

NEW PROVINCIAL RECORDS AND AN UPDATED LIST OF SNAKES (Squamata: Serpentes) FROM XUAN LIEN NATURE RESERVE, THANH HOA PROVINCE, VIETNAM

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ABSTRACT: We report six new records of snakes from Thanh Hoa province based on newly collected specimens from Xuan Lien Nature Reserve, comprising three species of Colubridae (*Lycodon futsingensis*, *L. meridionalis* and *Oreocryptophis porphyraceus*), two species of Natricidae (*Hebius boulengeri* and *Parahelicops annamensis*), and one species of Elapidae (*Bungarus slowinskii*). In addition, an updated list of 38 snake species from Xuan Lien Nature Reserve is also provided. The snake fauna of Xuan Lien Nature Reserve contains a number of species of conservation concern including six species listed in the Governmental Decree No. 32/2006/ND-CP (2006), eight species listed in the Vietnam Red Data Book (2007), and four species listed in the IUCN Red List (2016).

Keywords: Distribution, snakes, species list, Xuan Lien Nature Reserve.

Citation: Nguyen Van Tan, Pham The Cuong, Nguyen Quang Truong, 2016. New provincial records and an updated list of snakes (Squamata: Serpentes) from Xuan Lien Nature Reserve, Thanh Hoa province, Vietnam. Tap chi Sinh hoc, 38(3): 324-332. DOI: 10.15625/0866-7160/v38n3.8448.

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INTRODUCTION

The Xuan Lien Nature Reserve is located in Thuong Xuan district, Thanh Hoa province, Vietnam, covering an area of 27,668 ha of montane evergreen forest [18]. Although this protected area was established in 2000, the herpetofauna of Xuan Lien Nature Reserve is still poorly studied. Le et al. (1999) [10] provided the first list of 16 snake species from this reserve. Le & Pham (2009) [9] reported a total of 28 species of snakes from Xuan Lien Nature Reserve. Pham et al. (2012) [17] subsequently documented only 22 species of snakes from this nature reserve, including eight new provincial records for Thanh Hoa province. In this paper, we report six additional species for the list of snakes from Thanh Hoa province based on the new reptile collection from Xuan Lien Nature Reserve.

MATERIAL AND METHODS

Field surveys were conducted in the Xuan Lien Nature Reserve by C. T. Pham, C. V. Hoang, T. T. Nguyen, T. T. Chu from 1 to 10 November 2011, from 15 to 25 April, from 20 to 30 August 2012 and from 20 to 28 April

2013. Surveys sites were situated at elevations from 200 m to 1000 m above sea level (asl.). Specimens were collected at night time between 19:00 and 23:30 by hand or using a snakehook. Specimens were anaesthetized with ethyl acetate, fixed in 90% ethanol for 10-12 hours, and subsequently transferred into 70% ethanol for permanent storage. Specimens were deposited in the collection of the Institute of Ecology and Biological Resources (IEBR), Hanoi, Vietnam.

Taxonomic identification of the specimens were made mainly based on the following literature: Gressitt (1937) [4], Smith (1943) [20], Schulz (1996) [19], Orlov et al. (2004) [16], Kuch et al. (2005) [8], Stuart (2006) [21], Vogel et al. (2009) [25], Kharin et al. 2011 [7], Hecth et al. (2013) [5], Luu et al. (2013a, b) [11,12], Nguyen et al. (2014) [14], Ziegler et al. 2014 [26], David et al. (2013, 2015b) [1, 3]. For common names, we followed Nguyen et al. (2009) [13] and Uetz & Hošek (2016) [24].

Abbreviations used for morphometry are as follows: SVL (snout-vent length): from tip of snout to anterior margin of cloaca; TaL (Tail

length): from posterior margin of cloaca to tip of tail. Bilateral scale counts were given as left/right.

RESULTS AND DISCUSSION

Taxonomic accounts

Family Colubridae

Lycodon futsingensis (Pope, 1928)

Futsing Wolf Snake/Rắn khuyết fut-sing (Fig. 1a)

Specimen examined (n=2). One adult male, IEBR 3900 (Field no. XL-TH.2011.51), collected on 5 November 2011 near Vin Forest Ranger Station (19°58.777'N, 104°59.084'E, at an elevation of 873 m asl.); one adult male IEBR 3901 (Filed no. XL-TH.2012.2) collected on 15 April 2012 near the Hon Can Forest Ranger Station (19°51.645'N, E 105°14.558'E, at an elevation of 170 m asl.).

Morphological characters. IEBR 3900 (SVL 722.3 mm, TaL 128.5 mm), IEBR 3901 (SVL 577 mm, TaL 162.8 mm). Body elongated; head distinct from neck; eye moderate; pupil vertically oval; rostral broader than high, partly visible from above; internasals as broad as long, not in contact with loreal; prefrontal as long as frontal; frontal hexagonal; parietals large, longer than wide; nasal divided; loreal 1/1, small, not touching the eye; preocular 1/1; subocular absent; postoculars 2/2; anterior temporals 2/2; posterior temporals 2/2 or 3/3; supralabials 8/8, third to fifth entering orbit; infralabials 10/10, first to fifth bordering chin shields; dorsal scale rows 17-17-15, all smooth; ventrals 195-199; cloacal entire; subcaudals 46-75, all paired. Hemipenis short, unforked, reaching the 5th or 6th SC.

Coloration in life. Above pale brownish grey with 23-25 brownish rings on body and 8-10 rings on the tail. The rings wider at base, the first one starting at ventral scale 16 or 17, in width of 5-6 ventrals at its base and of 2 or 3 dorsal scales on dorsum. Belly cream, with dark marbling, dark grey posteriorly (determination after Vogel et al. 2009 [25], Hecht et al. 2013 [5], Luu et al. 2013a [11] and Nguyen et al. 2014 [14]).

Ecological notes. The specimens were found between 19:00 and 22:00 in two small

streams. The surrounding habitat was mixed secondary forest of small hardwoods, shrubs and bamboos.

Distribution. In Vietnam, this species is known from Lao Cai, Bac Kan, Bac Giang, Vinh Phuc, Ha Tinh and Quang Binh provinces [25]. Elsewhere, this species is recorded from Laos [11].

Lycodon meridionalis (Bourret, 1935)

Southern Big-tooth Snake/Rắn lệch đầu kinh tuyến (Fig. 1b)

Specimen examined (n=1). One adult female, IEBR 3902 (Field no. XL-TH.2013.1), collected on 5 April 2013 near Vin Forest Ranger Station (19°59.498'N, 104°57.907'E, at an elevation of 886 m asl.).

Morphological characters. SVL 1102.3 mm, TaL 234 mm. Body elongated; head distinct from neck; eye large; pupil vertically oval; rostral as broad as high, partly visible from above; internasals as broad as long, not in contact with loreal; prefrontal shorter than frontal; frontal hexagonal; parietals longer than wide; nasal divided; loreal 1/1, small, not touching the eye; preocular 1/1; subocular absent; postoculars 2/2; anterior temporals 2/2; posterior temporals 2/3; supralabials 8/8, third to fifth entering orbit; infralabials 10/10, first to fifth bordering chin shields; dorsal scale rows 17-17-15, strongly keeled except 5 outermost rows smooth, outer dorsal scales enlarged; ventrals 251; cloacal entire; subcaudals 75, paired.

Coloration in life. Dorsum black with 110 yellow narrow cross-bars on body and 26 on tail, bifurcate on the sides, enclosing dark spots; head black with symmetrical light markings, the most conspicuous being one running from the eye to the margin of the snout and another stretching from the hind margin of the parietals. Belly light yellow (determination after Orlov et al. 2004 [16], Hecht et al. 2013 [5] and Ziegler et al. 2014 [26]).

Ecological notes. The specimen was found at 21:00 in a small stream. The surrounding habitat was mixed secondary forest composed of small to medium hardwoods and shrubs.

Distribution. In Vietnam, this species is known from Lao Cai and Ha Giang provinces

southwards to Ninh Binh province [13]. Elsewhere, the species is recorded from China and Laos [13].

***Oreocryptophis porphyraceus* (Cantor, 1839)**-Black-banded Trinket Snake/Rắn sọc đốm đỏ (Fig. 1c)

Specimen examined (n=1). One juvenile, IEBR 3903 (Field no. XL-TH.2012.91), collected in 21 April 2012 near Hon Can Ranger Station (19°57.604'N, 105°14.371'E, at an elevation of 210 m asl.).

Morphological characters. SVL 238.3 mm, TaL 54.46 mm. Body elongated; head distinct from neck; eye large; rostral as broad as high, visible from above; internasals as broad as long, not in contact with loreal; prefrontal less than length of frontal; frontal hexagonal; parietals large, longer than wide; nasal divided; loreal 1/1, small, not touching the eye; preocular 1/1, large; subocular absent; postoculars 2/2; anterior temporals 1/1; posterior temporals 2/2; supralabials 8/8, four and fifth entering orbit, seventh largest; infralabials 10/10, first to fifth chin shields bordering; dorsal scale rows 19-19-17, all smooth; ventrals 205; cloacal paired; subcaudals 75, paired.

Coloration in preservative. Ground color reddish brown; body and tail with dark bands, bordered in black; two narrow black stripes extending from immediately behind eyes along entire length of the body; dorsal surface of head marked with a black line (determination after Smith 1943 [20], Schulz 1996 [19] and Ziegler et al. 2014 [26]).

Ecological notes. The specimen was found at 21:30 on forest path. The surrounding habitat was mixed secondary forest of small hardwoods, shrubs and bamboos.

Distribution. This species is known from northern Vietnam southwards to Quang Binh Province [13]. Elsewhere, the species is recorded from India, Nepal, China, Taiwan, Myanmar, Laos, Thailand, Cambodia, Malaysia, and Indonesia [13].

Family Natricidae

***Hebius boulengeri* (Gressitt, 1937)**

Tai-yong Keelback/Rắn sãi râu-lên-giờ (Fig. 1d)

Specimen examined (n=1). One subadult male, IEBR.3904 (Field no. XL-TH.2012.1), collected by CTP et al. on 2 April 2012 near the Hon Can Forest Ranger Station (19°51.645'N, 104°14.558'E, at an elevation of 170 m asl.).

Morphological characters. SVL 337.1 mm, TaL 106 mm. Body cylindrical, elongated; head flattened, distinct from neck; eye moderate; pupil round; maxillary teeth 25/25; rostral wider than high, partly visible from above; internasals subrectangular, truncated, not in contact with loreal, as long as prefrontal; prefrontal shorter than frontal; frontal hexagonal; parietals longer than wide; nasal undivided; loreal 1/1, small, not touching the eye; preocular 1/1; subocular absent; postoculars 3/3; anterior temporal 1/1; posterior temporal 1/1; supralabials 9/9, fourth to sixth entering orbit, seventh largest; infralabials 11/11, first to fifth bordering chin shields; dorsal scale rows 19-19-17, strongly keeled except outer row smooth; ventrals 141; cloacal entire; subcaudals 53, paired. Hemipenis short, reaching the 4th SC.

Coloration in life. Dorsal surface of body dark grey, distinctly darker on the five upper dorsal scale rows than on the sides; dorsolateral stripe extends from the neck to the base of the tail. Posterior supralabials dark brown, each with a median, horizontal and longate, thin cream blotch or streak, usually united as a narrow stripe, extending on the neck as a continuous stripe. The venter uniformly cream (determination after Gressitt 1937 [4], David et al. 2013 [1]).

Ecological notes. The specimen was found at 20:45 in a small stream. The surrounding habitat was mixed secondary forest of small hardwoods, shrub and arrowroot.

Distribution. In Vietnam, this species is known from Lao Cai and Ha Giang provinces southwards to Dak Lak and Lam Dong provinces [1]. Elsewhere, the species is recorded from China, Laos, Cambodia, and Thailand [1].

***Parahelicops annamensis* Bourret, 1934**

Annam Keelback/Rắn bình mũi trung bộ (Fig. 1e)

Specimen examined (n=1). One

adult female, IEBR 3905 (Field no. XL-TH.2013.24), collected on 21 April 2013 near

the Vin Forest Ranger Station (19°59.111'N, 104°58.215'E, at an elevation of 850 m asl.).



Figure 1. New provincial records of snakes from Xuan Lien Nature Reserve, Thanh Hoa province: (a) *Lycodon futsingensis* (IEBR 3900, adult male); (b) *Lycodon meridionalis* (IEBR 3902, adult female); (c) *Oreocryptophis porphyraceus* (IEBR 3903, juvenile); (d) *Hebius boulengeri* (IEBR 3904, subadult male); (e) *Parahelicops annamensis* (IEBR 3905, adult female); and (f) *Bungarus slowinskii* (IEBR 3906, adult female).

Morphological characters. SVL 402.7 mm, TaL 169 mm. Body moderately robust; head moderately distinct from neck; eye small; pupil round; rostral hexagonal, wider than high, barely visible from above; internasals narrowed anteriorly; prefrontal broader than long; frontal hexagonal; parietals longer than wide; nasal undivided; loreal 1/1, not touching the eye;

preocular 1/1; subocular absent; postoculars 1/3; anterior temporal 1/1, posterior temporal 1/1; supralabials 9/9, fourth to sixth entering orbit, seventh largest; infralabials 10/10, first to fifth bordering chin shields; dorsal scale rows 19-17-17, strongly keeled; ventrals 165; cloacal paired, subcaudals 106, paired.

Coloration in life. Dorsum dark purplish

brown; the dorsolateral blotches bright orange; the postocular streak orange on the neck. Belly pale reddish pink (determination after Stuart 2006 [21], Luu et al. 2013b [12] and David et al. 2015b [3])

Ecological notes. The specimen was found at 22:00 in a small stream. The surrounding habitat was mixed secondary forest of small to medium hardwoods and shrubs.

Distribution. In Vietnam, this species is known from Ha Tinh, Quang Binh, Quang Tri, Thua Thien Hue, Da Nang, and Kon Tum provinces [3]. Elsewhere, this species is recorded from Laos [3].

Remarks. *Parahelicops annamensis* is morphologically similar to *Pararhabdophis chapaensis* but it differs from *P. chapaensis* by having venter pale, more subcaudals (116-146 vs. 90-114 in *P. chapaensis*) [3].

Family Elapidae

***Bungarus slowinskii* Kuch, Kizirian, Nguyen, Lawson, Donnelly & Mebs, 2005**

Red River Krait/ Rắn cạp nia sông hồng (Fig. 1f)

Specimen examined (n=1). One adult female, IEBR 3906 (Field no. XL-TH.2011.1), collected on 2 November 2011 near Vin Forest Ranger Station (19°58.975'N, 104°58.413'E, at an elevation 730 m asl.).

Morphological characters. SVL 1300 mm, TaL 157.81 mm. Body elongated; head distinct from neck; eye small; rostral broader than high, visible from above; internasals narrow; prefront shorter than frontal; frontal scute hexagonal; parietals as long as wide; nasal divided; loreal absent; preocular 1/1; subocular absent; postoculars 2/2; anterior temporals 1/1; posterior temporals 2/2; supralabials 7/7, third and fourth entering orbit, sixth largest; infralabials 7/7, first to third bordering chin shields; mental small; dorsal scale rows 15-15-15, all smooth, vertebral scales and outer dorsal scale enlarged; ventrals 229; cloacal entire; subcaudals 40, paired.

Coloration in preservative. Body and tail with pattern of dark and light rings with 35

narrow white cross bands on body and 5 narrow white cross bands on tail, tip of tail black (determination after Kuch et al. 2005 [8] and Kharin et al. 2011 [7])

Ecological notes. The specimen was found at 22:00 in a rocky stream. The surrounding habitat was mixed secondary forest of small to medium hardwoods and shrubs.

Distribution. In Vietnam, this species is known from Lao Cai, Yen Bai, Quang Tri, Thua Thien Hue, and Quang Nam provinces [7]. Elsewhere, this species is recorded from Laos [7].

Discussion

Our new records bring the total number of snake species in Xuan Lien Nature Reserve to 38. Le et al. 1999 [10] and Le & Pham (2009) [9] reported the occurrence of *Hebius parallelum* in the Xuan Lien Nature Reserve. However, David et al. (2015b) [2] stated that the distribution of *H. parallelum* is restricted to India and Nepal. Therefore, the record of *H. parallelum* from Xuan Lien might be a misidentification of *H. boulengeri*. Records of some other species in previous studies [9, 17], e.g., *Dendrelaphis subocularis*, *Lycodon septentrionalis*, and *Hebius modestum* need to be verified by examination of voucher specimens and thus we excluded these species from the list of snakes from Xuan Lien Nature Reserve.

Among 38 recorded species, four species are listed in the IUCN Red List (2016): *Python molurus*, *Bungarus slowinskii*, *Naja atra*, and *Ophiophagus hannah* [6]; eight species are listed in the Vietnam Red Data Book (2007): *Python molurus*, *Coelognathus radiatus*, *Oreocryptophis porphyraceus*, *Ptyas korros*, *P. mucosa*, *Bungarus fasciatus*, *Naja atra*, and *Ophiophagus hannah* [22]; and six species are listed in the Governmental Decree No. 32/2006/ND-CP 2006: *Coelognathus radiatus*, *Ptyas mucosa*, *Bungarus fasciatus*, *B. multicinctus*, *Naja atra*, and *Ophiophagus hannah* [22] (Table 1). In addition, two other species, *Bungarus slowinskii* and *Parahelicops annamensis*, are currently known only from the Indochina region.

Table 1. List of snake species recorded in the Xuan Lien Nature Reserve, Thanh Hoa Province, Vietnam

Species name	Previous record	IUCN (2016)	RBVN (2007)	Decree 32 (2006)
Pythonidae				
<i>Python molurus</i> (Linnaeus, 1758)	1, 2	VU	CR	
Xenopeltidae				
<i>Xenopeltis unicolor</i> Reinwardt, 1827	1			
Colubridae				
<i>Ahaetulla prasina</i> (Boie, 1827)	1, 2, 3			
<i>Boiga guangxiensis</i> Wen, 1998	1			
<i>Boiga multomaculata</i> (Boie, 1827)	1, 2, 3			
<i>Calamaria septentrionalis</i> (Boulenger, 1890)	2, 3			
<i>Coelognathus radiatus</i> (Boie 1827)	1, 2		EN	IIB
<i>Cyclophiops multicinctus</i> (Roux, 1907)	2, 3			
<i>Dendrelaphis pictus</i> (Gmelin, 1789)	1			
<i>Dryocalamus davisonii</i> Boulenger, 1893	2			
<i>Gonyosoma boulengeri</i> (Mocquard, 1897)	1			
<i>Lycodon futsingensis</i> (Pope, 1928)*	3			
<i>Lycodon meridionalis</i> (Bourret, 1935)*	3			
<i>Oligodon chinensis</i> (Günther, 1888)	1			
<i>Oligodon taeniatus</i> (Günther, 1861)	1			
<i>Oreocryptophis porphyraceus</i> (Cantor, 1839)*	3		VU	
<i>Ptyas korros</i> (Schlegel, 1837)	1, 2		EN	
<i>Ptyas mucosa</i> Linnaeus, 1758	1, 2		EN	IIB
Homalopsidae				
<i>Hypsiglossus plumbeus</i> (Boie, 1827)	1, 2			
<i>Myrrophis chinensis</i> (Gray, 1842)	1			
Lamprophiidae				
<i>Psammodynastes pulverulentus</i> (Boie, 1827)	2, 3			
Natricidae				
<i>Amphiesma stolatum</i> (Linnaeus, 1758)	1			
<i>Hebius boulengeri</i> (Gressitt, 1937)*	3			
<i>Parahelicops annamensis</i> Bourret, 1934*	3			
<i>Rhabdophis subminiatus</i> (Schlegel, 1837)	1, 2, 3			
<i>Sinonatrix aequifasciata</i> (Barbour, 1908)	1			
<i>Sinonatrix percarinata</i> Boulenger, 1899	2, 3			
<i>Xenochrophis flavipunctatus</i> (Hallowell, 1860)	1			
Pareatidae				
<i>Pareas hamptoni</i> (Boulenger, 1905)	1, 2, 3			
Elapidae				
<i>Bungarus fasciatus</i> (Schneider, 1801)	1, 2		EN	IIB
<i>Bungarus multicinctus</i> Blyth, 1861	1,2			IIB
<i>Bungarus slowinskii</i> Kuch, Kizirian, Nguyen, Lawson, Donnelly & Mebs, 2005*	3	VU		
<i>Naja atra</i> Cantor, 1842	1	VU	EN	IIB
<i>Ophiophagus hannah</i> Cantor, 1836	1, 2	VU	CR	IB
<i>Sinomicrurus maccllellandi</i> (Reinhardt, 1844)	1			
Viperidae				

<i>Protobothrops muscrosquamatus</i> (Cantor, 1839)	2, 3
<i>Trimeresurus albolabris</i> Gray, 1842	1, 2, 3
<i>Trimeresurus stejnegeri</i> Schmidt, 1925	2, 3

* = new record for Xuan Lien NR; 1= Le & Pham 2009; 2 = Pham et al. 2012; 3 = This study; IUCN (2016) = The IUCN Red List of Threatened Species: VU = Vulnerable; NT = near threatened; RBVN (2007) = Vietnam Red Data Book: EN = Endangered; VU = Vulnerable; Decree 32 (2006) = The Governmental Decree No. 32/2006/ND-CP (2006): IB = Strict prohibition of collection and use for commercial purposes, IIB = Limit of collection and use for commercial purposes.

CONCLUSION

A total of 38 species of snakes were recorded from Xuan Lien Nature Reserve, Thanh Hoa province. In terms of species richness, the most diverse family is Colubridae with 16 recorded species, followed by Natricidae (7 species) and Elapidae (6 species). The snake fauna of Xuan Lien Nature Reserve contains a high level of species of conservation concern with six species listed in the Governmental Decree No. 32/2006/ND-CP (2006), eight species listed in the Vietnam Red Data Book (2007), and four species listed in the IUCN Red List (2016).

Acknowledgments: We are grateful to Hai Dinh Nguyen, Director of Xuan Lien Nature Reserve (Thanh Hoa) for support of our field work and issuing relevant permits. Many thanks to Hoang Van Chung, Nguyen Thien Tao, Chu Thi Thao, Dang Huy Phuong (Hanoi) and rangers of the Xuan Lien NR for their assistance in the field. This research was partially funded by the Vietnam Academy of Science and Technology (Grant No. VAST 04.08/12-13).

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**GHI NHẬN PHÂN BỐ MỚI VÀ DANH SÁCH CẬP NHẬT
CỦA CÁC LOÀI RẮN (Squamata: Serpentes) Ở KHU BẢO TỒN THIÊN NHIÊN
XUÂN LIÊN, TỈNH THANH HÓA**

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TÓM TẮT

Trong bài báo này, chúng tôi ghi nhận bổ sung phân bố của 6 loài rắn ở tỉnh Thanh Hóa dựa trên bộ mẫu vật thu được từ khu Bảo tồn Thiên nhiên Xuân Liên, bao gồm 3 loài thuộc họ Colubridae: *Lycodon futsingensis*, *L. meridionalis* và *Oreocryptophis porphyraceus*; 2 loài thuộc họ Natricidae: *Hebius boulengeri* và *Parahelicops annamensis*, và 1 loài thuộc họ Elapidae: *Bungarus slowinskii*. Ngoài ra, chúng tôi cập nhật danh sách 38 loài rắn ghi nhận ở Khu Bảo tồn thiên nhiên Xuân Liên, trong đó có 6 loài có tên trong Nghị Định 32/2006/NĐ-CP của Chính phủ, 8 loài bị đe dọa cấp quốc gia có tên trong Sách Đỏ Việt Nam (2007) và 4 loài bị đe dọa cấp toàn cầu có tên trong Danh lục Đỏ IUCN (2016).

Từ khóa: Rắn, danh sách loài, phân bố, Khu Bảo tồn thiên nhiên Xuân Liên.

Received: 26 June 2016, accepted 20 September 2016