



## New herpetofaunal observations from Laos based on photo records

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**Abstract.**—The results of herpetological surveys conducted throughout Laos in 2016–2019 resulted in significant records at the country and provincial levels for several amphibian and reptile species, other than lizards. Three species, namely *Quasipaa verrucospinosa*, *Gracixalus quangii*, and *Theلودerma lateriticum*, were recorded for Laos for the first time. The occurrences of *Glyphoglossus molossus*, *Subsessor bocourti*, and *Siebenrockiella crassicollis* in the country were also confirmed. Species with expanded distributions are represented by new records of *Nanorana aenea*, *Ophryophryne pachyproctus*, *Xenophrys palpebralespinosa*, *Glyphoglossus guttulatus*, *Rana johnsi*, *Gracixalus quyeti*, *Theلودerma petilum*, *Zhangixalus feae*, *Gonyosoma prasinum*, *Hebius leucomystax*, *Lycodon futsingensis*, *Bungarus candidus*, *Pareas hamptoni*, and *Trimeresurus gumprechtii*, which are reported for Laos for the second time. Furthermore, new distribution and natural history data are presented on 27 other poorly-known species from several provinces of Laos. These results suggest that the herpetofaunal diversity in Laos is still underestimated and highlight the importance of conducting further field surveys and elaborating the appropriate conservation actions.

**Keywords.** Amphibia, Annamite Mountains, Anura, morphology, new records, photo records, Reptilia, Serpentes, Testudines

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### Introduction

The herpetofauna of Laos PDR (Lao People's Democratic Republic, or simply "Laos") is poorly known, with basic information and scientific interest lacking compared to those of neighboring Thailand, China, and Vietnam. In Laos, only 95 amphibian and 89 reptile species were known as of 2008 (e.g., Deuve 1970; Stuart and Platt 2004; Teynié et al. 2004; Stuart 2005; Stuart and Heatwole 2008). These numbers have rapidly increased to 110 species of amphibians and 180 species of reptiles by 2014 (Teynié and David 2010, 2014; Teynié et al. 2014, 2017). Increased survey efforts and thorough examinations of natural history collections have led to the description of several new species and new species records for the country, resulting in current totals of 115 amphibian and 189 reptile species (Frost 2020; Uetz et

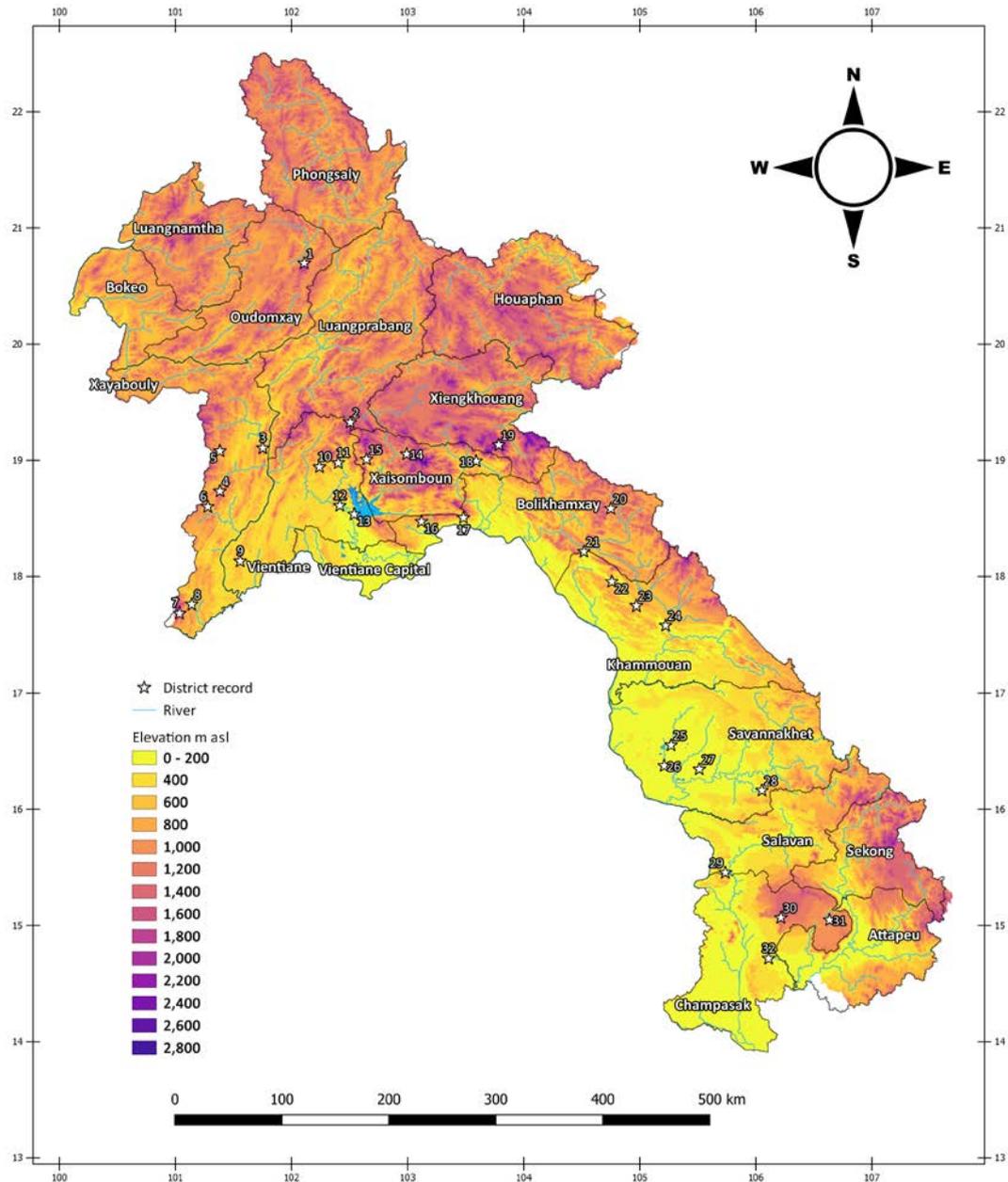
al. 2020), though these numbers are preliminary since some of the records given for Laos in the latter source are not yet verified.

Based on the results of field surveys, photo records, and the examination of animals sold at local markets which were carried out throughout the country in 2016–2019, this article provides a summary of new herpetofaunal records from Laos, including three species recorded for the country for the first time, three confirmed country records, 14 species reported for the second time, and 27 new provincial records for Laos.

### Materials and Methods

Field surveys in Laos were conducted in nine provinces (Fig. 1): Xaignabouli Province (June 2016, December 2018, and April and December 2019); Louangphabang

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**Fig. 1.** Map showing localities cited in the text. Sites surveyed: 1: Xay; 2: Phoukhoun; 3: Xayabury; 4: Phiang 1; 5: Phiang 2; 6: Thongmyxay; 7: Bortaen 1; 8: Bortaen 2; 9: Xanakharm; 10: Kasy; 11: Vangvieng; 12: Phonghong; 13: Keo Oudom 2; 14: Longcheng 1; 15: Longcheng 2; 16: Thapabath; 17: Hom; 18: Thathom; 19: Mork 1; 20: Xaychamphone; 21: Khounkham 1; 22: Khounkham 2; 23: Nakai; 24: Ngommalath; 25: Champhone 2; 26: Champhone 1; 27: Xonnabouly; 28: Phin; 29: Khongxedone; 30: Paksong 2; 31: Paksong 1; 32: Pathoumphone.

(November 2019); Vientiane Province (January, February, and April 2019); Xaisomboun Province (April, May, July, and October 2019); Oudomxai Province (August 2019); Xiengkhouang Province (July 2019); Khammouan Province (November 2018 and July 2019); Champasak Province (August 2018, and March and October 2019); and Savannakhet Province (March and July 2019). The areas surveyed included various habitat types: evergreen primary forest, secondary forest, limestone or karst forest, and wetland forest (Fig. 2). Since the transcription of Laotian names into the Latin alphabet is not standardized, the geographic names often

appear with different spellings in the literature. Here the spellings used in *The World Factbook* (Anonymous 2016) are adopted. Geographic coordinates and altitudes were obtained using a Garmin GPSMAP 64s GPS receiver (USA) and recorded in datum WGS 84. However, GPS data for turtle records are not presented herein, to prevent the misuse of the data by poachers. Specimens were observed during field trips both on sunny and rainy days from approximately 0700–2300 h. For identification purposes, specimens were photographed *in situ* using a digital camera (Sony Alpha 7 III or Sony Alpha 7R III; Sony Ltd., Japan). We were not allowed to physically

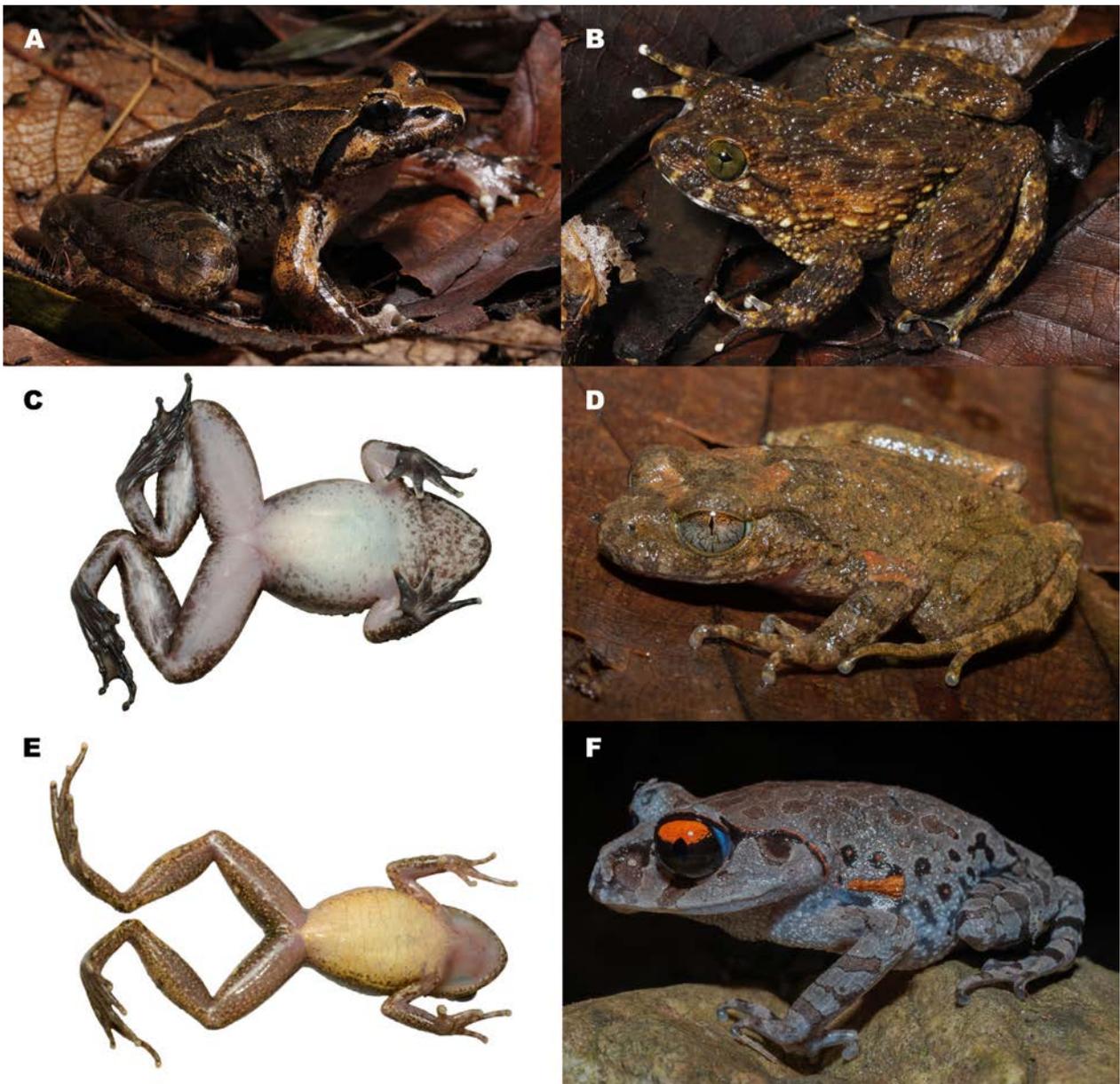


**Fig. 2. Various habitat types surveyed in Laos:** (A) forest in Mt. Phou Samsoum, Mork District, Xiangkhouang Province; (B) forest in Phou Khao Khouay NPA, Vientiane Province; (C) forest in Bortaen District, Xaignabouli Province; (D) forest in Longcheng District, Xaisomboun Province; (E) karst forest in Phou Hin Poun NPA, Khammouan Province; (F) lowland habitat in the Pathoumphone District, Champasak Province. *Photos by P. Brakels.*

handle many of these individuals to obtain morphological measurements. For snake specimens, scales on the head and abdomen were counted. After morphological examination and obtaining life photos, specimens were released immediately near the places where they were recorded.

Taxonomic identifications of the individuals were made based on the key literature sources for amphibians (Aowphol et al. 2013; Bain et al. 2009; Bordoloi et al. 2007; Bourret 1937; Dubois and Ohler 2005; Fei et al. 2010; Inger et al. 1999; Kou 1985; Liu and Hu 1962; Manthey and Manthey 2017a; Matsui et al. 1999; Ohler 2007; Ohler and Delorme 2006; Ohler et al. 2011;

Pawangkhanant et al. 2018; Pham et al. 2012, 2014, 2019; Phusaensri et al. 2018; Poyarkov et al. 2015, 2017; Qi et al. 2017; Rowley et al. 2012; Stuart et al. 2006), and for reptiles (Chan-ard et al. 2015; Calame et al. 2013; David et al. 2002, 2007; Deuve 1970; Guo and Deng 2009; Hauser 2017; Hendrie et al. 2011; Jiang et al. 2020; Mathew and Meetei 2004; Mulcahy et al. 2017; Murphy and Voris 2014; Smith 1943; Stuart and Heatwole 2008; Stuart and Platt 2004; Taylor 1965; Teynié and David 2010, 2014; Teynié et al. 2004, 2014, 2017; Vassilieva et al. 2016; Vogel 2009; Vogel and van Rooijen 2007; Vogel et al. 2004; Ziegler and Vogel 1999; Ziegler et al. 2010). The taxonomy and nomenclature used by Frost



**Fig. 3.** (A) *Nanorana aenea* in Mork District, Xiangkhouang Province; (B) dorsal view and (C) ventral view of *Quasipaa verrucospinosa* in Longcheng District, Xaisomboun Province; (D) dorsal view and (E) ventral view of *Leptobranchella eos* in Bortan District, Xaignabouli Province; (F) *Leptobranchium smithi* in Xay District, Oudomxai Province. Photos: P. Brakels (A–B, D, F) and N. Maury (C, E).

(2020) and Uetz et al. (2020) were generally followed, with the exception of the *Megophrys* assemblage (Anura, Megophryidae), for which we followed taxonomy proposed by Chen et al. (2017).

For each species mentioned in the **Taxonomic Accounts** below, photos in life are provided along with the following information: scientific name, English name, location of record (including coordinates and elevation), short description of morphological characters confirming our identification, ecological notes, distribution in Laos and elsewhere, and when necessary, remarks on problems in classification and distribution of the species. The abbreviation “NPA” stands for National Protected Area.

## Results

### Taxonomic Accounts

#### Amphibia: Anura

#### Family Dicoglossidae Anderson

#### *Nanorana aenea* (Smith, 1922)

#### Doi Chang Spiny Frog (Fig. 3A)

One individual of *N. aenea* was observed by P. Brakels and P. Pawangkhanant on 16 July 2019 on the northern slope of Phou Samsoum Mountain, Mork District,

Xiangkhouang Province (19°08.494'N, 103°46.867'E; elevation 2,070 m asl).

Morphological characters of this individual from Xiangkhouang Province agreed well with the descriptions of Taylor (1962), Dubois and Ohler (2005), and Pham et al. (2012). The photographed individual (Fig. 3A) agrees with the diagnosis of *N. aenea* for the following characters: medium body size, rather slender; snout rounded, very slightly protruding; canthus rostralis rounded; loreal region slightly concave; eye large, pupil horizontally oval; tympanum distinct, supratympanic fold present; tips of fingers and toes without discs; dorsal surface smooth with small ridges on flank; dorsolateral folds present, not prominent, narrow, continuous until the rear of back; ventral surface smooth; coloration of dorsum dark brown with several darker bands between eyes; tympanum covered with dark markings; ventral surface yellowish with brown marbling and numerous darker spots on margins; foot webs marbled with brown and cream; iris brown.

**Ecological notes.** This individual was found at ca. 2000 h on the ground near a small stream. The surrounding habitat was polydominant high-elevation, broad-leaved montane forest.

**Distribution.** In Laos, this species has been recorded only from Houaphan Province (Teynié et al. 2014). This is the second record from the country as well as the first from Xiangkhouang Province. Elsewhere, this species has been reported from China, Vietnam, and northern Thailand (Frost 2020).

***Quasipaa verrucospinosa* (Bourret, 1937)  
Granular Spiny Frog (Fig. 3B–C)**

Two individuals of *Q. verrucospinosa* were observed in Longcheng District, Xaisomboun Province: on 27 April 2019 by P. Brakels and N. Maury (19°00.782'N, 102°39.337'E; elevation 975 m asl) at Longcheng site 2; and on 17 July 2019 by T.V. Nguyen, P. Brakels, P. Pawangkhanant, and N.A. Poyarkov (19°00.983'N, 102°59.645'E; elevation 1,370 m asl) at Longcheng site 1.

Morphological characters of the individuals from Xaisomboun Province agreed well with the descriptions of Bourret (1937), Inger et al. (1999), and Fei et al. (2010). The photographed individual (Fig. 3B–C) agrees with the diagnosis of *Q. verrucospinosa* in the following characters: large body size; snout round; canthus rostralis indistinct; loreal region slightly flat; eye large, pupil oval; tympanum small, distinct; supratympanic fold present; tips of fingers and toes without discs, toe webbing complete; dorsal surface with very rough back covered by short, thick ridges, and round tubercles, and sides covered by oval tubercles with dark spines; coloration of dorsum gray-brown with dark brown spots; ventral surface cream; iris dark green.

**Ecological notes.** The first individual was found at ca.

1900 h in a fast-flowing stream between boulders under a small waterfall in evergreen forest with an abundance of banana plants; while the other individual was found on top of a small waterfall along the road. The surrounding habitat was mixed secondary submontane to montane forest.

**Distribution.** This species is known from northern and central Vietnam and southern China (Frost 2020). This is the first country record for Laos, ca. 291 km southwest from the type locality in Sa Pa District, Lao Cai Province, Vietnam (Bourret 1937).

**Family Megophryidae Bonaparte**

***Leptobrachella eos* (Ohler, Wollenberg, Grosjean, Hendrix, Vences, Ziegler, and Dubois, 2011)  
Rosy Litter Toad (Fig. 3D–E)**

One individual was observed by P. Brakels and N. Maury on 2 June 2019 in Longcheng District site 2, Xaisomboun Province (19°07.497'N, 102°40.502'E; elevation 1,240 m asl). Several individuals were observed in Xay District, Oudomxai Province by N. Maury on 21 August 2019 (20°39.598'N, 102°04.241'E; elevation 800–1,000 m asl) and by P. Brakels and N. Maury on 24 August 2019 (20°39.598'N, 102°04.241'E; elevation 850 m asl).

Morphological characters of the individuals from Xaisomboun and Oudomxai provinces agreed well with the descriptions of Ohler et al. (2011) and Pham et al. (2014). The photographed individual (Fig. 3D–E) agrees with the diagnosis of *L. eos* in the following characters: small body size; snout obtuse; canthus rostralis distinct, loreal region concave; eye large and slightly projecting from sides of head; tympanum round, distinct; supratympanic fold present; tips of fingers and toes rounded and slightly swollen; toe webbing and large dermal fringes on toes present; dorsal surface of head and body, upper part of flanks with tubercles; dorsolateral fold absent; ventral surface translucent, granules becoming more distinct on belly and body flanks; dorsal coloration brown with dark blotches, in irregular shapes; dark spots on flanks absent; dorsal surface of forelimbs and hindlimbs pinkish-brown with dark bars; throat with yellow spots; chest, belly whitish; webbing dark brown; iris bicolored (orange above, light golden below).

**Ecological notes.** The individuals in Longcheng District were found at ca. 1900–2130 h either on the leaf litter near rocks close to the stream or in bamboo forest on the leaf litter during a light rain. The individuals from Xay District were found on the leaf litter alongside the road and walking trails, and surrounding habitat was montane to submontane moist evergreen forest and partly riverine forest.

**Distribution.** In Laos, this species has been previously recorded from Phongsalī and Bolikhamxai provinces (Ohler et al. 2011). These are the first records from Xaisomboun and Oudomxai provinces. Elsewhere,

this species has been reported from China and Vietnam (Frost 2020).

**Remarks.** Until recently regarded as a member of the genus *Leptotalax* Dubois, 1980, but transferred to the genus *Leptobranchella* Smith, 1925 based on the molecular results of Chen et al. (2018).

***Leptobranchium smithi* Matsui, Nabhitabhata, and Panha, 1999  
Smith's Spadefoot Toad (Fig. 3F)**

Two individuals of *L. smithi* were observed by P. Brakels and N. Maury on 25 August 2019 in Xay District, Oudomxai Province (20°39.598'N, 102°04.241'E; elevation 850 m asl).

Morphological characters of the individuals from Oudomxai Province agreed well with the descriptions of Matsui et al. (1999) and Pawangkhanant et al. (2018). The photographed individual (Fig. 3F) agrees with the diagnosis of *L. smithi* in the following characters: medium body size; snout obtusely pointed, barely projecting beyond lower jaw; canthus rostralis distinct, sharp; loreal region slightly concave; eye large, projecting from sides of head; tympanum round, distinct; supratympanic fold present; tips of fingers and toes rounded and slightly swollen; dorsal surface nearly smooth, with minute granules scattered behind; ventral surfaces weakly granular; dorsal coloration gray brown with distinct dark markings; tympanum covered with dark markings; bicolored iris (black below and bright yellow above).

**Ecological notes.** The individuals were found at ca. 2200 h on the leaf litter along the side of a road in a mountain valley. The surrounding habitat was moist evergreen forest including parts of riverine forest.

**Distribution.** In Laos, this species has been previously recorded from Louangphabang, Vientiane, and Xaignabouli provinces (Pawangkhanant et al. 2018). This is the first record from Oudomxai Province. Elsewhere, this species has been reported from Myanmar, Thailand, and peninsular Malaysia (Frost 2020).

***Ophryophryne pachyproctus* Kou, 1985  
Yunnan Mountain Toad (Fig. 4A)**

One individual of *O. pachyproctus* was observed by P. Brakels and N. Maury on 15 April 2019 in Xanakharm District, Vientiane Province (18°12.517'N, 101°54.933'E; elevation 525 m asl); another individual was recorded by P. Brakels and P. Pawangkhanant on 18 July 2019 in Longcheng District site 1, Xaisomboun Province (19°00.983'N, 102°59.645'E; elevation 1,240 m asl); subsequently several individuals were observed calling by P. Brakels, N. Maury, and S. Sudavanh on 27 December 2019 in Phiang District site 2, Xaignabouli Province (19°4.748'N, 101°24.231'E; elevation 870 m asl).

Morphological characters of the individuals from

Vientiane, Xaisomboun, and Xaignabouli provinces agreed well with the descriptions of Kou (1895), Fei et al. (2010), and Poyarkov et al. (2017). The photographed individual (Fig. 4A) agrees with the diagnosis of *O. pachyproctus* in the following characters: small body size, habitus slender; snout short, sharply protruding in profile, projecting significantly beyond lower jaw; canthus rostralis distinct, sharp; loreal region slightly concave; eyes large, dorsally and laterally protuberant; tympanum round, distinct; supratympanic fold present; tips of fingers and toes rounded and slightly swollen; dorsal surface shagreened, with numerous small skin asperities present; ventral surfaces weakly granular; eyes with a large horn on the upper eyelid; dorsolateral glandular ridge connected to posterior tips of H-shaped glandular parietoscapular-sacral ridge; dermal protuberance with dermal flaps above cloacal opening well-developed; coloration of dorsum pale gray olive-brown; iris golden.

**Ecological notes.** The first individual was found on a steep slope in a narrow gorge at ca. 2000 h after some light rain, and surrounding habitat at the former site was moist mixed evergreen forest in a narrow gorge in larger dry evergreen hill forest with an abundance of bamboo. The individuals from Longcheng District were recorded at ca. 2100–2200 h when calling from vegetation near mountain streams, and surrounding habitat was polydominant montane evergreen forest. In Phiang District, several individuals were calling amongst the leaf litter and in the vegetation along the steep banks of the stream. The cool dry season (December–January) appears to be the breeding season of this species in Laos.

**Distribution.** In Laos, this species has been previously recorded only from Louangphabang Province (Teynié et al. 2014). This is the second record from the country as well as the first from Vientiane, Xaisomboun, and Xaignabouli provinces. Elsewhere, this species has been previously reported from China and Vietnam (Frost 2020).

**Remarks.** We follow Chen et al. (2017) in recognizing *Ophryophryne* as a distinct genus.

***Xenophrys palpebralespinosa* (Bourret, 1937)  
Spiny Horned Toad (Fig. 4B)**

Several individuals of *P. palpebralespinosa* were observed by P. Brakels, P. Pawangkhanant, T.V. Nguyen, S. Idiatullina, and N.A. Poyarkov on 16 July 2019 on the northern slope of Phou Samsoum Mountain, Mork District, Xiangkhouang Province (19°08.494'N, 103°46.867'E; elevation 2,070 m asl).

Morphological characters of the individuals from Xiangkhouang Province agreed well with the descriptions of Bourret (1937) and Fei et al. (2010). The photographed individual (Fig. 4B) agrees with the diagnosis of *P. palpebralespinosa* in the following characters: small to medium body size, dorsoventrally compressed; snout bluntly rounded, slightly protruding; canthus rostralis



**Fig. 4.** (A) *Ophryophryne pachyproctus* in Longcheng District, Xaisomboun Province; (B) *Xenophrys palpebralespinosa* in Mork District, Xiangkhouang Province; (C) *Glyphoglossus guttulatus* in Pathoumphone District, Champasak Province; (D) *G. molossus* in Savannakhet Province; (E) *Rana johnsi* in Xaignabouli Province; (F) *Sylvirana cubitalis* in Thongmyxay District, Xaignabouli Province. Photos by P. Pawangkhanant (A), P. Brakels (B–C), K. Inkhavilay (D), N. Maury (E), and P. Phiapalath (F).

sharp; loreal region not concave, vertical; eyes large, protuberant, pupil horizontal oval; tympanum round, distinct; supratympanic fold present; tips of fingers and toes without disc; dorsal surface tuberos with large tubercles of different size; eyes with a series of short palpebral horns on the upper eyelid; dorsolateral folds absent; ventral surfaces smooth; coloration of dorsum light-brown with dark spots, alternating orange to beige spots; ventrally marbled with alternating dark and orange spots; iris brown.

**Ecological notes.** The individuals were found at ca. 1900–2300 h on the ground along the trail and near a small runoff stream. The surrounding habitat was polydominant high-elevation broadleaved montane forest.

**Distribution.** In Laos, this species has been previously recorded only from Houaphan Province (Teynié et al. 2014). This is the second record from the country as well as the first from Xiangkhouang Province. Elsewhere, this species has been reported from China and northern Vietnam (Frost 2020).

**Remarks.** We follow Chen et al. (2017) in recognizing *Xenophrys* as a distinct genus. *Megophrys latidactyla* was recently described from Pu Mat National Park in Nghe An Province of Vietnam, not far from the Vietnam-Lao international border and adjacent to Xiangkhouang Province of Laos (Orlov et al. 2015). More recently, Wu et al. (2019) suggested *Megophrys latidactyla* is a junior synonym of *Xenophrys palpebralespinosa*.

## Family Microhylidae Günther

### *Glyphoglossus guttulatus* (Blyth, 1856)

#### Burmese Squat Frog (Fig. 4C)

Several individuals of *G. guttulatus* were observed by K. Inkhavilay on 19 May 2018 in Xonnabouly District, Savannakhet Province (16°16.071'N, 105°38.594'E; elevation 140 m asl). One individual was observed by P. Brakels on 14 March 2019 in Kiat Ngong Village, Pathoumphone District, Champasak Province (14°41.023'N, 106°06.413'E; elevation 170 m asl) and another individual was observed by P. Brakels and N. Maury on 10 August 2019 in Bortaen District site 2, Xaignabouly Province (17°47.338'N, 101°04.359'E; elevation 475 m asl).

Morphological characters of the individuals from Savannakhet, Champasak, and Xaignabouly provinces agreed well with the descriptions of Taylor (1962) and Vassilieva et al. (2016). The photographed individual (Fig. 4C) agrees with the diagnosis of *G. guttulatus* in the following characters: body habitus stocky, roughly triangular in shape; head wide and short, with blunt snout; tympanum indistinct; supratympanic fold distinct; limbs short; tips fingers and toes without discs; dorsal surfaces finely granulate with larger tubercles scattered on sides of neck and shoulders; coloration of dorsum brownish with scattered irregular brown blotches of different size.

**Ecological notes.** The individuals from Savannakhet Province were found in riverine forest and seasonally dry dipterocarp forest with patches of mixed deciduous forest. The individual from Champasak Province was found near a seasonal pond in the village, in an open area surrounded by seasonally flooded riparian secondary disturbed forest. The individual from Xaignabouly Province was found along the roadside in disturbed secondary dry evergreen hill forest.

**Distribution.** In Laos, this species has previously only been reliably recorded from Vientiane Province (Stuart 1999). This is the second record from the country as well as the first from Xaignabouly, Savannakhet, and Champasak provinces. Moreover, *G. guttulatus* was also recorded in June 2018 in Khammouan Province (Teynié, pers. comm.). Elsewhere, this species has been reported from Myanmar, Vietnam, Cambodia, Thailand, and peninsular Malaysia (Vassilieva et al. 2016).

### *Glyphoglossus molossus* Günther, 1869

#### Blunt-headed Balloon Frog (Fig. 4D)

One individual of *G. molossus* was observed by K. Inkhavilay on 19 May 2018 in Xonnabouly District, Savannakhet Province (16°16.071'N, 105°38.594'E; elevation 140 m asl).

Morphological characters of the individual from Savannakhet Province agreed well with the descriptions of Taylor (1962) and Vassilieva et al. (2016). The

photographed individual (Fig. 4D) agrees with the diagnosis of *G. molossus* in the following characters: large body size with robust, stocky habitus; head wide and short, with sharply truncated snout; tympanum indistinct; supratympanic fold distinct; limbs short; webbing on toes developed; tips of fingers and toes without discs; eye small; skin on dorsum thick, glandular, ventral surfaces smooth; dorsal coloration dark gray, with obscure yellow speckling; ventral surfaces whitish.

**Ecological notes.** Specimen was recorded near the bank of a small river in riparian forest, consisting partly of remains of seasonally dry dipterocarp forest with patches of mixed deciduous forest.

**Distribution.** In Laos, this species has been previously recorded from Salavan Province, where it is sold in markets for food (Stuart 1999). This is the first confirmed country record of this species in the wild, as well as the first record from Savannakhet Province. Moreover, *G. molossus* is also regularly reported from the market near the city of Pakse, Champasak Province, and in Vientiane Province and Vientiane Prefecture, where it is also sold for food (Manthey and Manthey 2017b; N. Maury, pers. obs.). Elsewhere, this species has been reported from Myanmar, Vietnam, Cambodia, Thailand, and peninsular Malaysia (Vassilieva et al. 2016).

## Family Ranidae Batsch

### *Rana johnsi* Smith, 1921

#### Johns' Frog (Fig. 4E)

One individual of *R. johnsi* was observed by P. Brakels and N. Maury on 27 December 2019 in Phiang District site 2, Xaignabouly Province (19°04.748'N, 101°24.231'E; elevation 870 m asl).

Morphological characters of the individual from Xaignabouly Province agreed well with the descriptions of Inger (1999) and Neang and Holden (2008). The photographed individual (Fig. 4E) agrees with the diagnosis of *R. johnsi* in the following characters: medium body size; snout obtusely pointed, projecting beyond lower jaw; canthus rostralis distinct, loreal region concave, oblique; pupil round; tympanum round, distinct, supratympanic fold absent; tips of fingers and toes without discs; dorsal surface smooth with some small tubercles, granular on tibia; coloration of dorsum light brown, tympanum covered by a dark lozenge, flanks pale whitish-brown anteriorly, yellow posteriorly, upper surface of limbs with narrow grayish transverse bars; ventral surface of throat, chest and anterior belly cream; posterior belly slight yellow, thighs yellow-lemon.

**Ecological notes.** The individuals were found at ca. 2000–2100 h on the ground among leaf litter at the entrance of a hole on the steep bank of a stream. The surrounding habitat was evergreen forest with an abundance of palm trees (Arecaceae) and bamboo thickets.

**Distribution.** In Laos, this species has been recorded from Bolikhamxai and Khammouan provinces (Stuart 2005). This is the second record from the country as well as the first from Xaignabouli Province. Elsewhere, this species has been reported from China, Taiwan, Vietnam, Cambodia, and Thailand (Frost 2020).

***Sylvirana cf. cubitalis* (Smith, 1917)**

**Siam Stream Frog (Fig. 4F)**

Several individuals of *S. cubitalis* were observed by P. Phiapalath on 28 December 2019 in Nam Phouy NPA, Thongmyxay District, Xaignabouli Province (18°35.928'N, 101°17.054'E; elevation 630 m asl).

Morphological characters of the individuals from Xaignabouli Province agreed well with the descriptions of Taylor (1962), Stuart et al. (2006), Ohler (2007), Fei et al. (2010), Pham et al. (2014), and Manthey and Manthey (2017a). The photographed individual (Fig. 4F) agrees with the diagnosis of *S. cubitalis* in the following characters: body medium-sized; snout obtusely pointed; canthus rostralis distinct, loreal region slightly concave; pupil round; tympanum round, distinct; supratympanic fold present; fingers free of webbing without discs; toes with small discs, webbing well developed; dorsal skin rough; tympanum and flanks region with small tubercles; tubercles forming longitudinal ridges on dorsal surface of limbs; dorsolateral fold distinct; coloration of dorsum reddish-brown, canthal streak black; tympanum dark brown; flanks brownish-gray with black spots; upper hindlimbs with wide dark pale bars; ventral surface cream.

**Ecological notes.** The individuals were found at ca. 1900–2000 h perched on rocks and fallen logs along the stream. The surrounding habitat consisted of riparian vegetation and evergreen forest with an abundance of palm trees (Arecaceae).

**Distribution.** In Laos, this species has been recorded from Phongsali and Louangnamtha provinces (Stuart et al. 2006; Manthey and Manthey 2017a). This is the first record from Xaignabouli Province. Elsewhere, this species has been reported from China, Myanmar, Vietnam, and Thailand (Frost 2020).

**Family Rhacophoridae Hoffman**

***Chirixalus doriae* Boulenger, 1893**

**Doria's Foam-nest Treefrog (Fig. 5A)**

Several individuals of *C. doriae* were observed by N. Maury on 15 July 2017 in Phonghong District, Vientiane Province (18°30.202'N, 102°24.121'E; elevation 190 m asl); one other individual was observed by P. Brakels on 3 July 2019 in Champhone District site 1, Savannakhet Province (16°21.500'N, 105°14.229'E; elevation 150 m asl) and two other individuals were observed by N. Maury on 21 August 2019 in Xay District, Oudomxai

Province (20°39.598'N, 102°04.241'E; elevation 850 m asl).

Morphological characters of the individuals from Vientiane, Oudomxai, and Savannakhet provinces agreed well with the descriptions of Taylor (1962), Fei et al. (2010), and Aowphol et al. (2013). The photographed individual (Fig. 5A) agrees with the diagnosis of *C. doriae* in the following characters: small body size, elongated body habitus; snout pointed; canthus rostralis obtuse; loreal region slightly concave; eye large, protruding, pupil horizontal; tympanum round, distinct; supratympanic fold present; 1<sup>st</sup> and 2<sup>nd</sup> fingers oppose 3<sup>rd</sup> and 4<sup>th</sup> fingers; tips of fingers and toes expanded into large discs; dorsal surface smooth; ventral surface glandular; coloration of dorsal uniform yellowish with brownish longitudinal stripes, ventral surfaces cream, undersides of thighs yellowish; tips of fingers and toes orange; iris golden.

**Ecological notes.** Most individuals were observed at ca. 1900–2200 h calling along the road in vegetation overhanging water puddles. Two individuals, male and female, were observed in amplexus at ca. 1.0–1.5 m from the forest floor, not near any standing water, but during light rain. The surrounding habitat was riparian vegetation and mixed secondary forest with dense shrubs.

**Distribution.** In Laos, *C. doriae* has been previously recorded from Louangprabang, Houaphan, Xaignabouli, and Champasak provinces (Stuart 2005; Ohler and Grosjean 2006). This is the first record of this species from Vientiane, Oudomxai, and Savannakhet provinces. Elsewhere, this species has been reported from India, China, Myanmar, Vietnam, Cambodia, and Thailand (Frost 2020).

**Remarks.** Until recently this species was assigned to the genus *Chiromantis* Peters, 1854, but it is re-assigned to *Chirixalus* Boulenger, 1893 based on the recent phylogenetic data of Chen et al. (2020).

***Chirixalus nongkhorensis* (Cochran, 1927)**

**Nongkhor Foam-nest Treefrog (Fig. 5B)**

Several individuals of *C. nongkhorensis* were observed by P. Brakels on 3 July 2019 in Champhone District site 1, Savannakhet Province (16°21.500'N, 105°14.229'E; elevation 150 m asl); several other individuals were observed by P. Brakels, P. Pawangkhanant, T.V. Nguyen, and N.A. Poyarkov on 12 July 2019 in Khounkham District site 1, Khammouan Province (18°12.543'N, 104°30.528'E; elevation 350 m asl); one individual was observed by P. Brakels on 10 August 2019 in Bortaen District site 2, Xaignabouli Province (17°47.338'N, 101°04.359'E; elevation 475 m asl).

Morphological characters of the individuals from Khammouan, Savannakhet, and Xiagnabouli provinces agreed well with the descriptions of Taylor (1962), Aowphol et al. (2013), and Vassilieva et al. (2016). The photographed individual (Fig. 5B) agrees with



**Fig. 5.** (A) *Chirixalus doriae* in Xay District, Oudomxai Province; (B) *C. nongkhorensis* in Khounkham District, Khammouan Province; (C) *Gracixalus quangi* in Longcheng District, Xaisomboun Province; (D) *G. quyeti* in Khounkham District, Khammouan Province; (E) *Rhacophorus kio* in Bortoen District, Xaignabouli Province; (F) *R. rhodopus* in Mork District, Xiangkhouang Province. Photos by P. Brakels.

the diagnosis of *C. nongkhorensis* in the following characters: small body size with elongated habitus; snout pointed; canthus rostralis obtuse; loreal region slightly concave; eye large, protruding with horizontal pupil; tympanum round, distinct, supratympanic fold sharp, prominent; 1<sup>st</sup> and 2<sup>nd</sup> fingers oppose 3<sup>rd</sup> and 4<sup>th</sup> fingers; tips of fingers and toes bearing large discs; dorsal surface slightly shagreened; ventral surface glandular; coloration of dorsum uniform yellowish-brown without longitudinal stripes, ventral surfaces cream, tips finger and toes yellowish; iris golden.

**Ecological notes.** The individuals were found at ca. 1900–2200 h when calling along the road in vegetation overhanging water puddles. The surrounding habitat was

secondary disturbed mixed evergreen forest consisting of bamboo, dense shrubs, and lianas.

**Distribution.** In Laos, *C. nongkhorensis* has been recorded from Vientiane and Champasak provinces (Stuart 2005). This is the first record of this species from Khammouan, Savannakhet, and Xaignabouli provinces. Elsewhere, this species has been recorded from Myanmar, Vietnam, Cambodia, Thailand, and Malaysia (Frost 2020).

**Remarks.** Until recently this species was assigned to the genus *Chiromantis* Peters, 1854, but it was re-assigned to *Chirixalus* Boulenger, 1893 based on the recent phylogenetic data of Chen et al. (2020).

***Gracixalus quangii* Rowley, Dau, Nguyen, Cao, and Nguyen, 2011  
Quang's Bushfrog (Fig. 5C)**

Several individuals of *G. quangii* were observed by P. Brakels and N. Maury on 16 February 2019 in Kasy District, Vientiane Province (18°92.980'N, 102°23.398'E; elevation 550 m asl) and a few individuals were observed by P. Brakels in Longcheng District site 2, Xaisomboun Province, both on 27 April 2019 (19°00.813'N, 102°39.488'E; elevation 940 m asl) and on 1 June 2019 (19°00.983'N, 102°59.645'E; elevation 1,240 m asl).

Morphological characters of the individuals from Vientiane and Xaisomboun provinces agreed well with the descriptions of Rowley et al. (2011) and Pham et al. (2019). The photographed individual (Fig. 5C) agrees with the diagnosis of *G. quangii* in the following characters: small body size; snout pointed; canthus rostralis distinct, loreal region slightly concave; tympanum distinct, supratympanic fold present; tips of fingers and toes enlarged into round discs; tibiotarsal projection present; dorsal surface with small tubercles; largest and most concentrated on eyelids; coloration of dorsum olive-green, with brighter pale green on dorsal surface of upper arms; line of large olive-brownish spots running from axilla to groin; anterior surface of thighs, groin, and axilla yellowish; ventral surface of throat, chest, and belly opaque white with translucent pale green margins.

**Ecological notes.** The individuals from Vientiane Province were found in a narrow gorge in the vegetation along a small stream during and after heavy rain at ca. 2200 h. The individuals from Xaisomboun Province were found at ca. 1900–2230 h in vegetation along the stream. The surrounding habitat of the latter site was moist montane mixed evergreen forest.

**Distribution.** Prior to these records, this species was considered endemic to northern Vietnam. This is the first country record for Laos, at locations ca. 267 km southwest from the type locality in Pu Hoat Proposed Nature Reserve, Que Phong District, Nghe An Province, Vietnam (Rowley et al. 2011).

***Gracixalus quyeti* (Nguyen, Hendrix, Böhme, Vu, and Ziegler, 2008)  
Quyét's Bushfrog (Fig. 5D)**

Two individuals of *G. quyeti* were observed by P. Brakels and N. Maury on 15 November 2018 in Khounkham District site 2, Khammouan Province (17°57.160'N, 104°43.793'E; elevation 500 m asl).

Morphological characters of the individuals from Khammouan Province agreed well with the description of Egert et al. (2017). The photographed individual (Fig. 5D) agrees with the diagnosis of *G. quyeti* in the following characters: small body size; snout rounded;

canthus rostralis distinct, loreal region slightly concave; tympanum distinct, supratympanic fold present; tips of fingers and toes enlarged into round discs; tibiotarsal projection absent; dorsal surface with small sharp tubercles; coloration of dorsum gray with brown marbling; ventral surface of throat, chest and belly yellowish.

**Ecological notes.** The individual was found at ca. 2100 h hiding in rock crevices a few meters inside a limestone cave. The surrounding habitat was dry mixed evergreen forest on limestone within close proximity of riverine forest.

**Distribution.** In Laos, this species has been previously recorded from Hin Nam No NPA, Boualapha District, Khammouan Province, near the Vietnam border (Egert et al. 2017). This is the first record from Khounkham District, Khammouan Province, which represents a range extension of ca. 150 km to the northwest. Elsewhere, this species has been reported from central Vietnam (Frost 2020).

***Rhacophorus kio* Ohler and Delorme, 2006  
Kio Flying Frog (Fig. 5E)**

One individual of *R. kio* was observed by P. Brakels and N. Maury on 10 August 2019 in Bortaen District site 2, Xaignabouli Province (17°47.338'N, 101°04.359'E; elevation 475 m asl).

Morphological characters of the individual from Xaignabouli agreed well with the descriptions of Ohler et al. (2006) and Fei et al. (2010). The photographed individual (Fig. 5E) agrees with the diagnosis of *R. kio* in the following characters: large body size, rather slender body habitus; snout pointed, not protruding; pupil horizontal, rounded; canthus rostralis rounded; loreal region slightly convex; tympanum round; supratympanic fold distinct; tips of fingers and toes enlarged into round discs; toes and finger webbing complete; dermal folds along limbs well-developed; supracloacal fold and tarsal projections present; dorsal surfaces smooth; ventral surface granular; coloration of dorsum green with white dots, a large black spot at the axilla, ventral surface yellow, posterior surfaces of thighs yellowish-orange, webbing orange with an ink black spot at base; iris golden with yellow sclera.

**Ecological notes.** The individual was found at ca. 2100 h in the dense vegetation along the edge of the road above the river. The surrounding habitat was disturbed secondary dry evergreen hill forest.

**Distribution.** In Laos, this species has been previously recorded from Phongsali, Bokeo, Louangphabang, Houaphan, Vientiane, Khammouan, and Xekong provinces (Ohler and Grosjean 2006; Ohler et al. 2006; Rowley et al. 2012; Teynié et al. 2014). This is the first record from Xaignabouli Province. Elsewhere, this species has been reported from India, China, Myanmar, Vietnam, and Thailand (Frost 2020).

***Rhacophorus rhodopus* Liu and Hu, 1960**  
**Red-webbed Treefrog (Fig. 5F)**

Several individuals of *R. rhodopus* were observed by P. Brakels, P. Pawangkhanant, T.V. Nguyen, S. Idiitullina, and N.A. Poyarkov on 16 July 2019 on the northern slope of Phou Samsoum mountain, Mork District, Xiangkhouang Province (19°08.494'N, 103°46.867'E; elevation 2,050 m asl) and one individual was observed by P. Brakels and N. Maury on 26 October 2019 along the fringes of Dong Hua Sao NPA in Paksong (2) District, Champasak Province (15°03'53.1"N, 106°12'44.6"E; elevation 1,250 m asl).

Morphological characters of the individuals from Xiangkhouang and Champasak provinces agreed well with the descriptions of Bordoloi et al. (2007) and Fei et al. (2010). The photographed individual (Fig. 5F) agrees with the diagnosis of *R. rhodopus* in the following characters: body medium-sized with rather slender habitus; snout pointed, not protruding; pupil rounded and horizontal; canthus rostralis rounded, loreal region slightly convex; tympanum round; supratympanic fold distinct; tips of fingers and toes enlarged into round discs; finger webbing reduced; dermal folds along limbs developed; supraclacal fold and tarsal projections present; dorsal surfaces smooth; ventral surface granular; coloration of dorsum orange-brown, with small dark spots, a large bluish-black spot on flank; ventral surfaces yellow, webbing reddish with an ink black spot at base; iris golden.

**Ecological notes.** The individuals were found at ca. 1900–2200 h when calling along the road in vegetation about a height of ca. 1–3 m; surrounding habitat was montane broadleaved forest. The individual from Champasak Province was found in the vegetation at a height of ca. 1–2 m along a large fast flowing stream; surrounding habitat was moist montane evergreen forest.

**Distribution.** In Laos, this species has been previously recorded from Phongsali and Louangphabang provinces (Bordoloi et al. 2007). This is the first record from Xiangkhouang and Champasak provinces. Elsewhere, this species has been reported from India, China, Myanmar, Vietnam, Cambodia, Thailand, and peninsular Malaysia (Frost 2020).

***Theoderma albopunctatum* (Liu and Hu, 1962)**  
**White-spotted Bug-eyed Frog (Fig. 6A)**

Two individuals of *T. albopunctatum* were observed by N. Maury on 13 November 2018 in Phou Khao Khouay NPA, Hom District, Xaisomboun Province (18°30.552'N, 103°28.787'E; elevation 350 m asl) at the border with Bolikhamxai Province.

Morphological characters of the individuals from Xaisomboun Province agreed well with the descriptions of Liu and Hu (1962), Fei et al. (2010), and Poyarkov et al. (2015). The photographed individual (Fig. 6A)

agrees with the diagnosis of *T. albopunctatum* in the following characters: small body size, slender habitus; snout rounded; pupil rounded and horizontal; tympanum round; supratympanic fold slight distinct; canthus rostralis indistinct; loreal region slightly concave, oblique; dorsal surfaces covered by tubercles with whitish granular asperities; coloration of dorsal surfaces of head and body whitish-gray with a small brown bar between eyes; scapular area with a large chocolate-brown chevron, posterior part of body whitish; dorsal surface of forelimbs and hindlimbs light chocolate with some crossbar brown marking; ventral surface gray with white marking.

**Ecological notes.** The individuals were found at ca. 2000 h in vegetation at a height of ca. 2 m near the stream. The surrounding habitat was mixed dry evergreen hill forest.

**Distribution.** In Laos, this species has been recorded from Louangphabang, Vientiane, and Khammouan provinces (Stuart et al. 2005; Ohler and Grosjean 2006). This is the first record from Xaisomboun Province. This species is also expected to be found in the Bolikhamxai provincial part of Phou Khao Khouay NPA. Elsewhere, this species has been reported from India, China, Myanmar, Vietnam, and Thailand (Frost 2020).

**Remarks.** The taxonomy of the *Theoderma asperum* complex is confusing and has been recently reviewed (Poyarkov et al. 2015; Dever 2017); correct identification of species is often possible only with the application of molecular methods. We tentatively assign the Laotian populations to *T. albopunctatum* based on distribution and preliminary results of Poyarkov et al. (2015).

***Theoderma gordonii* Taylor, 1962**  
**Gordon's Bug-eyed Frog (Fig. 6B)**

One individual of *T. gordonii* was observed by P. Brakels and N. Maury on 26 December 2019 in Phiang District site 2, Xaignabouli Province (19°04.748'N, 101°24.231'E; elevation 870 m asl).

Morphological characters of the individual from Xaignabouli Province agreed well with the descriptions of Taylor (1962) and Qi et al. (2018). The photographed individual (Fig. 6B) agrees with the diagnosis of *T. gordonii* in the following characters: large body size, flattened and stout; snout truncate; canthus prominent, loreal region slightly concave, oblique; pupil circular; nostrils nearer to tip of the snout than to eyes; tympanum round, distinct; supratympanic fold present; tips of fingers and toes enlarged into round discs; dorsal surfaces rough with large irregular gland ridges and warts; ventral surface smooth with thickened granules; coloration of dorsum dark coffee with some clustered light orange enlarged gland ridges on the lateral part from the posterior edge of tympanum over the shoulder extending backwards to the upper edge of cloacae; ventral surface slightly dark with



**Fig. 6.** (A) *Theلودerma albopunctatum* in Hom District, Xaisomboun Province; (B) *T. gordonii* in Phiang District, Xaignabouli Province; (C) lateral view and (D) ventral view of *T. lateriticum* in Vang Vieng District, Vientiane Province; (E) *T. petilum* in Kasy District, Vientiane Province; (F) *Zhangixalus feae* in Xay District, Oudomxai Province. Photos by P. Brakels (A–C, E–F) and N. Maury (D).

numerous, irregular whitish-gray spots and speckles.

**Ecological notes.** The individual was found at ca. 2000 h perched on a small branch near a large tree on the steep bank of the stream. The individual was found in the vicinity of *Rana johnsi* in the same habitat.

**Distribution.** In Laos, this species has been recorded from Houaphan and Louangnamtha provinces (Qi et al. 2018). This is the first record from Xaignabouli Province. Elsewhere, this species has been reported from China, Taiwan, Vietnam, and Thailand (Frost 2020).

***Theلودerma lateriticum* Bain, Nguyen, and Doan, 2009  
Brick-red Bug-eyed Frog (Fig. 6C–D)**

One individual of *T. lateriticum* was observed by P. Brakels and N. Maury on 5 January 2019 in Vang Vieng District, Vientiane Province (18°96.776'N, 102°39.689'E; elevation 1,130 m asl).

Morphological characters of the individual from Vientiane Province agreed well with the description of Bain et al. (2009). The photographed individual (Fig. 6C–D) agrees with the diagnosis of *T. lateriticum* in the following characters: small body size, dorsoventrally compressed body; snout slightly rounded; canthus rostralis distinct, rounded; loreal region oblique, slightly concave vertical; tympanum distinct, supratympanic fold distinct; tips of fingers and toes enlarged into round discs; dorsal surfaces granular, bearing tiny keratinized spicules; coloration of dorsum deep brick-red with some black blotches; ventral surface of throat, chest and belly grayish-brown with cream spots; iris brick-red.

**Ecological notes.** The individual was found on the ground (presumably, it had jumped onto the ground after it was disturbed by us) in a small dry rocky natural run off channel near a steep slope in dry mixed evergreen montane forest.

**Distribution.** This is the first country record for Laos, ca. 260 km southwest from the type locality in Nam Tha Commune, Van Ban District, Lao Cai Province, Vietnam (Bain et al. 2009). Elsewhere, this species has been reported from Vietnam and southern China (Chen et al. 2019).

***Theلودerma petilum* (Stuart and Heatwole, 2004)  
Slender Bug-eyed Frog (Fig. 6E)**

One individual of *T. petilum* was observed by P. Brakels and N. Maury on 15 April 2019 in Xanakharm District, Vientiane Province (18°12.510'N, 101°54.933'E; elevation 525 m asl).

Morphological characters of the individual from Vientiane Province agreed well with the descriptions of Stuart and Heatwole (2004), Nguyen et al. (2014), and Phusaensri et al. (2018). The photographed individual (Fig. 6E) agrees with the diagnosis of *T. petilum* in the following characters: small body size, very slender, elongate body habitus; snout slightly rounded;

pupil round; tympanum round, small, clearly visible; supratympanic fold distinct; loreal region slightly concave, oblique; tips of fingers and toes enlarged into round discs; dorsal surfaces smooth with microscopic white asperities on head, eyelids, back, dorsal surface of tibia and forelimbs, and anterior half of flanks; coloration of dorsum with dark-brown stripe below the edge of canthus rostralis extending from tip of snout to flanks near the level of mid-body; brownish-black spot slightly anterior to groin.

**Ecological notes.** The individual was found at ca. 2000 h in dense vegetation. Several individuals were calling along a small stream surrounded by large bamboo tangles. The surrounding habitat was mixed dry evergreen hill forest.

**Distribution.** In Laos, this species has been previously recorded only from Phongsali Province (Stuart and Heatwole 2004). This is the second record from the country as well as the first from Vientiane Province. Elsewhere, this species has been reported from Vietnam and Thailand (Phusaensri et al. 2018).

***Zhangixalus feae* (Boulenger, 1893)  
Fea's Large Treefrog (Fig. 6F)**

One subadult individual of *Z. feae* was observed by P. Brakels and N. Maury on 24 August 2019 in Xay District, Oudomxai Province (20°39.598'N, 102°04.241'E; elevation 1,150 m asl). Two adult individuals were observed by P. Brakels on 9 November 2019 in Phoukhoun District, Louangphabang Province (19°18.897'N, 102°30.883'E; elevation 1,350 m asl).

Morphological characters of the individual from Oudomxai Province agreed well with the description of Fei et al. (2010). The photographed individual (Fig. 6F) agrees with the diagnosis of *Z. feae* in the following characters: large body size; snout rounded, not protruding; pupil oval and horizontal; canthus rostralis distinct; loreal region concave; tympanum round; supratympanic fold distinct; tips of fingers and toes enlarged into round discs; toe and finger webbing complete; dermal folds along limbs, supraclacal fold and tarsal projections absent; dorsal surfaces smooth; ventral surfaces granular; coloration of dorsum green with some irregular yellow spots; ventral surface cream; iris emerald-green.

**Ecological notes.** The individual at Oudomxai Province was found at ca. 2200 h in dense vegetation near the stream, surrounding habitat was mixed mature evergreen forest. The individuals from Louangphabang Province were found at ca. 1530 h in vegetation overhanging a small stream which originated from a spring nearby, surrounding habitat was open pastures and rice paddies with a mosaic of disturbed secondary montane mixed evergreen forest.

**Distribution.** In Laos, this species has been previously recorded from Phongsali Province (Stuart 2005). This is the second confirmed record from the country as well as



**Fig. 7.** (A) *Boiga cyanea* in Phiang District, Xaignabouli Province; (B) *B. multomaculata* in Nakay District, Khammouan Province; (C) lateral view and (D) ventral view of *Dendrelaphis* cf. *cyanochloris* in Xay District, Oudomxai Province; (E) *Gonyosoma prasinum* in Xay District, Oudomxai Province. Photos by P. Brakels.

the first from Oudomxai and Louangphabang Provinces. Elsewhere, this species has been reported from China, Myanmar, Vietnam, and Thailand (Frost 2020).

## Reptilia: Squamata: Serpentes

### Family Colubridae Oppel

#### *Boiga cyanea* (Duméril, Bibron, and Duméril, 1854) Green Cat Snake (Fig. 7A)

One adult individual of *B. cyanea* was observed by P. Brakels on 17 April 2019 in Nam Phouy NPA, Phiang District site 1, Xaignabouli Province (18°50.424'N, 101°23.811'E; elevation 600 m asl), and five other adult individuals were observed by P. Brakels and N. Maury on 23–25 August 2019 in Xay District, Oudomxai Province (20°39.598'N, 102°04.241'E; elevation 750–1,150 m asl).

Morphological characters of the individuals from Xaignabouli and Oudomxai provinces agreed well with the descriptions of Smith (1943), Taylor (1965), Ziegler et al. (2010), and Chan-ard et al. (2015). The photographed individual (Fig. 7A) agrees with the diagnosis of *B. cyanea* in the following characters: large body size, elongate body habitus; tail long; head distinct from neck; eye moderate in size; pupil vertically oval;

nasal undivided; loreal present, not entering the orbit; 1 preocular; 2 postoculars; 2 anterior temporals; 3 posterior temporals; 8 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal, 2<sup>nd</sup> and 3<sup>rd</sup> in contact with the loreal, 4<sup>th</sup>–5<sup>th</sup> entering orbit, 6<sup>th</sup> and 7<sup>th</sup> largest; dorsal scales entirely smooth; anterior vertebral scales slightly enlarged; ventrals 245; cloacal scale undivided; subcaudals 126, divided. Body coloration dorsally green, greenish-white on venter; dorsal surface of head light green; infralabials, chin and throat bluish, mouth black; eye silver.

**Ecological notes.** The individual from Xaignabouli Province was found at ca. 2000 h moving in the vegetation at a height of ca. 2 m above the stream. The individuals from Oudomxai Province were recorded at ca. 2030–2200 h while moving in dense vegetation along the road and forest trails at height of ca. 1.5–3 m above the ground, all within close proximity of small streams and runoffs. The surrounding habitat at both sites was moist evergreen forest and riparian forest.

**Distribution.** In Laos, this species has been previously recorded from Vientiane, Khammouan, and Champasak provinces (Teynié and David 2010). This is the first record of this species from Xaignabouli and Oudomxai provinces. Elsewhere, this species has been reported from India, Bangladesh, Bhutan, Nepal, China, Vietnam, Cambodia, Thailand, Myanmar, and Malaysia (Uetz et al. 2020).

***Boiga multomaculata* (Boie, 1827)**  
**Many-spotted Cat Snake (Fig. 7B)**

One adult individual of *B. multomaculata* was observed by P. Brakels on 26 February 2018 in Phou Hin Poun NPA, Nakai District, Khammouan Province (17°42.734'N, 104°57.302'E; elevation 220 m asl).

Morphological characters of the individual from Khammouan Province agreed well with the descriptions of Smith (1943), Taylor (1965), Ziegler et al. (2010), and Chan-ard et al. (2015). The photographed individual (Fig. 7B) agrees with the diagnosis of *B. multomaculata* in the following characters: body medium-sized with elongate habitus; head distinct from neck; eye moderate in size; pupil vertically oval; nasal undivided; loreal present, not entering the orbit; 1 preocular; 2 postoculars; 2 anterior temporals; 3 posterior temporals; 8 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal, 2<sup>nd</sup> in contact with the loreal, 3<sup>rd</sup>–5<sup>th</sup> entering orbit, 6<sup>th</sup> and 7<sup>th</sup> largest; dorsal scales smooth; anterior vertebral scales slightly enlarged; ventrals 301; cloacal scale undivided; subcaudals 112, divided. Coloration of dorsal surfaces of head with two dark brown stripes extending from snout to neck; dorsal surfaces of body grayish-brown with two alternating series of large, rounded, dark brown pale-edged blotches and two other series of much smaller spots on the sides of the body; eye gray; ventral surface whitish with small to large brown spots.

**Ecological notes.** The individual was found at ca. 2200 h under a wood log near a village; surrounding habitat was disturbed secondary mixed evergreen dry hill forest.

**Distribution.** In Laos, this species has been previously recorded from Vientiane and Champasak provinces (Teynié and David 2010). This is the first record from Khammouan Province. Elsewhere, this species has been reported from Bangladesh, China, Vietnam, Cambodia, Thailand, Myanmar, Malaysia, Singapore, and Indonesia (Uetz et al. 2020).

***Dendrelaphis cf. cyanochloris* (Wall, 1921)**  
**Wall's Bronzeback (Fig. 7C–D)**

One adult individual of *D. cf. cyanochloris* was observed by P. Brakels and N. Maury on 24 August 2019 in Xay District, Oudomxai Province (20°39.598'N, 102°04.241'E; elevation 800 m asl).

Morphological characters of the individual from Oudomxai Province agreed well with the descriptions of Vogel and van Rooijen (2007) and Chan-ard et al. (2015). The photographed individual (Fig. 7C–D) generally agrees with the diagnosis of *D. cyanochloris* in the following characters: very elongate, slender body; tail long; head long, distinct from neck; eye rather large; pupil round; nasal divided; loreal present, not entering the orbit; 1 preocular; 2 postoculars; 2 anterior temporals; 2

posterior temporals; 9 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal, 2<sup>nd</sup> and 3<sup>rd</sup> in contact with the loreal, 4<sup>th</sup>–6<sup>th</sup> entering orbit, 6<sup>th</sup> and 7<sup>th</sup> largest; dorsal scales smooth without apical pits; anterior vertebral scales slightly enlarged; ventrals 184; cloacal scale undivided; subcaudals 153; divided. Coloration of dorsum grayish-bronze; reddish bronze on head and flanks, pale lateral stripe along flanks absent, skin between dorsal scales on flanks bluish-brown; supralabials, ventral surfaces of chin and anterior part of venter yellowish-green turning pale green posteriorly.

**Ecological notes.** The individual was found at ca. 2000 h while climbing a tree at a height of 3 m near a small forest stream with dense vegetation of shrubs and liana. The surrounding habitat was secondary mixed sub montane evergreen forest.

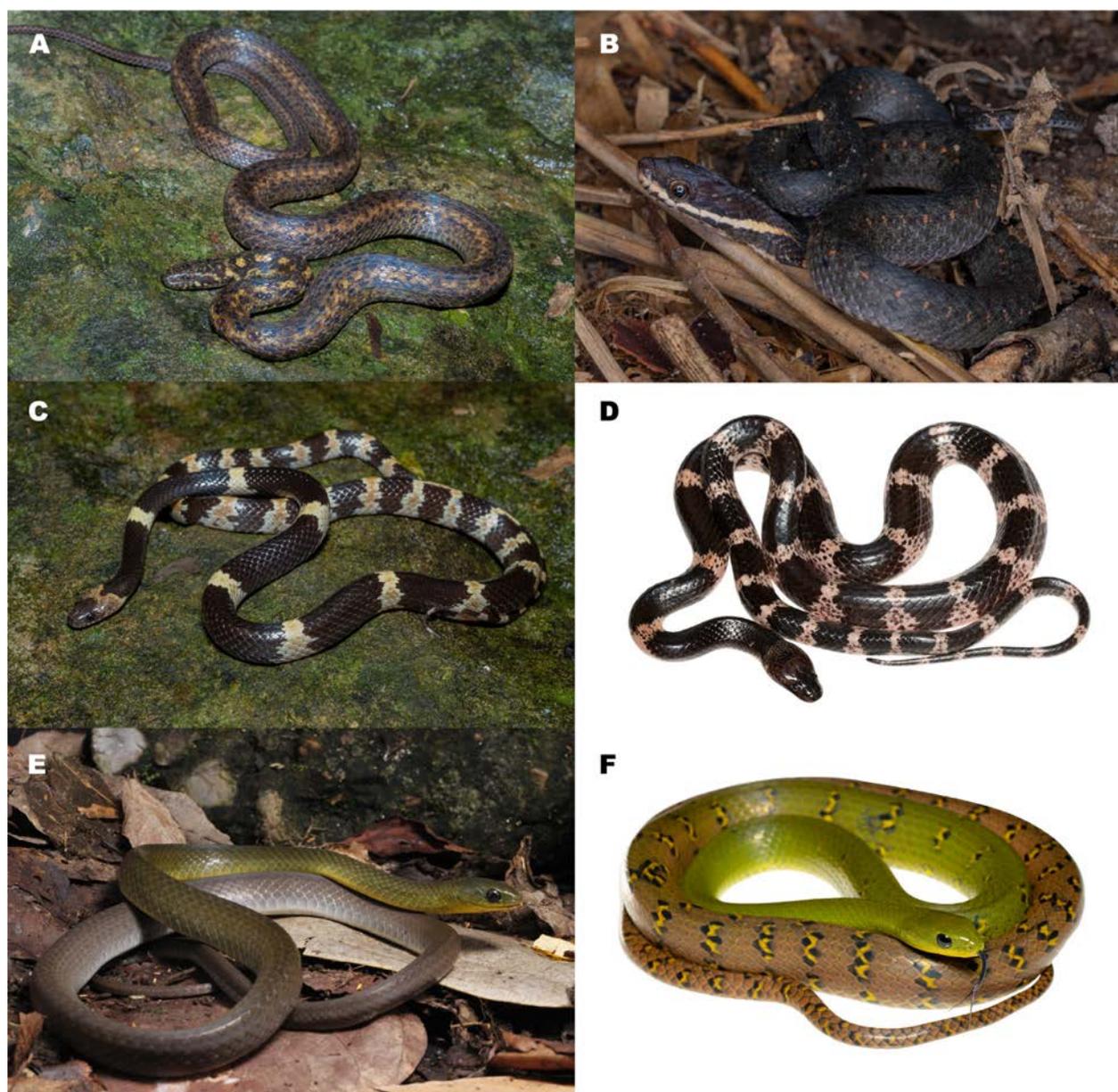
**Distribution.** In Laos, this species has been previously recorded from Phongsali, Xiangkhouang, Houaphan, and Champasak provinces (Teynié et al. 2014). This is the first record from Oudomxai Province. Elsewhere, this species has been reported from India, Bangladesh, Bhutan, Myanmar, Thailand, and Malaysia (Jiang et al. 2020; Uetz et al. 2020).

**Remarks.** *Dendrelaphis cyanochloris* is morphologically similar to *D. ngansonensis* (Bourret), but differs from it by more distinctly bluish-brown flanks with brighter bluish tint vs. bronze-brown flanks with generally more subdued bluish hue, pale green belly vs. cream belly, the first row of dorsals bronze-brown vs. cream, and a generally smaller number of dentary teeth of 20–23 vs. 24–27 (see Ziegler and Vogel 1999; Vogel and van Rooijen 2007; data above). Based on molecular and morphological data, Jiang et al. (2020) demonstrated that *D. ngansonensis* likely belongs to the *D. cyanochloris* complex; genetic differentiation between these two taxa was found to be minimal while the main morphological differences relate to coloration in life (see above). Thus, recognizing the problematic taxonomy of *D. cyanochloris* complex, we tentatively indicate this population as *D. cf. cyanochloris*, pending further research. Additional sampling and molecular analysis are required for clarification of the taxonomic status of these two species.

***Gonyosoma prasinum* (Blyth, 1854)**  
**Green Tree Snake (Fig. 7E)**

One adult individual of *G. prasinum* was observed by P. Brakels and N. Maury on 24 August 2019 in Xay District, Oudomxai Province (20°39.598'N, 102°04.241'E; elevation 750 m asl).

Morphological characters of the individual from Oudomxai Province agreed well with the descriptions of Smith (1943), Stuart and Heatwole (2008), and Chan-ard et al. (2015). The photographed individual (Fig. 7E) agrees with the diagnosis of *G. prasinum* in the following characters: body slender, elongated; tail



**Fig. 8.** (A) *Hebius chapaensis* in Longcheng District, Xaisomboun Province; (B) *H. leucomystax* in Paksong District, Champasak Province; (C) *Lycodon fasciatus* in Longcheng District, Xaisomboun Province; (D) *L. futsingensis* in Xay district, Oudomxai Province; (E) *Ptyas multicincta* (var. *bicolor*) in Gnommalath District, Khammouan Province; (F) *P. multicincta* (var. *multicincta*) in Vang Vieng District, Vientiane Province. Photos by P. Brakels (A, C, D), N. Maury (B, F), and P. Pawangkhanant (E).

long; head slightly distinct from neck; eye moderate in size; pupil round; nasal divided; loreal present, not entering the orbit; 1 preocular; 2 postoculars; 2 anterior temporals; 3 posterior temporals; 9 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal 2<sup>nd</sup> and 3<sup>rd</sup> in contact with the loreal, 4<sup>th</sup>–6<sup>th</sup> entering orbit, 6<sup>th</sup> and 8<sup>th</sup> largest; dorsal scales faintly keeled; ventrals 193; cloacal scale divided; subcaudals 100; divided. Coloration of dorsum green with bicolored bluish-yellow ventrolateral stripe; skin between dorsal scales with blue and dark reticulations; dorsal surface of tail light brown; tongue reddish brown; ventral surfaces light yellow-green with some irregular blue spots, underside of tail yellowish.

**Ecological notes.** The individual was observed at ca. 2200 h in the vegetation at a height of 4 m above the

ground coiled in a sleeping position. The surrounding habitat was mixed dry evergreen hill forest.

**Distribution.** In Laos, this species has been previously recorded only from Champasak Province (Stuart and Heatwole 2008). This is the second record from Laos as well as the first record from the northwest of the country in Oudomxai Province. Elsewhere, this species has been reported from India, China, Vietnam, Thailand, Myanmar, and Malaysia (Uetz et al. 2020).

***Hebius chapaensis* (Bourret, 1934)  
Sapa Keelback (Fig. 8A)**

One adult individual of *H. chapaensis* was observed by P. Brakels and N. Maury on 27 April 2019 in Longcheng

District site 2, Xaisomboun Province (19°01.413'N, 102°65.723'E; elevation 930 m asl).

Morphological characters of the individual from Xaisomboun Province agreed well with the description of Ren et al. (2018). The photographed individual (Fig. 8A) agrees with the diagnosis of *H. chapaensis* in the following characters: medium body size; cylindrical, rather elongated slender body; head distinct from neck; eye moderately large; pupil round; loreal present, not entering the orbit; 2 preoculars; 2 postoculars; 1 anterior temporal; 2 posterior temporals; 9 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal, 3<sup>rd</sup> and 4<sup>th</sup> in contact with the loreal, 5<sup>th</sup> and 6<sup>th</sup> entering orbit, 7<sup>th</sup> and 8<sup>th</sup> largest; all 17 dorsal scale rows strongly keeled; ventrals 172; cloacal scale divided; subcaudals 103, divided. Coloration of dorsal surfaces glossy black with two lighter series of pale orange spots, which grade into a continuous lighter stripes along the length of the body and tail; dorsal head scales densely covered by irregular and vermiculate golden spots; chin, throat, infralabials cream; ventral surfaces glossy black with pale yellow longitudinal streaks, tending to become fainter posteriorly.

**Ecological notes.** The individual was found at 2045 h on the rocks along the mountain stream. The surrounding habitat was mixed secondary submontane forest.

**Distribution.** In Laos, this species has been previously recorded from Houaphanh and Louangphabang provinces (Ren et al. 2018). This is the first record from Xaisomboun Province. Elsewhere, this species has been reported from China and northern Vietnam (Uetz et al. 2020).

***Hebius leucomystax* (David, Bain, Nguyen, Orlov, Vogel, Vu, and Ziegler, 2007)**  
**White-lipped Keelback (Fig. 8B)**

One individual of *H. leucomystax* was observed by P. Brakels on 28 September 2019 in Paksong (1) District, Champasak Province (15°24.529'N, 106°38.148'E; elevation 880 m asl), and one other individual was found by S. Lorphengsy on 25 October 2017 in Thaphabath District, Bolikhamxai Province (18°27.557'N, 103°83.543'E; elevation 330 m asl).

Morphological characters of the individuals from Champasak and Bolikhamxai provinces agreed well with the descriptions of David et al. (2007) and Stuart and Heatwole (2008). The photographed individual (Fig. 8B) agrees with the diagnosis of *H. leucomystax* in the following characters: body rather elongate, slender; head distinct from neck; eye moderately large; pupil round; loreal present, not entering the orbit; 1 preocular; 3 postoculars; 1 anterior temporals; 2 posterior temporals; 9 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal, 2<sup>nd</sup> and 3<sup>rd</sup> in contact with the loreal, 4<sup>th</sup> and 6<sup>th</sup> entering orbit, 6<sup>th</sup> and 7<sup>th</sup> largest; dorsal scale rows strong all keeled; ventrals 158; cloacal divided; subcaudals 110, divided. Coloration of dorsal head scales dark gray with a weak light longitudinal line extends on

hind part of head; dorsal surface dark gray with dark spots and irregular bars, dorsolateral spots extend to tail; venter surface cream.

**Ecological notes.** The individual from Paksong, Champasak Province, was found on the bank of a small stream, the surrounding habitat consist of extensive bamboo stalks. The individual from Bolikhamxai Province was found near the large stream, of which the surrounding habitats are secondary forest with bamboo and shrubs.

**Distribution.** In Laos, this species has been recorded previously from Khammouan and Xekong provinces (Stuart and Heatwole 2008). This is the third record from the country as well as the first ones from Champasak and Bolikhamxai provinces. Elsewhere, this species has been reported from Vietnam, Cambodia, and Thailand (Uetz et al. 2020).

***Lycodon fasciatus* (Anderson, 1879)**  
**Banded Wolf Snake (Fig. 8C)**

One adult individual of *L. fasciatus* was observed by P. Brakels and N. Maury on 27 April 2019 in Longcheng District site 2, Xaisomboun Province (18°58.645'N, 102°39.213'E; elevation 950 m asl), and another individual was observed by P. Brakels on 13 October 2019 in Thathom District, Xaisomboun Province (18°59.448'N, 103°35.554'E; elevation 300 m asl).

Morphological characters of the individual from Xaisomboun Province agreed well with the descriptions of Taylor (1965), Das (2010), and Vogel and David (2019). The photographed individual (Fig. 8C) agrees with the diagnosis of *L. fasciatus* in the following characters: medium body size, elongated; head moderately distinct from neck, markedly flattened; pupil vertically oval; loreal present, entering the orbit; 1 preocular; 2 postoculars; 1 anterior temporals; 2 posterior temporals; 8 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal 2<sup>nd</sup> and 3<sup>rd</sup> in contact with the loreal, 3<sup>rd</sup>–5<sup>th</sup> entering orbit, 6<sup>th</sup> and 7<sup>th</sup> largest; dorsal scale rows weakly keeled; ventrals 214; cloacal scale undivided; subcaudals 76; divided. Coloration of dorsal surfaces dark brown with 24 creamish-yellow bands across the body and 12 across the tail, bands on the posterior part of the body and tail are much more strongly speckled with black than anterior bands; head with an indistinct whitish-yellow band with irregular borders; ventral surfaces cream with wide transverse black bands in the anterior part, bands becoming narrower posteriorly.

**Ecological notes.** The first individual was found at ca. 2050 h in the valley of a rocky stream. The surrounding habitat was mixed evergreen forest with Banana plants (*Musa* sp.) in the undergrowth. The second individual was also found along a stream in mixed evergreen forest in the vicinity of some limestone formations.

**Distribution.** In Laos, this species has been previously recorded from Xiangkhouang and Champasak provinces (Teynié and David 2010; Vogel and David 2019). This is

the first record from Xaisomboun Province. Elsewhere, this species has been reported from India, China, Myanmar, Vietnam, and Thailand (Vogel and David 2019).

***Lycodon futsingensis* (Pope, 1928)**  
**Futsing Wolf Snake (Fig. 8D)**

One adult individual of *L. futsingensis* was observed by P. Brakels and N. Maury on 6 January 2019 in Vang Vieng District, Vientiane Province (18°97.408'N, 102°41.690'E; elevation 370 m asl), and one individual was observed by N. Maury on 21 August 2019 in Xay District, Oudomxai Province (20°39.598'N, 102°04.241'E; elevation 850 m asl).

Morphological characters of the individuals from Vientiane and Oudomxai provinces agreed well with the descriptions of Vogel et al. (2009) and Luu et al. (2013). The photographed individual (Fig. 8D) agrees with the diagnosis of *L. futsingensis* in the following characters: medium body size, elongate habitus; head moderately distinct from neck, markedly flattened; pupil vertically oval; loreal present, not entering the orbit; 1 preocular; 2 postoculars; 2 anterior temporals; 2 posterior temporals; 8 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal 2<sup>nd</sup> and 3<sup>rd</sup> in contact with the loreal, 3<sup>rd</sup>–6<sup>th</sup> entering orbit, 7<sup>th</sup> and 8<sup>th</sup> largest; dorsal scale rows entirely smooth; ventrals 199; cloacal scale undivided; subcaudals 73, divided. Coloration of dorsum dark brownish-gray with 24 whitish rings across the body and nine across the tail; head with the remnants of a dark-gray ring; ventral surfaces cream, anterior part uniform, with dark speckling posteriorly, underside of tail dark.

**Ecological notes.** The individual from Vientiane was found at ca. 2000 h on the rocks at the top of a waterfall, the specimen from Oudomxai was observed at ca. 2050 h along the road not far from the stream. The surrounding habitat was mixed secondary evergreen forest.

**Distribution.** In Laos, this species has been previously recorded only from Khammouan Province (Luu et al. 2013). This is the second record of *L. futsingensis* from Laos, as well as the first records from Vientiane and Oudomxai provinces. Elsewhere, this species has been reported from southern China and northern Vietnam (Luu et al. 2013).

***Ptyas multicincta* (Roux, 1907)**  
**Many-banded Green Snake (Fig. 8E–F)**

One adult individual of the banded morph of *P. multicincta* was observed by P. Brakels and N. Maury on 6 January 2019 in Vang Vieng District, Vientiane Province, Laos (18°97.408'N, 102°41.690'E; elevation 370 m asl); and one adult male (the *bicolor* morph) was observed by P. Brakels, P. Pawangkhanant, T.V. Nguyen, S. Idiattullina, and N.A. Poyarkov on 13 July 2019 in Ngommalath District, Khammouan Province (17°31.084'N, 105°13.746'E; elevation 200 m asl).

Morphological characters of the individuals from Vientiane and Khammouan provinces agreed well with the descriptions of Angel (1929), Smith (1943), and Hauser (2018). The photographed individuals (Fig. 8E–F) agree with the diagnosis of *P. multicincta* in the following characters: body cylindrical, body medium-sized; head distinct from neck; eye large, pupil round; loreal present, not in contact with orbit; 1 preocular; 2 postoculars; 1 anterior temporal; 2 posterior temporals; 7 or 8 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal, 2<sup>nd</sup> and 3<sup>rd</sup> in contact with the loreal, 4<sup>th</sup>–5<sup>th</sup> entering orbit, 6<sup>th</sup> and 7<sup>th</sup> largest; dorsal scale rows entirely smooth; ventrals 174–185; cloacal scale divided; subcaudals 83–87, divided. Coloration of dorsal surface uniform green anteriorly, turning uniform gray posteriorly (Fig. 8E; *bicolor* morph); or green anteriorly, becoming light gray and grayish-brown posteriorly with numerous regularly spaced, narrow, back-edged cream or yellow crossbars (Fig. 8F; *multicincta* banded morph); ventral surfaces yellowish-green anteriorly, pale gray posteriorly.

**Ecological notes.** The specimen in Vientiane Province was recorded at 1930 h on the tree, ca. 2 m above the ground along a rocky stream within close proximity of a waterfall; surrounding habitat was mixed secondary forest composed of small to medium hardwoods and shrubs. The subadult male in Khammouan Province was found at ca. 1900 h while it was moving on a limestone boulder near the ground; surrounding habitat was secondary evergreen forest on karst.

**Distribution.** In Laos, this species has been previously recorded from Xiangkhouang, Khammouan, and Bolikhamxai provinces (Angel 1929; Deuve 1970; Teynié et al. 2014). This is the first record of *P. multicincta* from Vientiane Province. Moreover, *P. multicincta* was also observed in Xiengngeun and Nane districts, Louangphabang Province (Teynié, pers. comm.). Elsewhere, this species has been reported from China, Vietnam, and Thailand (Uetz et al. 2020).

**Remarks:** *Ptyas multicincta* is morphologically similar to *Ptyas major* (Günther) but differs from the latter by olive-green dorsum turning grayish-brown posteriorly (vs. uniformly bright or grass green); dorsal scale rows entirely smooth (vs. 3–7 dorsal scale rows keeled); internasal distinctly narrowed anteriorly (vs. truncate anteriorly) [Angel 1929; Smith 1943; data above]. Two color morphs are known in this species: dorsum may be crossed by numerous narrow bichromatic bands (typical *multicincta* banded morph, see Fig. 8F) or lack such bands (*bicolor* morph, see Fig. 8E) [Angel 1929; P. David, pers. comm.].

**Family Elapidae Boie**

***Bungarus candidus* (Linnaeus, 1758)**  
**Blue Krait (Fig. 9A)**

One adult individual of *B. candidus* was observed by N. Maury on 16 July 2017 in Keo Oudom District, Vientiane



**Fig. 9.** (A) *Bungarus candidus* in Khongxedone District, Salavan Province; (B) *Subessor bocourti* in Champhone District, Savannakhet Province; (C) *Pareas carinatus* in Keo Oudom District, Vientiane Province; (D) *P. hamptoni* in Longcheng District, Xaisomboun Province. Photos by P. Brakels (A–C) and P. Pawangkhanant (D).

Province (18°31.223'N, 18°31.223'N; elevation 260 m asl). One adult individual was found by N. Maury and P. Brakels on 26 October 2019 in Phou Xiang Thong NPA, Khongxedone District, Salavan Province (15°27.178'N, 105°44.202'N; elevation 320 m asl).

Morphological characters of the individuals from Vientiane and Salavan provinces agreed well with the descriptions of Smith (1943), Nguyen et al. (2017), and Xie et al. (2018). The photographed individual (Fig. 9A) agrees with the diagnosis of *B. candidus* in the following characters: large body size, robust body habitus; head faintly distinct from neck; eye small, pupil round; loreal absent; 1 preocular; 2 postoculars; 1 anterior temporals; 2 posterior temporals; 7 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal 2<sup>nd</sup> and 3<sup>rd</sup> in contact with the preocular, 3<sup>rd</sup>–4<sup>th</sup> entering orbit, 5<sup>th</sup> and 6<sup>th</sup> largest; dorsal scale rows entirely smooth; anterior vertebral scales notably enlarged; ventrals 226; cloacal scale undivided; subcaudals 54, undivided. Coloration of dorsum black with 20 broad white cross-bands on body in which five of them are yellowish and five on tail; ventral surface uniform white.

**Ecological notes.** The individual from Vientiane Province was found at 1900 h crossing the road under light rain. The surrounding habitat was disturbed secondary dry mixed evergreen hill forest. The individual

from Salavan Province was found ca. 2100 h moving between the large boulders in the bed of a wide stream in the vicinity of a waterfall. The surrounding habitat was open riparian vegetation with bamboo thickets and mixed dry forest on the banks.

**Distribution.** In Laos, this species has been previously recorded only from Champasak Province (Teynié and David 2010) and Khammouan Province (Stuart 1998; Luu 2017). These are the first records from north-western Laos (Vientiane Province) and Salavan Province. Moreover, this species is known to occur in Savannakhet Province as well, based on snake bite records from the provincial hospital (Vongphoumy et al. 2015, 2016). A recent record was reported in the local news of a Blue Krait that supposedly killed a woman in Xayphouthong District, Savannakhet Province, in October 2019. Elsewhere, this species has been reported from China, Vietnam, Cambodia, Thailand, Malaysia, Singapore, and Indonesia (Uetz et al. 2020).

#### Family Homalopsidae Jan

##### *Subessor bocourti* (Jan, 1865) Bocourt's Mud Snake (Fig. 9B)

One adult individual of *S. bocourti* was observed by P.

Brakels on 19 March 2019 in Champhone District site 1, Savannakhet Province (16°34.728'N, 105°24.882'E; elevation 136 m asl), and another individual was observed by P. Phiapalath in May 2019 in Pathoumphone District, Champasak Province (14°41.023'N, 106°06.413'E; elevation 170 m asl).

Morphological characters of the individuals from Savannakhet and Champasak provinces agreed well with the descriptions of Murphy and Voris (2014) and Chan-ard et al. (2015). The photographed individual (Fig. 9B) agrees with the diagnosis of *S. bocourti* in the following characters: massive body size, stout; head depressed, indistinct from neck; nasals in contact; no rostral appendages; dorsal scale rows keeled. Coloration of dorsal surfaces olive with an irregular series of narrow, transverse, yellowish bars, with each bar bordered by black; eye ruby red.

**Ecological notes.** The first individual was observed in a lake during the daytime at ca. 1000 h while it was consuming a fish. The second individual was trapped by villagers from a shallow seasonal lake.

**Distribution.** In Laos, this species has been previously recorded only from Vientiane Province (Deuve 1970). However, it is not mentioned in the recent snake species lists of Laos (see Teynié and David 2010; Murphy and Voris 2014; Uetz et al. 2020). This is the first confirmed record from Laos after the work of Deuve (1970), as well as the first record from southern part of the country in Savannakhet and Champasak provinces. Elsewhere, this species has been reported from Vietnam, Cambodia, Thailand, and Malaysia (Chan-ard et al. 2015).

## Family Pareidae Duméril

### *Pareas carinatus* (Boie, 1828)

#### Keeled Slug Snake (Fig. 9C)

One adult *P. carinatus* was observed by P. Brakels and N. Maury on 9 November 2018 in Keo Oudom District, Vientiane Province (18°34.985'N, 102°23.532'E; elevation 190 m asl) and four other individuals were observed by N. Maury in the same area during earlier visits in 2016 and 2017.

Morphological characters of the individuals from Vientiane Province agreed well with the descriptions of Smith (1943), Mathew and Meetei (2004), and Guo et al. (2009). The photographed individual (Fig. 9C) agrees with the diagnosis of *P. carinatus* in the following characters: slender, laterally compressed body; head elongated, distinct from neck; eye large; pupil vertical; loreal present, not entering the orbit; 1 preocular; 2 postoculars; 2 crescent-like suboculars; 3 anterior temporals; 4 posterior temporals; 7 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> contact with the nasal 2<sup>nd</sup> in contact with the loreal, 2<sup>nd</sup>–5<sup>th</sup> supralabials in contact with suboculars, not contacting the eye, 6<sup>th</sup> largest; prefrontals not in contact with eye; mental groove absent; dorsal scale rows slightly keeled;

anterior vertebral scales slightly enlarged; ventrals 174; cloacal undivided; subcaudals 80, divided. Coloration of dorsal olive-brown with indistinct, diffuse dark crossbars; head with thin, dark subocular streaks and indistinct black postocular lines fusing on nape; ventral surfaces pale yellow with irregular small black spots, becoming denser towards the tail; iris orange.

**Ecological notes.** The individuals were found at 2300 h in the vegetation above a small pond in the garden of a resort. The resort is situated along the Nam Lik River, with riparian vegetation and secondary open disturbed forest along the banks.

**Distribution.** In Laos, this species has been previously reported from Phongsali, Oudomxai, Bolikhamxai, and Champasak provinces (Teynié and David 2010). This is the first record from Vientiane Province. Elsewhere, this species has been reported from southern China, Myanmar, Vietnam, Cambodia, Thailand, Malaysia, and Indonesia (Uetz et al. 2020).

### *Pareas hamptoni* (Boulenger, 1905)

#### Hampton's Slug Snake (Fig. 9D)

Three adult individuals of *P. hamptoni* were observed by P. Brakels and N. Maury on 28 December 2018, in Bortaen District site 1, Xaignabouli Province (17°43.118'N, 101°06.670'E; elevation 1,400 m asl) and by P. Brakels, P. Pawangkhanant, S. Idiitullina, and T.V. Nguyen on 17 July 2019 in Longcheng District site 1, Xaisomboun Province (19°00.983'N, 102°59.645'E; elevation 1,370 m asl).

Morphological characters of the individuals from Xaignabouli and Xaisomboun provinces agreed well with the descriptions of Smith (1943), Guo et al. (2009), Vogel (2009), and Wang et al. (2019). The photographed individual (Fig. 9D) agrees with the diagnosis of *P. hamptoni* in the following characters: body small-sized, slender, compressed laterally; head elongate, distinct from neck; eye moderately large; pupil vertical; loreal present; 1 preocular; 1 postocular; 1 crescent-like subocular; 1 anterior temporal; 2 posterior temporals; 7 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with the nasal, 2<sup>nd</sup> in contact with loreal, 2<sup>nd</sup>–5<sup>th</sup> supralabials in contact with suboculars, not contacting the eye, 7<sup>th</sup> largest; prefrontals in contact with eye; mental groove absent; dorsal scale rows smooth; anterior vertebral scales slightly enlarged; ventrals 188; cloacal undivided; subcaudals 78, divided. Coloration of dorsum brown with blackish-brown bars or spots on the flanks, head with a thick black line extending from above the eye to the nape; ventral surface orange with some small black spots; iris orange.

**Ecological notes.** The individuals from Bortaen District were observed at ca. 2100 h at a height of ca. 3–5 m in a tree, while the individuals from Longcheng District were found at ca. 2000–2100 h on the rocks and in the trees along a stream. The surrounding habitat at both sites was montane mixed secondary evergreen



**Fig. 10.** (A) *Pareas macularius* in Longcheng District, Xaisomboun Province; (B) *P. margaritophorus* in Khounkham District, Khammouan Province; (C) adult male and (D) adult female of *Trimeresurus gumprechtii* in Bortae District, Xaignabouli Province; (E) adult male and (F) adult female of *T. popeiorum* in Xay District, Oudomxai Province. Photos by P. Brakels (A, C–F) and N. Maury (B).

forest of small hardwoods, shrubs, and arrowroot.

**Distribution.** In Laos, this species has been previously recorded only from Houaphan and Champasak provinces (Teynié and David 2010; Teynié et al. 2014). This is the third record from the country as well as the first from northwestern Laos and from Xaisomboun and Xaignabouli provinces. Elsewhere, this species has been reported from China, Myanmar, Vietnam, Cambodia, and Thailand (Uetz et al. 2020).

**Remarks.** A number of recent molecular phylogenetic studies demonstrated that populations of *P. hamptoni* from Vietnam and southeastern China are more closely related to *P. formosensis* (Van Denburgh), than to typical *P. hamptoni* from the western part of Yunnan Province

of China and, supposedly, Myanmar (You et al. 2015; Li et al. 2020). Li et al. (2020) refer the Indochinese populations of this species as *P. formosensis*, however populations from Laos were not included in the molecular phylogenetic analysis so their taxonomic status requires further study.

***Pareas macularius* Theobald, 1868  
Spotted Slug Snake (Fig. 10A)**

One adult individual of *P. macularius* was observed by P. Brakels, P. Pawangkhanant, S. Idiitullina, and T.V. Nguyen on 17 July 2019 in Longcheng District site 1, Xaisomboun Province (19°00.983'N, 102°59.645'E;

elevation 1,370 m asl). Two subadults were observed by N. Maury and P. Brakels on 24–25 October 2019 in Paksong (2) District, Champasak Province (near 15°11.178'N, 106°15.716'E; elevation 1,350 m asl).

Morphological characters of the individuals from Xaisomboun and Champasak provinces agreed well with the descriptions of Teynié and David (2010) and Hauser (2017). The photographed individual (Fig. 10A) agrees with the diagnosis of *P. macularius* in the following characters: body small-sized, slender, laterally compressed; head elongate, distinct from neck; eye size medium; pupil vertical; loreal present, not entering the orbit; 1 preocular; 1 postoculars; 1 crescent-like subocular; 1 anterior temporal; 2 posterior temporals; 7 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact with nasal, 2<sup>nd</sup> in contact with loreal, 3<sup>rd</sup>–5<sup>th</sup> supralabials in contact with suboculars, not contacting the eye, 7<sup>th</sup> largest; prefrontals in contact with eye; mental groove absent; upper dorsal scale rows slightly keeled; anterior vertebral scales slightly enlarged; ventrals 156; cloacal undivided; subcaudals 44, divided. Coloration of dorsum dark grayish-brown with irregular black or white spots localized always on single scales; nuchal region with and grayish-white “W-shaped” marking sparsely speckled with brown; ventral surfaces cream with dense speckling and few larger blotches; iris dark.

**Ecological notes.** The individual at Xaisomboun Province was found at 2300 h crossing the mountain dirt road. The surrounding habitat was secondary montane evergreen forest. The first individual from Champasak Province was found on a path in a coffee plantation at ca. 1830 h and the second individual was found in a patch of secondary mixed evergreen forest along a coffee plantation at ca. 1900 h.

**Distribution.** In Laos, this species has been previously recorded from Phongsali and Houaphan provinces (Hauser 2017). These are the first records from Xaisomboun and Champasak provinces. Elsewhere, this species has been reported from China, Myanmar, Vietnam, and Thailand (Uetz et al. 2020).

### *Pareas margaritophorus* (Jan, 1866) Mountain Slug Snake (Fig. 10B)

One adult individual of *P. margaritophorus* was observed by N. Maury on 26 November 2018 near Konglor Cave in Khoukham District site 2, Khammouan Province (17°53.945'N, 104°49.485'E; elevation 185 m asl).

Morphological characters of the individual from Khammouan Province agreed well with the descriptions of Teynié and David (2010) and Hauser (2017). The photographed individual (Fig. 10B) agrees with the diagnosis of *P. margaritophorus* in the following characters: body small-sized, slender, laterally compressed; head elongate, distinct from neck; eye medium-sized; pupil vertical; loreal present, not entering the orbit; 1 preocular; subocular and postocular fused into one crescent-shaped scale; 2 anterior temporals; 3 posterior temporals; 7 supralabials, 1<sup>st</sup> and 2<sup>nd</sup> in contact

with nasal, 2<sup>nd</sup> in contact with loreal, 3<sup>rd</sup>–5<sup>th</sup> supralabials in contact with suboculars, not contacting the eye, 7<sup>th</sup> largest; prefrontals in contact with eye; mental groove absent; dorsal scale rows entirely smooth; anterior vertebral scales slightly enlarged; ventrals 158; cloacal undivided; subcaudals 41, divided. Coloration of dorsum gray with irregular black or white spots; nuchal region with large pinkish spots; ventral surfaces cream with sparse speckling; iris dark.

**Ecological notes.** The individual was found at 2230 h on a limestone boulder under a dense bush. The surrounding habitat consisted of secondary dry mixed deciduous forest on karst.

**Distribution.** In Laos, this species has been previously recorded from Louangprabang, Vientian, Houaphan, Champasak, and Xekong provinces (Hauser 2017). This is the first documented record from Khammouan Province. Elsewhere, this species has been reported from China, Myanmar, Vietnam, Cambodia, Thailand, Malaysia, and Singapore (Uetz et al. 2020).

### Family Viperidae Oppel

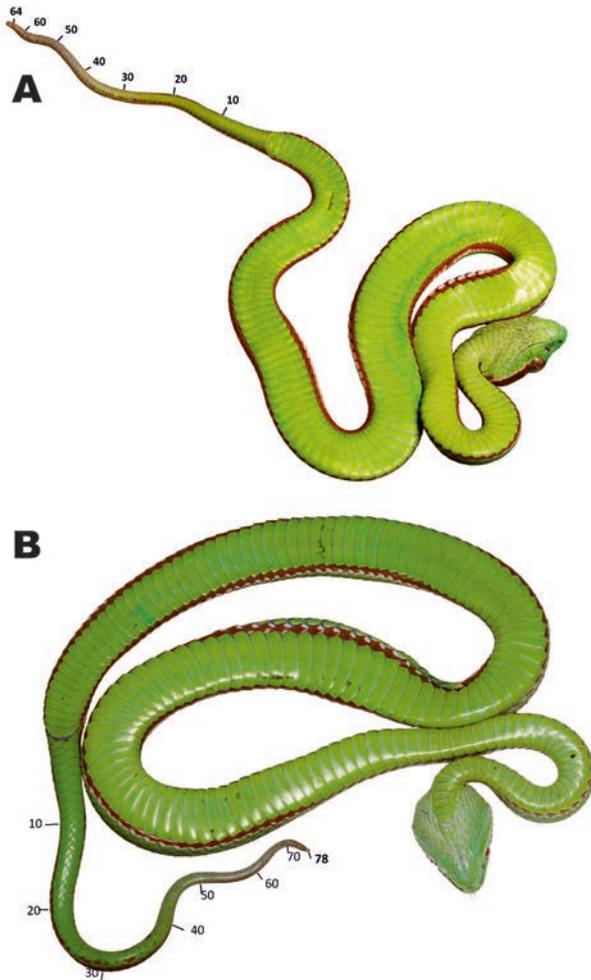
#### *Trimeresurus gumprehti* David, Vogel, Pauwels, and Vidal 2002

#### Gumprecht's Pitviper (Figs. 10C–D, 11A)

Two adult males and one female of *T. gumprehti* were observed by P. Brakels and N. Maury on 28 December 2018 in Bortaen District site 1, Xaignabouli Province (17°43.118'N, 101°06.670'E; elevation 1,400 m asl).

Morphological characters of the individuals from Xaignabouli Province agreed well with the descriptions of David et al. (2002) and Nguyen et al. (2018). The photographed individuals (Fig. 10C–D) agree with the diagnosis of *T. gumprehti* in the following characters: slender, slightly laterally compressed body; head triangular, clearly distinct from the neck; eye in size; pupil vertical; internasals separated from each other by a scale; loreal pit present; two small scales between the nasal and the shield bordering the anterior region of the loreal pit; 3 preoculars; 1 crescent-shaped subocular; 2 postoculars; temporals small; 11–12 supralabials, the 1<sup>st</sup> separated from the nasal, 3<sup>rd</sup> large, in contact with subocular, 4<sup>th</sup> and 5<sup>th</sup> separated from subocular by a small scale; dorsal scale rows strongly keeled but smooth on the outermost row; ventrals 161 in males, 163 in female; cloacal plate undivided; subcaudals 64 in male (see Fig. 11A), 57 in female, divided. Coloration of dorsum deep green with bicolored (dorsally white, ventrally red) ventrolateral stripe present in males; in female only thin white ventrolateral stripe; head laterally with a white postocular streak, ventrally edged with red in males, absent in female; tail green with dorsal part of the posterior half rusty red; ventral surfaces bright green; eyes deep red in males, deep yellow in female.

**Ecological notes.** The individuals were recorded at 2100–2300 h in a tree along a small narrow stream at 2–5



**Fig. 11.** Ventral views of two *Trimeresurus* species from Laos, showing scalation and tail base; numbers correspond to subcaudal scale count. **(A)** Adult male of *T. gumprechtii* from Bortae District, Xaignabouli Province; **(B)** adult male of *T. popeiorum* in Xay District, Oudomxai Province. Photos by N. Maury.

m above the ground. The surrounding habitat was mixed secondary montane forest.

**Distribution.** In Laos, this species has been previously recorded only from Khammouan Province (Malhotra and Thorpe 2004). This is the second record of this species for Laos, as well as the first record from Xaignabouli Province. Elsewhere, this species has been reported from India, China, Myanmar, Vietnam, and Thailand (Uetz et al. 2020).

***Trimeresurus popeiorum* Smith, 1937**  
**Pope’s Pitviper (Figs. 10E–F, 11B)**

Multiple individuals of *T. popeiorum* were observed by P. Brakels and N. Maury from 21–25 August 2019 in Xay District, Oudomxai Province (20°39.598’N, 102°04.241’E; elevation 850 m asl).

Morphological characters of the individuals from Oudomxai Province agreed well with the descriptions of

Vogel et al. (2004), Guo et al. (2015), and Mulcahy et al. (2017). The photographed individuals (Fig. 10E–F) agree with the diagnosis of *T. popeiorum* in the following characters: base of tail not especially enlarged in males (see Fig. 11B); body slender, laterally compressed; head triangular, clearly distinct from the neck; eye medium; pupil vertical; internasals separated from each other by a scale; loreal pit present; two small scales between the nasal and the shield bordering the anterior region of the loreal pit; 3 preoculars; 1 crescent-shaped subocular; 2 postoculars; temporals small; 10–11 supralabials, the 1<sup>st</sup> separated from the nasal, 3<sup>rd</sup> large, in contact with subocular, 4<sup>th</sup> and 5<sup>th</sup> separated from subocular by a small scale; dorsal scale rows strongly keeled but smooth on the outermost row; ventrals 166 in a single male, 159–162 in females; cloacal undivided; subcaudals 78 in a single male, 55–58 in females, all divided. Coloration of dorsal surfaces deep green with bicolored (with dorsally white, ventrally red) ventrolateral stripe present in male, in females thin ventrolateral stripe, anteriorly yellowish, posterior whitish; lateral surfaces of head with a white postocular streak ventrally edged with red in male, absent in female; tail greenish with the posterior half dorsally rusty red; ventrally green; eyes red to deep red both in male and females.

**Ecological notes.** The individuals from Oudomxai Province were found at 1900–2300 h perching just at 0.5–4 m above the ground along a road in a forested valley. The surrounding habitat was mixed secondary submontane forest.

**Distribution.** In Laos, this species has been previously recorded only from Phongsali, Louangphabang, Xaignabouli, and Vientiane provinces (Vogel et al. 2004; Sanders et al. 2006). This is the first record from Oudomxai Province. Elsewhere, this species has been reported from India, Nepal, China, Myanmar, and Thailand (Uetz et al. 2020).

**Remarks.** *Trimeresurus popeiorum* can be confused with *T. gumprechtii*, but differs from it by the shape of its hemipenes (long, without spines vs. short, strongly spinose), a generally longer tail, a generally higher number of subcaudals in males: 59–78 (avg. 68.1) vs. 55–71 (avg. 64.7); and eye color (deep red in both sexes in adult specimens vs. deep red in males, yellow in females) (David et al. 2002; Vogel et al. 2004; Guo et al. 2015).

**Reptilia: Testudines**

**Family Platysternidae Gray**

***Platysternon megacephalum* Gray, 1831**  
**Big-headed Turtle (Fig. 12A)**

One subadult individual of *P. megacephalum* was observed by P. Brakels and P. Pawangkhanant on 16 July 2019 in Mork District, Xiangkhouang Province (elevation 2,000 m asl).



**Fig. 12.** (A) *Platysternon megacephalum* in Mork District, Xiangkhouang Province; (B) *Cuora mouhotii* in Xayaburi District, Xaignabuli Province; (C) *Heosemys annandalii* in Champhone District, Savannakhet Province; (D) *Siebenrockiella crassicollis* in Pathoumphone District, Champasak Province; (E) *Indotestudo elongata* in Pathoumphone District, Champasak Province; (F) *Manouria impressa* in Xaychamphone District, Bolikhamxai Province. Photos by P. Pawangkhanant (A), P. Sysouphanthong (B), P. Brakels (C–D, F), and WCS Laos (F).

Morphological characters of the individual from Xiangkhouang Province agreed well with the descriptions of Hendrie et al. (2011) and Chan-ard et al. (2015). The photographed individual (Fig. 12A) agrees with the diagnosis of *P. megacephalum* in the following characters: head covered dorsally and laterally with a continuous horny shield, very large, triangular, cannot be withdrawn into the carapace; jaws well-developed, covered with horny plates forming a beak; tail as long as the body. Head and carapace olive with irregular black spots; plastron and bridge yellowish with small black spots.

**Ecological notes.** The turtle was recorded at 2000 h at a large rocky stream at 2,000 m asl, and subsequently released in the same location.

**Distribution.** In Laos, this species has been previously recorded from Houaphan, Vientiane, Bolikhamxai, Khammouan, and Xekong provinces (Teynié and David 2010). This is the first record of this species from Xiangkhouang Province. Elsewhere, this species has been reported from China, Myanmar, Vietnam, Cambodia, and Thailand (Rhodin et al. 2017).

#### Family Geoemydidae Theobald

##### *Cuora mouhotii* (Gray, 1862) Keel Box Turtle (Fig. 12B)

One adult individual of *C. mouhotii* was observed by

P. Sysouphanthong on 28 June 2016 near Keo Village, Xayabury District, Xaignabouli Province (elevation 1,000 m asl).

Morphological characters of the individual from Xaignabouli Province agreed well with the descriptions of Hendrie et al. (2011) and Das et al. (2016). The photographed individual (Fig. 12B) agrees with the diagnosis of *C. mouhotii* in the following characters: head small and smooth; carapace high, rather narrow, with a clear midline dorsal keel running the length of the vertebral scutes; carapace considerably flattened laterally into the costal scutes on both sides where secondary keels present; posterior marginals markedly serrated and scalloped anteriorly; plastron relatively large, with a well-formed hinge between the hyo- and hypoplastra and with a distinct anal notch; tail rather long; carapace uniformly dark brown; head light brown; plastron and bridge dark brown with light brown markings around the outer edge; eye red.

**Ecological notes.** The individual was found at 1730 h on the forest floor in old growth primary dry mixed evergreen forest.

**Distribution.** In Laos, this species has been previously recorded from Vientiane, Bolikhamxai, Khammouan, and Champasak provinces (Rhodin et al. 2017). This is the first record from Xaignabouli Province. Elsewhere, this species has been reported from India, Bangladesh, Bhutan, China, Myanmar, and Vietnam (Rhodin et al. 2017).

***Heosemys annandalii* (Boulenger, 1903)  
Yellow-headed Temple Turtle (Fig. 12C)**

Eight individuals of *H. annandalii* were observed by P. Brakels on 1 July 2019 in Champhone District site 2, Savannakhet Province (elevation 150 m asl), and in August 2018 and March 2019 in captivity in villages in Pathoumphone District, Champasak Province (all turtles were captured in and around the Beung Kiat Ngong Ramsar site wetland).

Morphological characters of the individuals from Savannakhet and Champasak provinces agreed well with the descriptions of Hendrie et al. (2011), Chan-ard et al. (2015), and Vasilieva et al. (2016). The photographed individual (Fig. 12C) agrees with the diagnosis of *H. annandalii* in the following characters: large size; head small and smooth, with enlarged scales on forehead and pointed snout; upper beak sharply dentate; carapace elongate, flattened above, without vertebral keel, serrated posteriorly; plastron with distinct anal notch. Surface carapace uniformly dark black; head gray with yellow speckling; surface plastron and bridge are yellow with large black blotches on each scute.

**Ecological notes.** Six individuals were found in the shallow muddy part of an oxbow scavenging for fallen fruits. Two large individuals, carapace length >50 cm, were observed crossing the trail in the forest near the

oxbow. The surrounding habitat consisted of riparian and deciduous forest along the river.

**Distribution.** In Laos, this species has been recorded from Vientiane, Khammouan, and Attapu provinces (Rhodin et al. 2017). These are the first records from Savannakhet and Champasak provinces. Elsewhere, this species has been reported from Vietnam, Cambodia, Thailand, and Malaysia (Rhodin et al. 2017).

***Siebenrockiella crassicollis* (Gray, 1831)  
Black Marsh Turtle (Fig. 12D)**

One juvenile individual of *S. crassicollis* was observed by P. Brakels in August 2018 in Phapho Village, Pathoumphone District, Champasak.

Morphological characters of the individual from Champasak Province agreed well with the descriptions of Hendrie et al. (2011) and Chan-ard et al. (2015). The photographed individual (Fig. 12D) agrees with the diagnosis of *S. crassicollis* in the following characters: almost totally black coloration; head black to dark gray with a faded, cream spot behind each eye; carapace oval, depressed and strongly serrated posteriorly; plastron and bridge black, with some brownish streaks.

**Ecological notes.** The specimen was collected by local people in a rice paddy in the vicinity of Phapho Village.

**Distribution.** In Laos, this species has been previously recorded only from Champasak Province, based on interview data and from specimens sold at a local market in Lomsaktay Village, Batiengchaleunsouk District (Baird 1993; Suzuki et al. 2015). This record represents an additional confirmation of *S. crassicollis* from Laos. In addition, we observed several *S. crassicollis* in the wildlife markets in Vientiane during 2016–2019, all originating from Laos but the precise locations are not known. Elsewhere, this species has been reported from Myanmar, Vietnam, Cambodia, Thailand, Malaysia, Indonesia, and Singapore (Rhodin et al. 2017).

**Family Testudinidae Gray**

***Indotestudo elongata* (Blyth, 1854)  
Elongated Tortoise (Fig. 12E)**

Several individuals of *I. elongata* were observed by P. Brakels in August 2018 and March 2019 in captivity in villages in Pathoumphone District, Champasak Province. All tortoises were said to be captured in nearby forest areas, including the territory of Xe Pian NPA. Furthermore, one individual was observed by K. Inkhavilay in May 2018 in Phin District, Savannakhet Province; other records include reports from villagers in Xonnabouly District who recently collected this species from nearby open woodlands and dry dipterocarp forests (photo record only).

Morphological characters of the individuals from

Savannakhet and Champasak provinces agreed well with the descriptions of Hendrie et al. (2011) and Chan-ard et al. (2015). The photographed individuals (Fig. 12E) agree with the diagnosis of *I. elongata* in the following characters: head elongate, with sharply truncated snout, large scutes located over tympanum; carapace high, domed, flattened dorsally with moderately serrated posterior marginal scutes; plastron elongated with a posterior notch. Carapace yellowish-brown, with black blotches on the vertebrals and pleurals; plastron and bridge yellowish, unmarked.

**Distribution.** In Laos, this species has been recorded from Vientiane, Khammouan, Saravan, and Attapu provinces (Stuart and Patt 2004; Teynié and David 2010). These are the first records from Savannakhet and Champasak provinces. Elsewhere, this species has been reported from India, Bangladesh, Bhutan, Nepal, China, Myanmar, Vietnam, Cambodia, Thailand, and Malaysia (Rhodin et al. 2017).

### ***Manouria impressa* (Günther, 1882)** **Impressed Tortoise (Fig. 12F)**

One individual of *M. impressa* was observed by D. Lety (WCS Laos) on 1 July 2018 in Phou Si Thone Endangered Species Conservation Area, Xaychamphone District, Bolikhamxai Province.

Morphological characters of the individual from Bolikhamxai Province agreed well with the descriptions of Hendrie et al. (2011), Calame et al. (2013), and Chan-ard et al. (2015). The photographed individual (Fig. 12F) agrees with the diagnosis of *M. impressa* in the following characters: carapace oval, flattened dorsally, strongly serrated; posterior marginals upturned, well-defined growth annuli present on the vertebrals and marginals; head large, upper jaw without hook, snout non-projecting; plastron large with a deep cloacal notch; carapace brown with dark seams, marginals with large black blotches; plastron yellowish-brown with dark seams.

**Ecological notes.** The tortoise was found on a mountain ridge in semi-evergreen forest with extensive bamboo in the undergrowth.

**Distribution.** In Laos, this species has been recorded from Attapu, Khammouan, Xekong, Houaphan, Phongsali, and Salavan provinces (Calame et al. 2013). This is the first record from Bolikhamxai Province. Several individuals have been offered for a sale at a local market in Ban Xong Cha, Nam Bak District, Louangphabang Province; and all these tortoises were said to be locally sourced. As this species is often found for sale on the main market in Louangphabang City as well, they are all expected to be locally sourced turtles from Louangphabang Province or nearby provinces. Furthermore, tortoises of this species are offered for sale in a local market in Vang Vieng District, Vientiane Province, where, again all are said to be collected from the nearby mountain ranges. Elsewhere, the species has

been reported from India, China, Myanmar, Vietnam, Cambodia, Thailand, and Malaysia (Uetz et al. 2020).

## **Discussion**

The inventory of the herpetofauna of Laos is still far from complete. Although several recent surveys have significantly increased the number of amphibian and reptile species already recorded for the country (Teynié et al. 2004, 2014, 2017; Teynié and David 2010, 2014; Luu et al. 2013; Egert et al. 2017), the recent findings reported here bring the total numbers of amphibians and reptiles recorded from Laos to 118 and 191 species, respectively. Most of the new species described or recorded for Laos here have all been found in karstic formations in the central or northern parts of the country, especially in Khammouan Province of the Annamite Mountains range (e.g., Luu et al. 2013; Egert et al. 2017). This study demonstrates that yet unknown herpetofaunal diversity exists also in the non-karstic areas of central, southern, and northern Laos, in particular in Xiangkhouang, Xaisomboun, Champasak, and Oudomxai provinces.

Here based on photo records, the presence of three amphibian species (*Quasipaa verrucospinosa*, *Gracixalus quangi*, and *Theloderma lateriticum*) are reported for the herpetofauna of Laos for the first time. Photo records confirming the occurrence of one amphibian (*Glyphoglossus molossus*) and two reptile species (*Subessor bocourti* and *Siebenrockiella crassicollis*) in the country are also provided. This study also significantly expands known distributions of nine amphibian (*Nanorana aenea*, *Ophryophryne pachyproctus*, *Xenophrys palpebralespinosa*, *Glyphoglossus guttulatus*, *Rana johnsi*, *Sylvirana cubitalis*, *Gracixalus quyeti*, *Theloderma gordonii*, *T. petilum*, and *Zhangixalus feae*) and five reptile species (*Gonyosoma prasinum*, *Hebius leucomyax*, *Lycodon futsingensis*, *Pareas hamptoni*, and *Trimeresurus gumprechtii*); these taxa are here reported for Laos for the second time.

These new records are based on a series of short field trips and demonstrate that the list of herpetofauna for Laos is still far from being complete. This study provides further evidence that photo records represent an important tool for assessing and monitoring vertebrate diversity (Pimm et al. 2015). The taxonomic status of several species recorded here requires further studies using morphological and molecular methods (e.g., *Ophryophryne pachyproctus*, *Sylvirana cf. cubitalis*, *Pareas hamptoni*, *P. carinatus*, and *Dendrelaphis cf. cyanochloris*). We hope that our results will spur additional interest in documenting the distribution and conservation of the reptile and amphibian diversity in Laos. Further field survey efforts throughout Laos are essential for better understanding of herpetofaunal diversity in Laos and the elaboration of necessary conservation measures.

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