, R.W. (1998) A new species of mountain stream snake, genus *Opisthotropis* Günther, 1872 (Serpentes: Colubridae: Natricinae) from the tropical rain forests of southern Vietnam. *Russian Journal of Herpetology*, 5 (1), 61–64.
- Ota, H. & Mori, A. (1985) On the fourth specimen of *Opisthotropis kikuzatoi*. *The Snake*, 17 (2), 160–162.
- Peracca, M.G. (1904) Nouvelles espèces d'ophidiens d'Asie et d'Amérique faisant partie de la collection du Muséum d'Histoire Naturelle de Genève. *Revue Suisse de Zoologie*, 12 (3), 663–668.
- Pope, C.H. (1928) Seven new reptiles from Fukien Province, China. *American Museum Novitates*, 320, 1–6.



- Pope, C.H. (1935) *The reptiles of China. Turtles, crocodilians, snakes, lizards*. American Museum of Natural History, New York, *Natural History of Central Asia*, Vol. 10, xlii + 604 pp., Pl. 1–27.
- Smith, M.A. (1918) Description of a new snake (*Opisthotropis spenceri*) from Siam. *The Journal of the Natural History Society of Siam*, 3 (1), 13.
- Smith, M.A. (1943) *The Fauna of British India, Ceylon and Burma, including the whole of the Indo-chinese subregion. Reptilia and Amphibia. Vol. III, Serpentes*. Taylor & Francis, London, xii + 583 pp.
- Stuart, B.L. & Chuaynkern, Y. (2007) A new *Opisthotropis* (Serpentes: Colubridae: Natricinae) from Northeastern Thailand. *Current Herpetology*, 26 (1), 35–40.
- Taylor, E.H. (1965) The serpents of Thailand and adjacent waters. *University of Kansas Science Bulletin*, 45 (9), 609–1096.
- Taylor, E.H. & Elbel, R.E. (1958) Contribution to the herpetology of Thailand. *University of Kansas Science Bulletin*, 38 (2), 1033–1189.
- Teynié, A. & David, P. (2010) *Voyages Naturalistes au Laos: Les Reptiles*. Éditions Revoir, Nohanent (France), 315 pp.
- Teynié, A. & David, P. (2014) Amphibiens et reptiles des formations karstiques du Laos. *Bulletin de la Société Herpétologique de France*, 148 [2013] (4), 451–489.
- Teynié, A., David, P., Lottier, A., Le, D.M. & Nguyen, T.Q. (2014) A new genus and species of xenodermatid snake (Squamata: Colubroidea: Xenodermatidae) from northern Lao People's Democratic Republic. *Zootaxa*, in press.
- Toyama, M. (1983). Taxonomic reassignment of the colubrid snake, *Ophiodrys kikuzatoi*, from Kume-jima Island, Ryukyu Archipelago. *Japanese Journal of Herpetology*, 10 (2), 33–38.
- Van Lidth de Jeude, T.W. (1890) Reptilia from the Malay Archipelago. II. Ophidia. In: Weber, M. (Ed.), *Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien. Heft 2*, Leiden, E.J. Brill, 178–192, Pl. 15–16.
- Vogel, G., Nguyen, T.Q., Kingsada, P. & Ziegler, T. (2012) A new species of the genus *Lycodon* Boie, 1826 from Laos (Squamata: Colubridae). *North-western Journal of Zoology*, Oradea (Romania), 8 (2), 344–352.
- Yang, J.H., Sung, Y.-H. & Chou, B.P.-L. (2013) A new species of the genus *Opisthotropis* Günther, 1872 (Squamata: Colubridae: Natricinae) from Guangdong Province, China. *Zootaxa*, 3646 (3), 289–296.  
<http://dx.doi.org/10.11646/zootaxa.3646.3.7>
- Yang, J.H., Wang, Y.Y., Zhang, B., Lau, M.W.-N. & Chou, W.-H. (2011) Revision of the diagnostic characters of *Opisthotropis maculosa* Stuart and Chuaynkern, 2007 with notes on its distribution and variation, and a key to the genus *Opisthotropis* (Squamata: Natricidae). *Zootaxa*, 2785, 61–68.
- Zhao, E.M. (1999) Diagnoses of a new frog and a new snake from China. *Sichuan Journal of Zoology*, 18 (3), inside front cover.
- Zhao, E.M. (2004) A re-description of *Opisthotropis cheni* Zhao, 1999 (Serpentes: Colubridae). *Sichuan Journal of Zoology*, 24 (3), 342–343.
- Zhao, E.M. (2006) *Zhongguo Shelei*. Anhui Science and Technology Publishing House Publishing, Hefei (Anhui Province), Vol. I, 372 pp; Vol. II, 279 pp. (In Chinese).
- Zhao, E.M., Huang, M.H., Zong, Y., Zheng, J., Huang, Z.J., Yang, D. & Li, D.J. (Eds.) (1998) *Fauna Sinica. Reptilia Vol. 3. Squamata Serpentes*. Science Press, Beijing, xvii + 522 pp., Pl. I–VIII, Col. Pl. I–IV. (In Chinese).
- Zhao, E.M., Jiang, Y.M. & Huang, Q.Y. (1978) Three new snake species in China. *Material for Herpetological Researches*, Chengdu, 4, 21.
- Ziegler, T., David, P. & Vu, N.T. (2008) A new natricine snake of the genus *Opisthotropis* from Tam Dao, Vinh Phuc Province, northern Vietnam (Squamata, Colubridae). *Zoosystematics and Evolution*, Berlin, 84 (2), 197–203.

#### APPENDIX. List of examined specimens.

- Opisthotropis atra* (n = 1). “West Africa”. BMNH 1946.1.15.31 (Holotype), no locality.
- Opisthotropis balteata* (n = 5). **Vietnam**. Bac Giang Province. IEBR A.0861, ZFMK 94229, Tay Yen Tu Nature Reserve, Son Dong District; Tonkin. NMW 22979.—**Cambodia**. No locality. NMW 22978:1–2.
- Opisthotropis cucae* (n = 1). **Vietnam**. Kon Tum Province. IEBR A.0924 (Holotype), Chu Mom Ray National Park, Sa Thay District, (14°26.227'N, 107°43.268'E), 740 m.
- Opisthotropis daovantieni* (n = 1). **Vietnam**. Kon Tum Province. ZISP 26073, Kon Plong Forest, Xa Hieu, Kon Plong District (14°41.447'N 108°22.376'E, 1,170 m).
- Opisthotropis guangxiensis* (n = 3). **China**. Guangxi Province. CIB 9972–4, Dayao Shan (Mt. Dayao).
- Opisthotropis jacobi* (n = 7). **Vietnam**. Lao Cai Province. IEBR 2910, Sa Pa; MNHN 1933.0010, MNHN 1935.0083, MNHN 1938.0126–0127, “Chapa, Tonkin”, now Sa Pa. Vinh Phuc Province. MNHN 1935.0457, CAS-SU 9147, Tam Dao.
- Opisthotropis lateralis* (n = 3). **Vietnam**. Bac Giang Province. IEBR 3644–3645, Tay Yen Tu Nature Reserve, Son Dong District. Quang Nam Province. IEBR 83, Tra My, Tra Don Commune, Mt. Ngoc Linh.
- Opisthotropis latouchii* (n = 2). **China**. Jiangxi Province. NMW 26028: 1–2, “Pingshiang, Kiangsi Province”, now Pinjiang.
- Opisthotropis rugosa* (n = 1). **Indonesia**. Province of Sumatera Barat. RMNH 4330 (Holotype), Kayutanam.
- Opisthotropis spenceri* (n = 2). **Thailand**. Lampang Province. BMNH 1946.1.15.31, BMNH 1965.640, “Muang Ngow, N. Siam”, at present Ngao.
- Opisthotropis tamdaoensis* (n = 1). **Vietnam**. Vinh Phuc Province. VNUH 010606, Tam Dao, ca. 195 m a.s.l.

*Opisthotropis typica* (n = 2). **Federation of Malaysia**. *Borneo*. State of Sabah. MNHN 1889.0216, “Mt. Kina-Balu, Alt. 4175 m (Nord Borneo)”, Mt. Kinabalu.—**The Philippines**. *Palawan Island*. CAS 28676, about 7 km NW of Iwahig.

“*Opisthotropis boonsongi*” (n = 1). **Thailand**. Loei Province. FMNH 135328 (holotype), Phu Nam Lang Mt., 1,780 m, Ban Khok, Na Phung, Dan Sai District.

*Parahelicops annamensis* (n = 12). **Vietnam**. Ha Tinh Province. AMNH 147129, Po Mu forest, Rao An, Huong Son District (18°20'26"N 105°14'13"E, 870 m); ZISP NLO 2478, Rao An, Huong Son District (300 m). Quang Binh Province. ZFMK 86457, ZISP NLO 2714, Phong Nha - Ke Bang National Park. Quang Tri Province. ZISP NLO 3257, Ban Cup, Huong Hoa District (16°55.863'N 106°35.361'E, 400 m). Thua Thien-Hue Province. ZFMK 83513, Bach Ma; ZISP NLO 2790, Bach Ma National Park, 1,350 m. Da Nang City. MNHN 1938.0117 (holotype), “Bana”, now Ba Na Hill Station (1,500 m); ZISP NLO 2831, Ba Na National Park (1,400 m). Kon Tum Province. IEBR 351, ZISP NLO 3435, Mang Canh village, Kon Plong District, (14°41'950N 108°14'642E, 1,200–1,250 m).—**Laos**. Xé Kong Province. FMNH 258637, Xe Sap National Biodiversity Conservation Area, Kaleum District, (16°04.167'N 106°58.750'E, 1,280–1,500 m).

*Paratapinophis praemaxillaris* (n = 2). **Laos**. Xiangkhoang Province. MNHN 1928.0063–1928.0064, “Xiengkhouang”.