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Two new Kukri Snake species (Colubridae: *Oligodon*) from the Nakhon Si Thammarat Mountain Range, and addition of *O. ocellatus* to the fauna of Thailand

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Abstract

We describe two new Kukri snakes of the genus *Oligodon* from the Nakhon Si Thammarat Mountain Range, southern peninsular Thailand. *Oligodon phangan* **sp. nov.**, endemic to Pha-Ngan Island, Surat Thani Province, is characterized by a maximal known SVL of 369.1 mm; 12 maxillary teeth, the posterior three enlarged; 17-17-15 dorsal scale rows; 163–166 ventrals; 33–42 divided subcaudals; a single anal; dorsal color brown with a pair of discreet paravertebral and lateral stripes; no dorsal or supracaudal bands, blotches or crossbars; background color of belly pinkish-orange; underside of tail immaculate. *Oligodon promsombuti* **sp. nov.**, whose type-locality is Khao Phanom Wang, Surat Thani Province, is also found in Trang Province, and is characterized by a maximal known SVL of 552.7 mm; 12 maxillary teeth, the posterior three enlarged; 17-17-15 dorsal scale rows; 177 ventrals; 40 divided subcaudals; a single anal; deeply forked hemipenes lacking spines; dorsal color blackish brown with nearly indistinct paravertebral stripes; no dorsal or supracaudal blotches or crossbars; background color of belly ivory, heavily speckled with subrectangular blackish blotches. We tentatively allocate both new species to the informal *Oligodon-cyclurus*-group. They are the 5th and 6th *Oligodon* species endemic to Thailand. We add *Oligodon ocellatus*, so far known only from Cambodia, southern Laos and southern Vietnam, to the Thai fauna, based on a specimen from Chong Mek, Ubon Ratchathani Province.

Key words: Thai-Malay Peninsula, Thailand, *Oligodon ocellatus*, *Oligodon phangan* **sp. nov.**, *Oligodon promsombuti* **sp. nov.**, taxonomy, limestone, karst

Introduction

The genus *Oligodon* Fitzinger currently includes at least 81 recognized species (Nguyen *et al*. 2020; Uetz *et al.* 2020). Partial phylogenies have been proposed for the genus *Oligodon* (Green 2010; Green *et al*. 2010; Nguyen *et al*. 2020). However, in the absence to date of a global revision and phylogeny of the genus *Oligodon*, its species can still be attributed to practical, informal species groups according to a restricted set of obvious morphological characters (Wagner 1975; David *et al.* 2008a–b), facilitating interspecific comparisons. The most important of these characters are the number of maxillary teeth, the dorsal pattern and the shape of the hemipenes, the latter being unfortunately still unknown in a number of species.

In the course of our systematical herpetofaunal field surveys of Peninsular Thailand, we encountered an intriguing blackish kukri snake in Surat Thani and Trang provinces, unlike any we had seen in Thailand. Within the same mountain range, on the island of Pha-Ngan in Surat Thani Province, we found a second unusually colored population of *Oligodon*. Both possess a large rostral scale and characteristic enlarged and compressed, blade-like posterior maxillary teeth, a combination typical of the genus *Oligodon* (David *et al.* 2012). We hence compared them with

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all *Oligodon* taxa described in the region, and found them well diagnosable based on pattern, color, scalation and dentition differences, and we consequently describe and name them hereafter as new species. While examining comparison material, we also encountered a Thai specimen of *Oligodon ocellatus*, a species still unrecorded from the country.

Material and methods

Specimens were fixed in 90% ethanol and subsequently transferred to 70% ethanol for storage. Measurements and meristic counts follow Pauwels *et al*. (2017) and Sumontha *et al*. (2017). All measurements were taken with a slide-caliper to the nearest 0.1 mm. Ventral scales were counted according to Dowling (1951a); the terminal scute is not included in the number of subcaudals. Dorsal scale row counts are given at one head length behind head, at midbody (i.e., at the level of the ventral plate corresponding to a half of the total number of ventrals), and at one head length before vent. The scale row reduction was determined according to the method of Dowling (1951b). Paired head measurements are given for the right side. Paired meristic characters are given left/right. Maxillary teeth were counted by removing the gums of the left maxilla. Hemipenes were forcedly everted just before preservation by injection of ethanol with a syringe at the base of the tail.

Comparative morphological and pattern data are drawn from the original descriptions, and recent species accounts and revisions providing comparisons (including Blyth 1854; Günther 1864, 1865, 1868; Boulenger 1888, 1890, 1914; Wall & Evans 1900, 1901; Wall 1905, 1914; Pellegrin 1910; Gyldenstolpe 1916; Smith 1916, 1917, 1943; Werner 1925; Angel 1927; Bourret 1934a–b; Rendahl 1937; Leviton 1953, 1960; Taylor & Elbel 1958; Taylor 1965; Campden-Main 1970; Dowling & Jenner 1989; Grossmann 1992; Pauwels *et al*. 2002, 2008, 2017; Wüster & Cox 2002; Leong & Grismer 2004; David *et al*. 2008a–b, 2011, 2012; Tillack & Günther 2009; Van Rooijen *et al*. 2011; Zhang *et al.* 2011; David & Vogel 2012; Jiang *et al*. 2012; Neang *et al.* 2012; Neang & Hun 2013; Sutradhar & Nath 2013; Vassilieva *et al*. 2013; Vassilieva 2015; Nguyen *et al.* 2016, 2017; Sumontha *et al*. 2017; Nguyen *et al*. 2020; Sah *et al*. 2020; and references therein).

We also compared our new species with preserved material (see Appendix) from the collections of the Chulalongkorn University Museum of Zoology, Reptile Collection, Bangkok (CUMZ (R)), Field Museum, Chicago (FMNH), Muséum national d'Histoire naturelle, Paris (MNHN), Queen Saovabha Memorial Institute, Thai Red Cross Society, Bangkok (QSMI), Prince of Songkhla University Zoological Collection, Songkhla (PSUZC), Royal Belgian Institute of Natural Sciences, Brussels (RBINS), Royal Forest Department of Thailand, Bangkok (RFD), Natural History Museum, National Science Museum, Technopolis, Pathum Thani (THNHM), and United States National Museum, Washington (USNM).

In particular, we compared our specimens with all 35 *Oligodon* species found in Cambodia, peninsular Malaysia, southern Myanmar, Thailand and southern Vietnam, as well as with the taxa described from the same region and currently regarded as synonyms: *O. annamensis* Leviton, *O. arenarius* Vassilieva, 2015, *O. barroni* (Smith) (and its subjective junior synonym *Holarchus taeniatus caudaensis* Bourret), *O. booliati* Leong & Grismer, 2004, *O. catenatus* (Blyth), *O. cattienensis* Vassilieva, Geissler, Galoyan, Poyarkov, Van Devender & Böhme, 2013, *O. cinereus* (Günther) (and its junior subjective synonyms *Holarchus lightfooti* Rendahl and *Simotes violaceus pallidocinctus* Bourret), *O. condaoensis* Nguyen, Nguyen, Le & Murphy, 2016, *O. cruentatus* (Günther), *O. cyclurus* (Cantor), *O. deuvei* David, Vogel & Van Rooijen, 2008, *O. dorsalis* (Gray), *O. eberhardti* Pellegrin, *O. fasciolatus* (Günther), *O. huahin* Pauwels, Larsen, Suthanthangjai, David & Sumontha, 2017, *O. inornatus* (Boulenger), *O. jintakunei* Pauwels, Wallach, David & Chanhome, 2002, *O. joynsoni* (Smith), *O. kampucheaensis* Neang, Grismer & Daltry, 2012, *O. macrurus* (Angel), *O. mcdougalli* Wall, *O. moricei* David, Vogel & Van Rooijen, 2008, *O. mouhoti* (Boulenger), *O. ocellatus* (Morice) (and its junior synonym *O. analepticos* Campden-Main), *O. octolineatus* (Schneider), *O. planiceps* (Boulenger), *O. pseudotaeniatus* David, Vogel & Van Rooijen, 2008, *O. purpurascens* (Schlegel), *O. rostralis* Nguyen, Tran, Nguyen, Neang, Yushenko & Poyarkov, 2020, *O. saintgironsi* David, Vogel & Pauwels, 2008, *O. saiyok* Sumontha, Kunya, Dangsri & Pauwels, 2017, *O. signatus* (Günther), *O. taeniatus* (Günther) (and its synonym *Simotes quadrilineatus* Jan & Sordelli), *O. theobaldi* (Günther) and *O. vertebralis* Günther.

Abbreviations of morphological characters are as follows: Morphometry: ED, eye diameter (horizontal); ELip, distance between orbit and lip; FrW, maximum width of frontal; HD, maximum head depth; HL, head length (from the tip of rostral to the posterior end of the jaw); HW, maximum head width; RosH, maximum rostral height; RosW,

maximum rostral width; SnL, snout length (from the tip of rostral to the anterior eye margins); SVL, snout-vent length; TaL, tail length; TL, total length. Scalation & others: ASR, number of dorsal scale rows at neck (at one HL behind head); DSR, dorsal scale rows; IL, infralabial scale(s); LOR, loreal scale; MSR, number of dorsal scale rows at midbody (at number of VEN/2); MT: maxillary teeth; PosOc, postocular scale(s); PreOc, preocular scale(s); PreSubOc, presubocular scale (below the preocular and not in contact with the loreal); PV, preventral(s) (directly preceding the ventrals, unpaired, wider than long but not in contact with the 1st dorsal scale row); SC, subcaudal scale(s); SL, supralabial scale(s); SubOc, subocular; Tem, temporal formula; VEN, ventral scale(s).

Results

Description of *Oligodon phangan* sp. nov.

(Figs 1–5)

Holotype. PSUZC-R 732 (field number MS 631); adult female found in Wat Phu Khao Noi (9°44'02.8"N, 99°59'25.1"E), Ko Pha-Ngan Sub-district, Ko Pha-Ngan District, Pha-Ngan Island (= Ko Pha-Ngan or Koh Phangan), Surat Thani Province, peninsular Thailand; collected by P. Chantong on 20 December 2018.

Paratype. PSUZC-R 733 (field number MS 632); adult male; same locality and collector as holotype, collected on 15 December 2018.

Diagnosis. *Oligodon phangan* **sp. nov.** can be distinguished from all other congeneric species by a combination of its maximal known SVL of 369.1 mm; 12 maxillary teeth, the posterior three enlarged; two internasals; two prefrontals; eight supralabials; loreal present; two postoculars; 17-17-15 dorsal scale rows; 163–166 ventrals and 33–42 divided subcaudals; a single anal; dorsal color brown with a pair of discreet paravertebral and lateral stripes; no dorsal or supracaudal bands, blotches or crossbars; background color of belly pinkish-orange; underside of tail immaculate.

FIGURE 1. Forebody of the holotype of *Oligodon phangan* **sp. nov.** (PSUZC-R 732) in life. Photograph by M. Sumontha.

Description of holotype. Adult female. Body robust but elongate. SVL 358.3 mm; TaL 53.2 mm. Tail robust, tapering, accounting for 12.9 % of the TL (411.5 mm). Pupil round. Head short (HL 13.2 mm, i.e. 3.7 % of SVL; HW 7.3 mm; HD 5.3 mm), barely distinct from the poorly marked neck. SnL 4.5 mm. Snout long (34 % of HL, 2.1 times as long as ED). ED 2.1 mm; ELip 1.8 mm; distance eye-nostril 2.3 mm. Straight distance between nostrils 3.4 mm. Distance between eyes 5.6 mm.

Body scalation. DSR 17-17-15, all smooth. DSR reduction from 17 to 15 occurs above the 93rd VEN (left) and 95th VEN (right) by fusion of DSR 3 and 4. 1 PV + 163 VEN, laterally angulated. Anal plate single. SC 33, all divided.

FIGURE 2. Live holotype of *Oligodon phangan* **sp. nov.** (PSUZC-R 732) in ventral view. A red line marks every 10 ventrals and every 10 subcaudals. Photograph by M. Sumontha.

Head scalation. Rostral thick, curved onto upper snout surface, well visible from above, separating internasals by about one half of their length. RosW 2.6 mm, RosH 2.3 mm. Nasals vertically divided, with the posterior part smaller. Nostril large, piercing top of middle of nasal (Fig. 4A). Two internasals, in broad contact, shorter than prefrontals. Two prefrontals, subrectangular, distinctly wider than long. Length of suture between internasals (0.9 mm) shorter than the length of suture between prefrontals (1.3 mm). Frontal pentagonal, frontal length 4.2 mm, 1.3 times as long as wide; 1/1 supraoculars, distinctly longer (3.3/3.1 mm) than wide (2.2/2.0 mm); on the left side 7 SL, only the 4th in contact with orbit (the long 4th SL seems to result from a fusion of two SL, because a segment of a suture is still visible at the level where the 3rd and 4th SL are separated on the right side of the head); on the right side 8 SL, 4th and 5th in contact with orbit; on both sides 2nd and 3rd SL in contact with LOR; posterior three SL distinctly enlarged. LOR 1/1, distinctly longer than high (Fig. 4A). PreOc 1/1; no PreSubOc; no SubOc. PosOc 2/2, the upper one larger on each side. Tem 1+2 on each side. Parietals length 3.7/4.0 mm; parietals larger than the frontal, in contact on 3/4 of their length behind the frontal. Parietals bordered posteriorly by four undifferentiated dorsal scales. Mental width 1.8 mm, mental length 1.1 mm. IL 8/8, 1st pair in contact behind mental, IL 1 to 4 in contact with anterior chin

shields. First pair of chin shields much longer (3.5/3.4 mm) than 2nd pair (1.9/1.7 mm). Second pair of chin shields in contact on each side with the 4th and 5th IL.

Maxilla dentition. Twelve MT, the three posterior ones enlarged, kukri-shaped; no diastema.

Coloration in life. Dorsal surface of the head light brown, with poorly contrasted, difficult-to-see darker marks: an interorbital transversal bar and a suborbital bar. The lateral sides of the head are light brown, lighter on the supralabials. The dorsum is light brown. Two paravertebral stripes, poorly contrasted as they are slightly darker than the background color, each less than two dorsals wide, begin on the neck and run along the dorsum. Two parallel lateral stripes, similarly poorly contrasted, less than one dorsal wide. The ventral color of the head is pinkish white. The belly is pinkish-orange, with light speckling posteriorly. No dark blotches on belly. The underside of tail is pinkish-orange, without any speckling or dark marks. In preservative, the general color darkens, and the dorsal vertebral stripes nearly disappear; the belly and underside of tail become whitish.

Variation. Main morphological characters of the paratype are provided in Table 1; they agree in most respects with the holotype. Tail of the male paratype accounting for 16.6 % of its TL, suggesting that males probably have proportionally longer tails than females. Hemipenes of the male paratype are not everted, and the hemipenis structure of this species is still unknown. The possession on each head side of the paratype of eight supralabials of which the 4th and 5th contact the eye indicates that this is the normal configuration in the species, and that the near-complete fusion of two supralabials on one side of the head of the holotype is an abnormality. Live coloration of the paratype is similar to the holotype.

TABLE 1. Meristic and morphometric (in mm) data for the type-series of *Oligodon phangan* **sp. nov.** and *O. promsombuti* **sp. nov.** Paired meristic characters are given left/right. Paired measurements are given for the right side. Supralabial numbers are followed in brackets by the ones contacting the orbit. Infralabial numbers are followed in brackets by how many contact the anterior chin shields. A = anal plate; S = single. For the other abbreviations, see Material and methods.

Morphological character	*Oligodon phangan* **sp. nov.**, holotype (PSUZC-R 732)	*Oligodon phangan* **sp. nov.**, paratype (PSUZC-R 733)	*Oligodon promsombuti* **sp. nov.**, holotype (QSMI 1508)
Sex	F	M	M
SVL	358.3	369.1	552.7
TaL	53.2	73.5	86.9
HL	13.2	14.4	18.3
HW	7.3	7.2	11.2
HD	5.3	5.3	8.4
RosW	2.6	2.3	4.1
FrW	3.1	3.6	4.6
SnL	4.5	4.2	6.3
ED	2.1	2.4	2.5
ELip	1.8	1.4	2.6
DSR	17-17-15	17-17-15	17-17-15
PV + VEN	1+163	0+166	2+177
A	S	S	S
SC	33	42	40
SL	7(4) / 8(4–5)	8(4–5) / 8(4–5)	8(4–5) / 8(4–5)
IL	8(4) / 8(4)	8(4) / 8(4)	8(4) / 8(4)
LOR	1/1	1/1	1/1
PreOc	1/1	1/1	2/2
PreSubOc	0/0	0/0	0/0
SubOc	0/0	0/0	0/0
PosOc	2/2	2/2	2/2
Tem	1+2 / 1+2	1+2 / 1+2	1+1+2 / 1+1+2
MT	12	12	12

FIGURE 3A–B. Preserved holotype of *Oligodon phangan* **sp. nov.** (PSUZC-R 732) in dorsal (A) and ventral (B) views. Photographs by M. Sumontha.

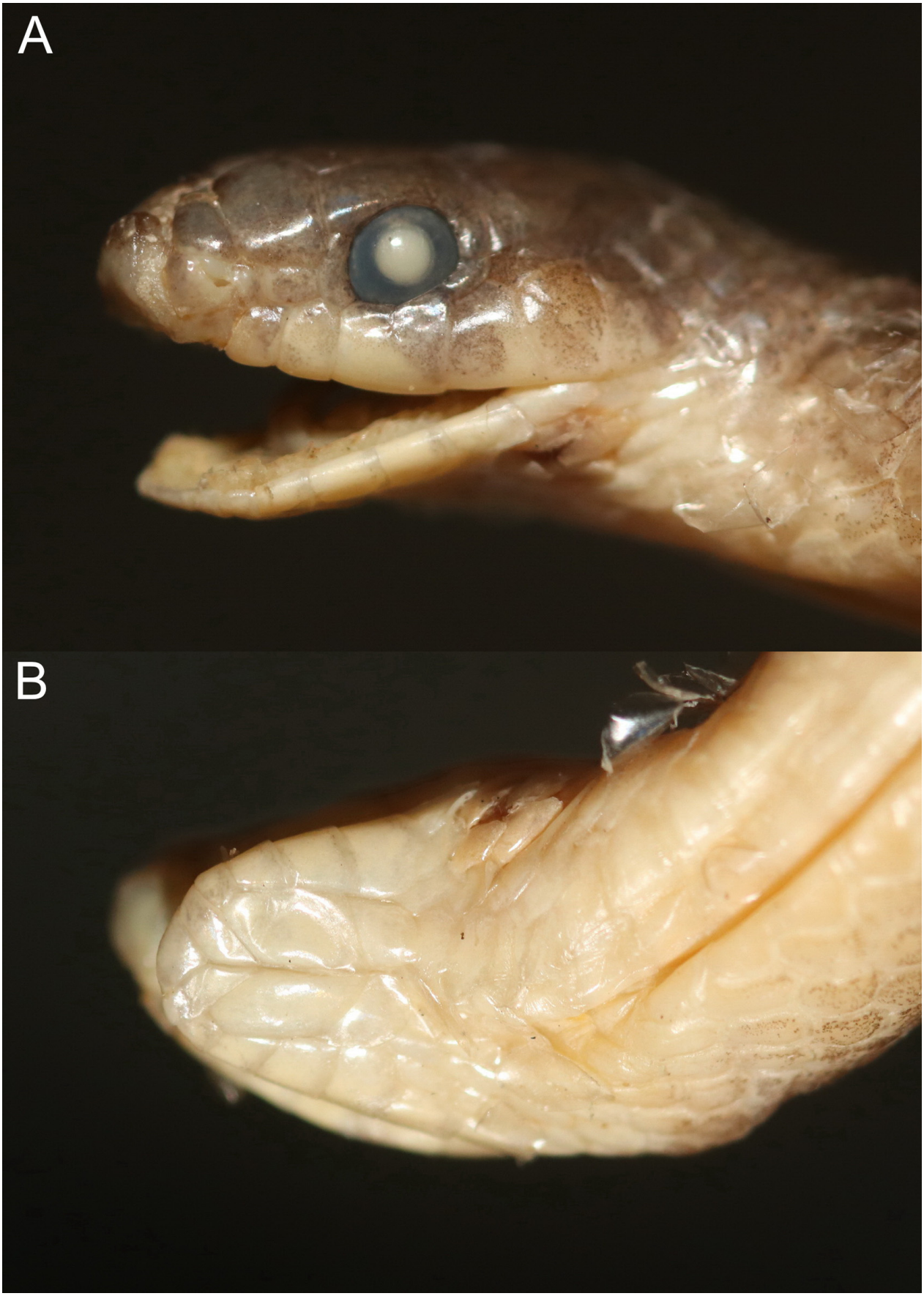

FIGURE 4A–B. Head of the preserved holotype of *Oligodon phangan* **sp. nov.** (PSUZC-R 732). Left profile (A); ventral surface (B). Photographs by M. Sumontha.

Distribution and natural history. *Oligodon phangan* **sp. nov.** is currently known only from its type-locality on Pha-Ngan Island in Surat Thani Province (Fig. 9). The island belongs to the northern part of the Nakhon Si Thammarat Mountain Range, a mountain chain located about 60 km east of the Phuket Mountain Range and running parallel to it. Pha-Ngan Island lies at about 50 km from the mainland of Surat Thani Province; in between one finds Samui Island (Ko Samui) and small islets. A *Naja* aff. *kaouthia* Lesson individual was observed in direct proximity to the types of *Oligodon phangan* **sp. nov.** at the type-locality.

The types of *Oligodon phangan* **sp. nov.** were collected at night, along a wall of the temple. They were kept in captivity and refused any food, but were observed mating on 21 December 2018, thus shortly after having been collected. We have never encountered *Oligodon phangan* **sp. nov.** in the pet trade. The presence of *Oligodon phangan* **sp. nov.** in the nearby Than Sadet Waterfall National Park should be checked to ensure that the species is represented in a protected area.

Etymology. The specific epithet is a noun in apposition, invariable, referring to Pha-Ngan Island where the type-locality lies. We suggest the following common names: *Ngu Pee Kaew Ko Pha-Ngan* (Thai), Pha-Ngan Kukri Snake (English), *Oligodon de Pha-Ngan* (French), and *Pha-Ngan Kukrinatter* (German).

FIGURE 5. Live paratype of *Oligodon phangan* **sp. nov.** (PSUZC-R 733) in pre-shedding phase. Photograph by M. Sumontha.

Comparisons of *Oligodon phangan* sp. nov. with other species. Its single anal plate separates *Oligodon phangan* **sp. nov.** from the following species which show a divided anal plate: *O. catenatus*, *O. cruentatus*, *O. dorsalis*, *O. eberhardti*, *O. jintakunei*, *O. mcdougalli*, *O. planiceps* and *O. theobaldi*. With its 17 MSR, *Oligodon phangan* **sp. nov.** is easily distinguished from *Oligodon annamensis* (13), *O. catenatus* (13), *O. cyclurus* (19), *O. dorsalis* (15), *O. eberhardti* (13), *O. fasciolatus* (21), *O. inornatus* (15), *O. jintakunei* (15), *O. kampucheaensis* (15), *O. mcdougalli* (13), *O. ocellatus* (19), *O. planiceps* (13), *O. purpurascens* (19 or 21), *O. rostralis* (15), *O. taeniatus* (19) and *O. vertebralis* (15). Its striped, non-reticulated, non-blotched, dorsal pattern allows distinguishing it from *Oligodon annamensis* (banded), *O. arenarius* (indistinct pattern), *O. barroni* (blotched), *O. booliati* (banded), *O. cattienensis* (blotched), *O. cinereus* (indistinct/banded pattern), *O. cruentatus* (reticulated), *O. cyclurus* (reticulated/blotched) , *O. fasciolatus* (reticulated/blotched), *O. inornatus* (patternless), *O. jintakunei* (banded), *O. joynsoni* (reticulated/banded), *O. kampucheaensis* (banded), *O. moricei* (striped and reticulated), *O. mouhoti* (two blotches above tail),

O. ocellatus (reticulated/blotched), *O. planiceps* (reticulated), *O. purpurascens* (blotched/reticulated), *O. rostralis* (blotched/reticulated), *O. saintgironsi* (blotched/reticulated), *O. saiyok* (banded/blotched), *O. signatus* (blotched /banded) and *O. vertebralis* (blotched). The VEN number of *Oligodon phangan* **sp. nov.** (163–166) is distinctly higher than in *O. arenarius* (131–144), *O. booliati* (143–153), *O. deuvei* (140–155), *O. planiceps* (132–145), *O. pseudotaeniatus* (137–156), *O. signatus* (141–157), and *O. vertebralis* (136–154), and distinctly lower than in *O. jintakunei* (189), *O. joynsoni* (186–198), *O. mcdougalli* (199) and *O. saiyok* (181–187). Its possession of 12 MT distinguishes *Oligodon phangan* **sp. nov.** from *O. annamensis* (8), *O. arenarius* (6–8), *O. catenatus* (7), *O. cattienensis* (8–10), *O. cruentatus* (14–16), *O. cyclurus* (9–10), *O. dorsalis* (6–7), *O. eberhardti* (7), *O. fasciolatus* (9–10), *O. huahin* (6), *O. jintakunei* (6), *O. kampucheaensis* (11), *O. macrurus* (13), *O. mcdougalli* (6), *O. mouhoti* (14–16), *O. ocellatus* (9–11), *O. octolineatus* (9–10), *O. planiceps* (10), *O. pseudotaeniatus* (15), *O. purpurascens* (9–10), *O. rostralis* (6), *O. saiyok* (13), *O. signatus* (7–8), *O. taeniatus* (14–17), *O. theobaldi* (15–16) and *O. vertebralis* (8–9) (number of MT unknown in *O. booliati*). *Oligodon phangan* **sp. nov.** shows morphological similarities with the Vietnamese *O. condaoensis*, endemic to Hon Ba Island, from which it can be separated by its lower VEN number (163–166 vs. 168–176), higher SC number in males (42 vs. 37), its pinkish-orange (vs. cream to grayish) belly, and the absence (vs. presence) of dark dots under the tail.

Description of *Oligodon promsombuti* sp. nov.
(Figs 6–8)

Holotype. QSMI 1508 (field number MS 710); adult male found at the foot of Khao Phanom Wang (= Phanomwung; ca. 9°05'35.3"N, 99°36'30.9"E), a limestone hill in Kanchanadit District, Surat Thani Province, peninsular Thailand; collected by Saksit Promsombut and Kanokorn Thongyai on 28 January 2017.

Diagnosis. *Oligodon promsombuti* **sp. nov.** can be distinguished from all other congeneric species by a combination of its maximal known SVL of 552.7 mm; 12 maxillary teeth, the posterior three enlarged; two internasals; two prefrontals; eight supralabials; loreal present; two postoculars; 17-17-15 dorsal scale rows; 177 ventrals and 40 divided subcaudals; a single anal; deeply forked hemipenes lacking spines; dorsal color blackish brown with nearly indistinct paravertebral stripes; no dorsal or supracaudal blotches or crossbars; background color of belly ivory, heavily speckled with subrectangular blackish blotches.

Description of holotype. Adult male. Body robust but elongate. SVL 552.7 mm; TaL 86.9 mm. Tail robust, tapering, accounting for 13.6 % of the TL (639.6 mm). Pupil round. Head short (HL 18.3 mm, i.e. 3.3 % of SVL; HW 11.2 mm; HD 8.4 mm), barely distinct from the poorly marked neck. SnL 6.3 mm. Snout long (34 % of HL, 2.5 times as long as ED). ED 2.5 mm; ELip 2.6 mm; distance eye-nostril 3.3 mm. Straight distance between nostrils 4.6 mm. Distance between eyes 7.4 mm.

Body scalation. DSR 17-17-15, all smooth. DSR reduction from 17 to 15 occurs above the 105th VEN (left) and 106th VEN (right) by fusion of DSR 3 and 4. 2 PV + 177 VEN, laterally angulated. Anal plate single. SC 40, all divided.

Head scalation. Rostral thick, curved onto upper snout surface, well visible from above, separating internasals by about one half of their length (Fig. 7B). RosW 4.1 mm, RosH 3.9 mm. Nasals vertically divided, with the posterior part smaller. Nostril large, piercing top of middle of nasal (Fig. 7A). Two internasals, in broad contact, shorter than prefrontals. Two prefrontals, subrectangular, distinctly wider than long, partly separated posteriorly by a triangular anterior projection of the frontal. Length of suture between internasals (1.2 mm) about twice the length of suture between prefrontals. Frontal octagonal, 1.3 times as long as wide; 1/1 supraoculars, distinctly longer (4.7/4.1 mm) than wide (2.5/2.7 mm); SL 8/8, 2nd and 3rd in contact with LOR, 4th and 5th in contact with orbit, posterior three distinctly larger than the five anterior ones. LOR 1/1, distinctly longer than high. PreOc 2/2, the upper one much taller on each side; no PreSubOc (the lower PreOc is in contact with the loreal, so it cannot be regarded as a PreSubOc); no SubOc. PosOc 2/2, the upper one larger. Tem 1+1+2 on each side. Parietals length 5.6/5.7 mm; parietals larger than the frontal, in contact on 2/3 of their length behind the frontal. Parietals bordered posteriorly by undifferentiated dorsal scales. Mental width 2.7 mm, mental length 1.3 mm. IL 8/8, 1st pair in contact behind mental, IL 1 to 4 in contact with anterior chin shields. First pair of chin shields much longer (4.1/4.4 mm) than 2nd pair (2.4/2.2 mm). Second pair of chin shields in contact on each side with the 4th and 5th IL.

FIGURE 6A–B. Preserved holotype of *Oligodon promsombuti* **sp. nov.** (QSMI 1508) in dorsal (A) and ventral (B) views. Photographs by M. Sumontha.

Maxilla dentition. Twelve MT, the three posterior ones enlarged, kukri-shaped; no obvious diastema.

Hemipenes. Both hemipenes of the holotype were everted (Fig. 7D). They are bilobed and deeply forked at the level of the 5th SC. Sulcal surface mostly smooth. Distal ends of hemipenial lobes with small calyces. Spines absent. Hemipenes tip reaching SC 13; hemipenes possibly not fully everted.

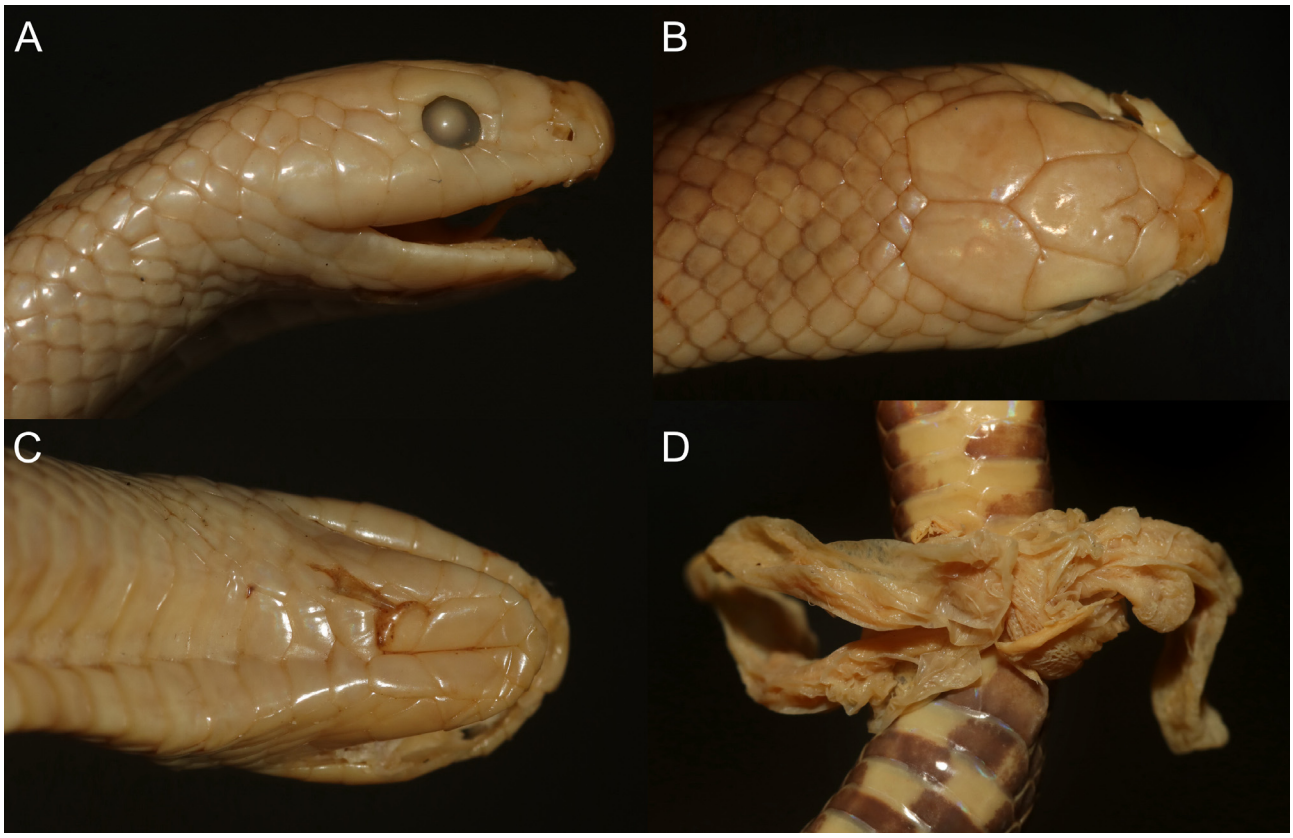

FIGURE 7A–D. Right profile (A), dorsal surface (B), and ventral surface (C) of the head, and hemipenes (D) of the preserved holotype of *Oligodon promsombuti* **sp. nov.** (QSMI 1508). Photographs by M. Sumontha.

Coloration in life. Dorsal surface of the head blackish brown, with poorly contrasted, difficult-to-see darker marks: an interorbital transversal bar and a chevron pointing forward whose apex is on the middle of the frontal, extending backwards on each side of the neck. The lateral sides of the head are blackish brown, slightly lighter on the lower parts of the supralabials. The dorsum is blackish brown. Two paravertebral stripes, near-invisible as they are just very slightly darker than the background color, each less than two dorsals wide, begin on the nape and run along the dorsum. Uniformly dark pink tongue. The ventral color of the head, belly and tail is ivory, but a large proportion of the ventrals and subcaudals have their left or right side, or sometimes both, of the same color as the dorsum, giving a checkered appearance. Only the anteriormost part of the throat and the underside of the tail tip are uniformly ivory without dark marks. In preservative, the general color lightens, the cephalic marks become very difficult to see, and the dorsal vertebral stripes nearly disappear; the contrasted ventral pattern remains.

Variation. A second adult individual was encountered in Na Yong District (ca. 7°31’51.5”N, 99°47’35.7”E), central-eastern Trang Province (Fig. 8), but was not preserved. Photographs of the left side of the head of this individual alive showed the same scalation features as in the holotype, except that the lower PreOc is not in contact with the LOR, so it should be rather regarded as a PreSubOc; the frontal lacks a triangular anterior projection, and is thus pentagonal (the shape of the anterior part of the frontal of the holotype is probably an abnormality). Live coloration is similar to the holotype.

Distribution and natural history. *Oligodon promsombuti* **sp. nov.** is currently known only from its type-locality in the Kanchanadit District of Surat Thani Province (Fig. 9) and in the Na Yong District of the adjacent Trang Province. In spite of intensive surveys in the whole Thai peninsula since more than two decades, we never found other individuals of the new species. We believe that it is associated to limestone hills (Fig. 10) and restricted to the Nakhon Si Thammarat Mountain Range. Other squamates found in the immediate surroundings on the hill at the

type-locality include *Cnemaspis chanardi* Grismer, Sumontha, Cota, Grismer, Wood, Pauwels & Kunya, *Cyrtodactylus lekaguli* Grismer, Wood, Quah, Anuar, Muin, Sumontha, Ahmad, Bauer, Wangkulangkul, Grismer & Pauwels (an individual from this locality was illustrated by Grismer *et al*. 2012: 19, 21) and *C. zebraicus* (Taylor), *Gehyra mutilata* (Wiegmann), *Gekko gecko* (Linnaeus) (Gekkonidae), *Elaphe taeniura ridleyi* (Butler) (Colubridae) and *Trimeresurus venustus* Vogel (Viperidae). The two known individuals of *Oligodon promsombuti* **sp. nov.** were kept in captivity in Thailand and refused any food. They were not aggressive and could be easily handled (Fig. 8). We have never seen *Oligodon promsombuti* **sp. nov.** in the pet trade, and its dull color will probably preserve it from animal dealers. The two known localities are situated at proximity to three protected areas, Namtok Sikhit, Tai Rom Yen and Khao Pu-Khao Ya national parks, where it should be searched.

FIGURE 8A–B. General view (A) and detail of the head (B) of a live *Oligodon promsombuti* **sp. nov.** from Na Yong District, Trang Province. Individual not preserved. Photographs by S. Amuntaikul.

Etymology. The specific epithet is a mark of friendship to Saksit Promsombut, one of the collectors of the holotype. We suggest the following common names: *Ngu Pee Kaew Surat Thani* (Thai), Surat Thani Kukri Snake (English), *Oligodon de Surat Thani* (French), and *Surat Thani Kukrinatter* (German).

Comparisons of *Oligodon promsombuti* sp. nov. with other species. By its possession of a single anal plate, *Oligodon promsombuti* **sp. nov.** is readily distinguished from the following species which show a divided anal plate: *O. catenatus*, *O. cruentatus*, *O. dorsalis*, *O. eberhardti*, *O. jintakunei*, *O. mcdougalli*, *O. planiceps* and *O. theobaldi*. Its 17 MSR easily separate it from *Oligodon annamensis* (13), *O. catenatus* (13), *O. cyclurus* (19), *O. dorsalis* (15), *O. eberhardti* (13), *O. fasciolatus* (21), *O. inornatus* (15), *O. jintakunei* (15), *O. kampucheaensis* (15), *O. mcdougalli* (13), *O. ocellatus* (19), *O. planiceps* (13), *O. purpurascens* (19 or 21), *O. rostralis* (15), *O. taeniatus* (19) and *O. vertebralis* (15). The absence of a prominent striped pattern separates it from *Oligodon arenarius*, *O. catenatus*, *O. condaoensis*, *O. cruentatus*, *O. deuvei*, *O. dorsalis*, *O. huahin*, *O. mcdougalli*, *O. moricei*, *O. mouhoti*, *O. octolineatus*, *O. pseudotaeniatus*, *O. taeniatus* and *O. vertebralis*. Lacking a blotched, banded and/or reticulated pattern makes *Oligodon promsombuti* **sp. nov.** is distinguishable from *O. annamensis* (banded), *O. bar-*

roni (blotched), *O. booliati* (banded), *O. cattienensis* (blotched), *O. cruentatus* (reticulated), *O. cyclurus* (reticulated/blotched), *O. fasciolatus* (reticulated/blotched), *O. jintakunei* (banded), *O. joynsoni* (reticulated/banded), *O. kampucheaensis* (banded), *O. moricei* (striped and reticulated), *O. mouhoti* (two blotches above tail), *O. ocellatus* (reticulated/blotched), *O. planiceps* (reticulated), *O. purpurascens* (blotched/reticulated), *O. rostralis* (blotched/reticulated), *O. saintgironsi* (blotched/reticulated), *O. saiyok* (banded/blotched), *O. signatus* (blotched/banded) and *O. vertebralis* (blotched). The VEN number of *Oligodon promsombuti* **sp. nov.** (177) is distinctly higher than in *O. arenarius* (131–144), *O. barroni* (136–160), *O. booliati* (143–153), *O. deuvei* (140–155), *O. kampucheaensis* (164), *O. macrurus* (139–162), *O. mouhoti* (145–163), *O. planiceps* (132–145), *O. pseudotaeniatus* (137–156), *O. rostralis* (167), *O. signatus* (141–157), *O. taeniatus* (142–165) and *O. vertebralis* (136–154), and distinctly lower than in *O. jintakunei* (189), *O. joynsoni* (186–198) and *O. mcdougalli* (199). Its bifurcate hemipenes put *Oligodon promsombuti* **sp. nov.** apart from the following among the above listed species for which hemipenes are known to be unforked: *O. arenarius*, *O. catenatus*, *O. cinereus*, *O. cruentatus*, *O. inornatus*, *O. joynsoni*, *O. mcdougalli*, *O. octolineatus*, *O. planiceps*, *O. purpurascens*, *O. signatus*, *O. theobaldi* and *O. vertebralis* (hemipenes unknown in *O. booliati*, *O. eberhardti*, *O. jintakunei*, *O. moricei* and *O. saiyok*). With its 12 MT, *Oligodon promsombuti* **sp. nov.** is distinguished from *O. annamensis* (8), *O. arenarius* (6–8), *O. catenatus* (7), *O. cattienensis* (8–10), *O. cruentatus* (14–16), *O. cyclurus* (9–10), *O. dorsalis* (6–7), *O. eberhardti* (7), *O. fasciolatus* (9–10), *O. huahin* (6), *O. jintakunei* (6), *O. kampucheaensis* (11), *O. macrurus* (13), *O. mcdougalli* (6), *O. mouhoti* (14–16), *O. ocellatus* (9–11), *O. octolineatus* (9–10), *O. planiceps* (10), *O. pseudotaeniatus* (15), *O. purpurascens* (9–10), *O. rostralis* (6), *O. saiyok* (13), *O. signatus* (7–8), *O. taeniatus* (14–17), *O. theobaldi* (15–16) and *O. vertebralis* (8–9) (number of MT unknown in *O. booliati*).

Oligodon promsombuti **sp. nov.** can be distinguished from *O. phangan* sp. nov. described above by its larger size (SVL 553 mm vs. 358 mm), its higher VEN number (177 vs. 163–166), its two PreOc, or one PreOc with one PreSubOc (vs. one PreO and no PreSubOc), its darker dorsal coloration, and its ivory belly with numerous subrectangular blackish blotches (vs. pinkish-orange belly without such blotches).

Addition of *Oligodon ocellatus* to the herpetofauna of Thailand

In their description of *Oligodon jintakunei*, Pauwels *et al.* (2002) listed as such the following specimen among the comparative preserved material they examined: "*Oligodon* '*ocellatus*' - FMNH 143301, Chong Mek, Thailand". At that time *Oligodon ocellatus* was poorly characterized versus its closest relatives and a positive identification was difficult. Meanwhile David *et al.* (2008) reviewed *Oligodon ocellatus*, confirmed *O. analepticos* as a synonym of the latter, and described the closely related *O. saintgironsi. Oligodon ocellatus* is known from Cambodia, southern Laos and southern Vietnam (David *et al.* 2008; Teynié & David 2010; Uetz *et al.* 2020).

The preserved specimen FMNH 143301, an adult male, has not yet been re-examined in light of the taxonomic and morphological revision of David *et al.* (2008). It shows a robust but elongate body (Fig. 11). Tail robust, tapering. SVL 354 mm; TaL 58 mm; ratio TaL/TL 0.14. Round pupil. 1 PV + 163 VEN (the last VEN is forked on the right side), laterally slightly angulated; a single anal and 39 divided SC. 19-19-15 DSR, all smooth; no apical pit. DSR reduction from 19 to 17 occurs above the 96th VEN (left and right) by fusion of DSR 5 and 6. DSR reduction from 17 to 15 occurs above the 109th (left) and 111th (right) VEN by fusion of DSR 4 and 5. Two internasals, in broad contact, shorter than prefrontals. Two prefrontals, subrectangular, distinctly wider than long. 1/1 supraoculars, distinctly longer than wide; 8/8 SL, the 4th and 5th in contact with orbit; 9/9 IL, 1st pair in contact behind mental, IL 1 to 4 in contact with anterior chin shields. First pair of chin shields much longer than 2nd pair, and about the same width. LOR 1/1, in contact on each side with post-nasal, prefrontal, PreOc, and 2nd and 3rd SL. PreOc 1/1, the upper one much taller. PreSubOc 1/1, much smaller than PreOc; no SubOc; PosOc 2/2, of subequal size. Tem 2+2 on each side. A dark mark on forehead, extending below the eyes to SL 5 and 6. Two dark marks extending from the frontal to the angle of the mouth. A chevron with its apex on the middle of the frontal, extending posteriorly to the first DSR above the 10th VEN; 11 blotches on dorsum, separated by three reticulations; 3 more such blotches above tail, with less contrasted reticulations in between. Underside of head, body and tail uniformly cream, without any blotch or speckling.

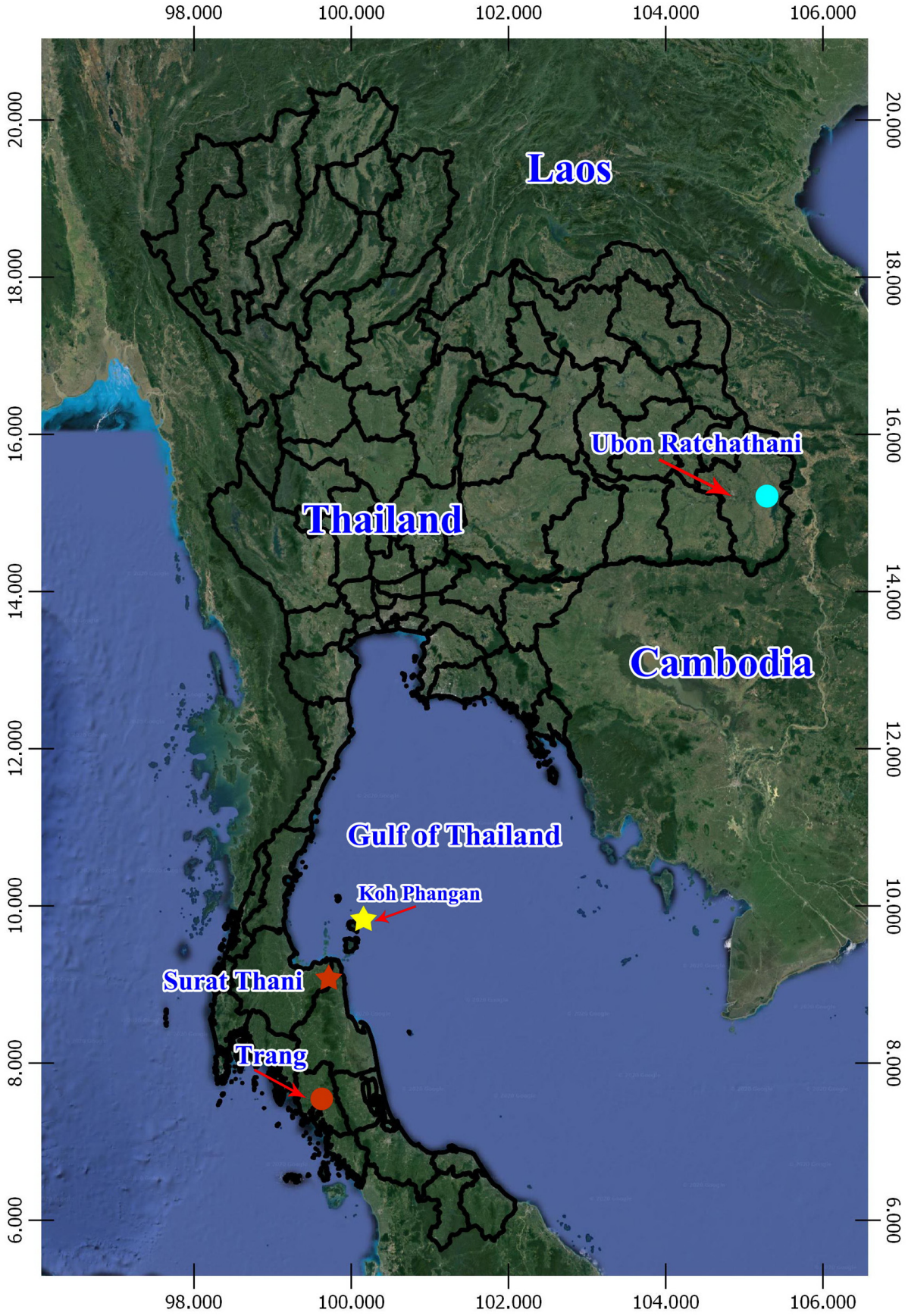

FIGURE 9. Map of Thailand showing the geographical locations for *Oligodon phangan* (yellow) and *O. promsombuti* (red) **spp. nov.** and the first known Thai locality for *O. ocellatus* (blue). Type-localities are indicated by a star. Map by W. Sodoab.

David *et al.* (2008) provided the following diagnosis for *Oligodon ocellatus*: "A species of the genus *Oligodon cyclurus*-group, characterized by long and deeply forked hemipenes, reaching 15th–17th SC, thin, smooth and not spinose throughout; 19-19-15 (rarely 13) dorsal scale rows; reductions between 19 and 17 rows occurring between VEN 79–107 (mean 90.3); a very short tail, TaL/TL 0.097–0.141; 9–11 maxillary teeth, the last two or three strongly enlarged; anal plate single; head scalation complete, including a presubocular; 8 (rarely 7) supralabials; 2 anterior temporals; and a typically blotched dorsal pattern, with large blotches in most specimens, or sometimes merely a reticulated pattern with very faint blotches." They added that it showed 157–180 VEN and 26–44 SC. The specimen FMNH 143301 perfectly fits with this description.

Chong Mek (15°07'59.0"N, 105°28'01.0"E) is located in the Sirindhorn District of Ubon Ratchathani Province in eastern Thailand, about 90 airline km east of the city of Ubon Ratchathani. It is a border town between Thailand and Laos. This is thus the first formal record of the species from Thailand. The closest known locality is Ban Kiatngong (= Ban Khiet Ngong) in Xe Pian National Bio-Diversity Conservation Area, Champassak Province, southern Laos (Teynié & David 2010); it is located at about 75 airline km SE of the new Thai locality.

We take this opportunity to confirm the presence of *Oligodon mouhoti* in Uthai Thani Province, western Thailand. The photograph of a live juvenile individual was provided by Cox *et al*. (1998) to illustrate their account for this species. Its coloration and pattern are diagnostic for the species: two dark longitudinal paravertebral stripes edging a yellowish vertebral stripe; two narrower dorsolateral stripes; two large rounded, black blotches on the upper surface of the tail, one at its base, the other one near the tip; and five major markings on upper head surface; it shows no dark hexagonal or butterfly-like dorsal blotches on the body. No locality was indicated for the photograph, but P. P. van Dijk (pers. comm. to OSGP, Feb. 1999) took it in the part of Huai Kha Khaeng Wildlife Sanctuary located in Uthai Thani Province. The individual's total length was about 12 cm (van Dijk, pers. comm.). The species was not recorded from Uthai Thani Province by David *et al*. (2008); it was listed by Cox *et al*. (2012: 290) from Uthai Thani Province but without more detail on location or voucher reference.

FIGURE 10. Biotope of *Oligodon promsombuti* **sp. nov.** at its type locality, Khao Phanom Wang in Surat Thani Province. Photograph by K. Thongyai.

FIGURE 11 A–B. Preserved *Oligodon ocellatus* (FMNH 143301) in dorsal (A) and ventral (B) views. Photographs by A. Resetar.

Discussion

Thanks to the fact that the hemipenial structure of *Oligodon promsombuti* **sp. nov.** is known, a tentative placement in one of the informally recognized species groups can be attempted. Its forked hemipenes exclude a placement in the "*Oligodon-cinereus*-group", the "*O. cruentatus-planiceps-theobaldi-torquatus* group" and the "*O.-purpurascens*-group". The absence of a prominent striped pattern and its relatively large size (SVL 553 mm vs. a maximum of 530 mm, generally under 450 mm) prevent its placement in the *Oligodon-taeniatus*-group (see David *et al*. 2008b); the latter group is also not known so far south (see the discussion of this group's southernmost distribution in David *et al*. 2008b: 28). The *Oligodon-cyclurus*-group is defined as follows by David *et al*. (2008a): "(1) long and deeply forked hemipenes, neither spinose or papillate, (2) 17–23 dorsal scale rows, (3) 10–12 maxillary teeth, (4) a full complement of head scales, including a loreal and a presubocular, (5) anal plate entire; and (6) a mainly blotched and/or reticulated pattern, never prominently striped (although specimens of *Oligodon cyclurus* from Myanmar and western Thailand may have occasionally a pair of broad paravertebral stripes along with the dorsal blotches)." All characters presented by *Oligodon promsombuti* **sp. nov.** fit with this definition, except its lack of a presubocular (in the holotype, but it is well present in the other known individual) and of a blotched or reticulate dorsal pattern. However, *Oligodon formosanus* with its mostly striped dorsal pattern and *Oligodon huahin* with its discrete striped pattern have been included in this group (David *et al*. 2008a; Pauwels *et al*. 2017).

The following species are currently included in the informal *Oligodon-cyclurus*-group: *O. cattienensis*, *O. chinensis*, *O. condaoensis*, *O. cyclurus*, *O. fasciolatus*, *O. formosanus*, *O. huahin*, *O. kampucheaensis*, *O. ocellatus*, *O. saintgironsi*, to which we tentatively add *Oligodon promsombuti* **sp. nov.** Although the hemipenes of *Oligodon phangan* **sp. nov.** are currently unknown, other morphological characters (17 MSR; 12 MT; 2 internasals; 2 prefrontals; loreal present; anal plate single; non prominently striped pattern) and its occurrence in Peninsular Thailand agree with the definition of the *Oligodon-cyclurus*-group, to which we provisionally add it. Along with *Oligodon huahin*, *O. phangan* **sp. nov.** and *O. promsombuti* **sp. nov.** would thus represent the second and third species of the *Oligodon-cyclurus*-group to be endemic to the Thai-Malay Peninsula. With *Oligodon huahin*, *O. jintakunei*, *O. pseudotaeniatus* and *O. saiyok*, they are the 5th and 6th *Oligodon* species endemic to Thailand. The present work brings to 20 the total number of *Oligodon* species recorded from Thailand.

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APPENDIX. Comparative material examined (locality data are copied *verbatim*). Dist. = District; Prov. = Province.

Oligodon bitorquatus Boie: RBINS 508, "Java", Indonesia; RBINS 508b, "Fjomas Gadok", unlocated; RBINS 508c, "Pondok Gédek", Java, Indonesia; RBINS 508d (2 specimens), "Indes"; RBINS 508e (2 specimens), no locality.

Oligodon cinereus: THNHM 24271, "Phu Khiew National Park, Chaiyaphum [Prov.]", Thailand.

Oligodon deuvei: QSMI 1503, "Ban Na Muang (17.613402 N, 101.688626 E, approximately 270 m asl), Si Song Rak, Muang Dist., Loei Prov.", Thailand.

Oligodon fasciolatus: CUMZ (R) 1998.12.11.2, "Km 22, road 3219 from Hua Hin to Pala-U Waterfall, Thailand"; MNHN 1998.0530, "Ban Khao Kling, Kaeng Krachan Dist., Phetchaburi Prov., Thailand"; QSMI 223–224, "Thailand"; QSMI 359, "Thailand"; QSMI 381, "Thailand"; QSMI 533, "Korat Zoo, Nakhon Ratchasima Prov., Thailand" (albino specimen, see Pauwels *et al*., 2008); QSMI 540, "Thailand"; RBINS 1188β, "Pak-Chong, Siam [Thailand]"; RBINS 15491, "Chiang Mai city, Muang Dist., Chiang Mai Prov., Thailand"; RBINS 15492, "Ban Khao Tao, Hua Hin Dist., Prachuap Khiri Khan Prov., Thailand"; RBINS 16552, "Cha-am, Cha-am Dist., Phetchaburi Prov., Thailand"; RBINS 18565, "Boeng Char, Kratie Prov., Cambodia"; THNHM 90, "Lum Changwat Protected Unit, Khao Ang Ru Ni Wildlife Sanctuary, Chachoengsao [Prov.], Thailand"; THNHM 438, "Suan Phung Project Area, Suan Phung, Ratchaburi [Prov.], Thailand"; THNHM 1121, "Phu Thai Protected Unit, Khao Ang Ru Ni Wildlife Sanctuary, Chachoengsao [Prov.], Thailand"; THNHM 13696, "Ban Sai Kaw, Soi Daw, Chanthaburi [Prov.], Thailand''; THNHM 13835, "Ta Phraya Na National Park, Ta Phraya, Sa Kaeo [Prov.], Thailand"; THNHM 19121, "Tud Lan, Nakhon Ratchasima [Prov.], Thailand"; THNHM 21062, "Wang Chin Forest Plantation, Phrae [Prov.], Thailand"; THNHM 21151, "Tha Pla Forest Plantation, Tha Pla, Uttaradit [Prov.], Thailand"; THNHM 24766, "Kasetsart University, Bang Khen, Bangkok, Thailand".

Oligodon huahin: see type and other material listed by Pauwels *et al*. (2017).

Oligodon jintakunei: QSMI 385, "Krabi Prov., Thailand" (holotype).

Oligodon maculatus (Taylor): RBINS 14935–37, "Manobo Tasaday Special Forest Reserve, around Mt. Tasaday, 6°18'10''N-124°32'52''E, alt. 1000-1100 m, Barangay Ned, Municipality of Lake Sebu, South Cotabato Prov., Mindanao Island, Philippines".

Oligodon mouhoti: MNHN 1999.7635 and RBINS 16554, "Ban Salakern, Ban Lat Dist., Phetchaburi Prov., Thailand"; MNHN 1998.0572, "Ban Ton Kaet, Kaeng Krachan Dist., Phetchaburi Prov., Thailand"; RBINS 16553, "Khao Nakwang, Nayang subdistrict, Cha-am Dist., Phetchaburi Prov., Thailand"; THNHM 1295, "Forestry Training Center, Cha-am, Cha-am Dist., Phetchaburi Prov., Thailand".

Oligodon ocellatus: USNM 90409 and USNM 95080, "station agricole de Blao, Prov. Haut Donaï, 800 m. alt., Annam", Vietnam; USNM 146178 and USNM 146179, "Fyan, Viet Nam"; USNM 163859, "near Chulai, Quang Nam Prov., Viet Nam"; USNM 164373, "Landing Zone Sandra, 35 miles NE Bong Son, 1 mile E of An Lao Valley, 2300 ft, S. Viet Nam".

Oligodon octolineatus: RBINS 528, "Java", Indonesia; RBINS 528b, no locality; RBINS 528c, "Amboine, Moluques", Indonesia; RBINS 717, "Batavia" (= Jakarta, Java, Indonesia); RBINS 717b, no locality; RBINS 3460 (3 specimens), no locality.

Oligodon purpurascens: RBINS 527, "Java", Indonesia; RBINS 1188, "Trang, Peninsular Siam"; RBINS 2802, "Telokbetong" [= Bandar Lampung, Lampung Prov., Sumatra, Indonesia]; RFD (field number P243), "Sanang Mahnora Forest Park, Muang Dist., Phang-Nga Prov., Thailand".

Oligodon saiyok: see type material listed by Sumontha *et al*. (2017).

Oligodon taeniatus: RBINS 436β, "Cochinchine", Vietnam; RBINS 1403, "Pak-Chong, Siam"; RBINS 18566, "Ou Krieng, Kratie Prov., Cambodia".

Oligodon theobaldi: USNM 520624, "Burma [Myanmar]: Sagaing; Kanbalur Township; Chatthin, ca. 2 km WNW of Chatthin Wildlife Sanctuary, San Myaung Camp, 360 ft, 23°34'46''N, 095°44'26''E" (see David *et al*. 2008b: 17).

Oligodon torquatus: FMNH 122255, "Myitkyina, Myanmar".

Oligodon travancoricus Beddome: RBINS 13794, "Shembaganur, Madoura, Indes" (= Senbahanoor, Madurai, India).