

NEW RECORDS AND UPDATED LIST OF SNAKES (SQUAMATA: SERPENTES) FROM BINH DINH PROVINCE, CENTRAL-SOUTHERN VIETNAM

Tan Van Nguyen¹, Loi Duc Duong^{2*}, Tho Thi Anh Duong³

¹ Save Vietnam' Wildlife Center, Nho Quan, Ninh Binh province, Vietnam

² University of Education, Hue University, 34 Le Loi St., Hue, Vietnam

³ Hoa Chau High School, Quang Dien District, Thua Thien Hue Province, Vietnam

Correspondence to Duong Duc Loi (email: ducloiduong@gmail.com)

(Received: 15-5-2019; Accepted: 6-6-2019)

Abstract. In recent herpetological surveys, we recorded six snakes comprising two species of Culubridae (*Amphiesma stolatum*, *Hebius leucomystax*), two species of Homalopsidae (*Enhydris enhydris*, *E. subtaeniata*), one species of Pareatidae (*Pareas hamptoni*), and one species of Xenopeltida (*Xenopeltis unicolor*) for the first time in Binh Dinh province, central-southern Vietnam. In addition, an updated list of 26 snake species from Binh Dinh province contains species of conservation concern including 6 species listed in the Governmental Decree No. 32/2006/ND-CP (2006), 7 species listed in the Vietnam Red Data Book (2007), and 2 species listed in the IUCN Red List (2019).

Keywords: new records, snakes, taxonomy, Binh Dinh province

1 Introduction

Although the number of studies of herpetology in Vietnam has been increasing during the past years, probably supported by the availability of comprehensive books (e.g., [1], [2]), more local studies are needed to fill gaps in our knowledge about the distribution of species and species richness. Geographic distribution records are crucial for assessing the conservation status and are also evidence to elucidate species' evolution and biology [3]. One of the most poorly studied regions in terms of herpetodiversity is Binh Dinh province in central-southern Vietnam. Only a few studies have been conducted in this province so far. Duong & Ngo [4] and Ngo & Duong [5] provided the preliminarily recorded snakes from Binh Dinh province with a total of 15 species. From the novel data collected during the fieldwork in 2012–2013, we herein provide new

records of snakes including an updated checklist of the snakes known from Binh Dinh.

2 Material and methods

Field surveys were conducted in 4 districts of Binh Dinh province, namely An Lao, An Nhon, Hoai Nhon, and Van Canh by Loi Duc Duong, Truc Thanh Vu Nguyen, Thong Van Le, Nhat Thanh Nguyen, Phong Thanh Phan, Ung Ma La, Gioi Van Le, Chinh Quoc Nguyen (hereafter LDD et al.) in July, September, and November 2012; February, March, and May 2013. Specimens were collected by hand or by using a snake hook between 8:00 and 23:00. Most of the specimens were photographed in life except for some snakes.

The specimens were euthanized in a closed vessel with a piece of cotton wool containing ethyl acetate, fixed in 85% ethanol, and subsequently stored in 70% ethanol. The tissue samples of some

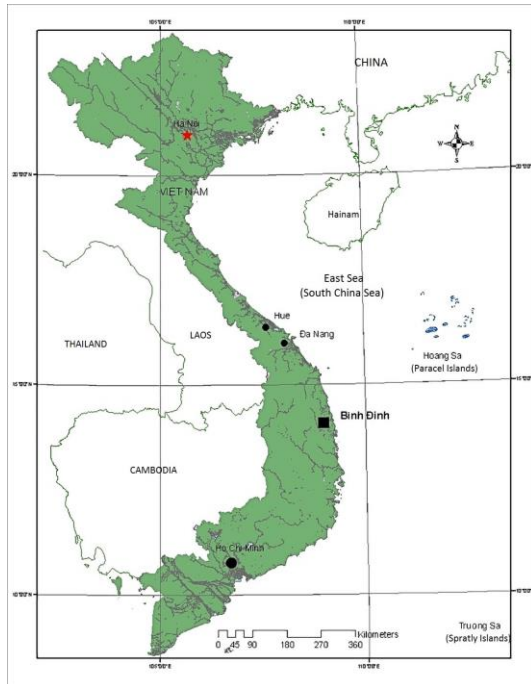


Fig. 1. Map showing locations research of snake (black square) in Binh Dinh province, Vietnam

species were kept separately in 90% ethanol. The specimens were deposited in the collection of the Faculty of Biology, University of Education, Hue University (CLBH), Vietnam.

Morphological characteristics: all measurements except for body and tail lengths were taken with a caliper to the nearest 0.1 mm. Measurements of reptiles were performed as snout-vent length (from tip of snout to vent – SVL) and tail length (from vent to tip of tail – TaL). Bilateral scales counts were given as right/left and above sea level (asl). The specimens that were photographed and directly released into the field afterwards do not have scale counts and measurements. The sex was determined by the examination of secondary sexual characteristics, and the sex of collected specimens lacking distinct secondary sexual characteristics was determined by gonad inspection.

Taxonomic identifications were based on the literature: [6], [7], [8], [9], [10], [11], [12], [13]. Systematics and nomenclature followed [1], [14].

3 Results

Taxonomic accounts

Family Colubridae

Amphiesma stolatum (Linnaeus, 1758)

Buff Striped Keelback / (Rắn sãi thường) (Fig. 2a)

Specimens examined ($n = 1$): CLBH 13307 (adult female) collected by LDD et al. on 7 July 2013, in An Hao Tay Commune, An Lao District (14°29.127'N, 108°54.367'E, elevation 21 m asl.)

Description: Morphological characteristics of the specimens from Binh Dinh province agree well with the descriptions of Smith (1943): SVL 366.3 mm; TL 108.8 mm; body elongated; head distinct from neck; eye moderate; nasal divided; loreal 1/1, not touching the eye; preocular 1/1; postoculars 3/3; anterior temporals 1/1; posterior temporals 2/2; supralabials 8/8, third to fifth entering orbit; infralabials 9/9, first to fifth bordering chin shields; dorsal scale rows 19–19–17, all keeled except the outermost rows of scales, vertebral scales relatively enlarged; ventrals 141; cloacal paired; subcaudals 60, all paired; coloration preserved: dorsal surface brown above with two light dorsolateral stripes, ventral surface white, occasionally with powdery gray spots.

Ecological notes: The specimen was found in the bushes in a small field, between 9:00–20:00. The surrounding habitat consists of bushes and grass near a small lake in the field.

Distribution: Vietnam: from Lao Cai, Yen Bai, Cao Bang in the North southwards Tay Ninh provinces, and Ho Chi Minh city. Elsewhere: Pakistan, India, Sri Lanka, Nepal, China, Taiwan, Laos, Myanmar, Thailand, Cambodia, and Indonesia [1].



Fig. 2. a) *Amphiesma stolatum* (CLBH 13307), b) *Hebius leucomystax* (CLBH 14336), c) *Enhydris enhydris* (CLBH 14312), d) *Enhydris subtaeniata* (CLBH 13321), e) *Pareas hamptoni* (CLBH 14307), f) *Xenopeltis unicolor* (CLBH 12303) from Binh Dinh Province, Vietnam.

***Hebius leucomystax* (David, Bain, Nguyen, Orlov, Vogel, Vu & Ziegler, 2007)**

White-lipped Keelback / (Rắn sãi mép trắng) (Fig. 2b)

Specimens examined ($n = 1$): CLBH 14336 (adult female) collected by LDD et al. on 5 May 2014, in Canh Lien Commune, Van Canh District (13°36.302'N, 108°51.041'E, elevation 500 m asl.)

Description: Morphological characteristics of the specimens from Binh Dinh province agree well with the descriptions of [7], [11]: SVL 422.0 mm; TL 217.2 mm; body elongated; head distinct from neck; eye moderate; nasal divided; loreal 1/1, not touching the eye; preocular 1/1; postoculars 3/3; anterior temporals 1/1; posterior temporals 2/2; supralabials 9/9, third to six entering orbit;

infralabials 10/10, first to fifth bordering chin shields; dorsal scale rows 19–19–17, all keeled except the two outer rows of scales; ventrals 157; cloacal paired; subcaudals 110, all paired; coloration in life: dorsal surface dark brown, dorsolateral stripe faint, white labial stripes, V-like chevron on nape, ventral surface pale yellow.

Ecological notes: The specimen was found on small rocky middle a stream, between 9:00–12:00. The surrounding habitat consists of a mixed secondary forest composed of medium to small hardwood and shrub.

Distribution: Viet Nam: Nghe An, Ha Tinh, Quang Binh, Quang Tri, Thua Thien Hue, Da Nang, Kon Tum, Gia Lai provinces [1]. Elsewhere: Laos, Cambodia, Thailand) [11].

Family Homalopsidae

***Enhydris enhydris* (Schneider, 1799)**

Rainbow Mud Snake / (Rắn bông súng) (Fig. 2c)

Specimens examined ($n = 2$): CLBH 14308 (subadult female) collected by LDD et al. on 15 March 2013, in Nhon Khanh Commune, An Nhon District (13°41.718'N, 109°10.277'E, elevation 15 m asl.); CLBH 14312 (adult female) collected by LDD et al. on 8 May 2014, in An Hao Trung Commune, An Lao District (14°29.270'N, 108°54.793'E, elevation 18 m asl.).

Description: Morphological characteristics of the specimens from Binh Dinh province agree well with the descriptions of [9]: CLBH 14308 (SVL 263.0 mm, TL 55.8 mm); CLBH 14312 (SVL 400.0 mm, TL 84.58 mm); body stout; head indistinct from neck; eye moderate; pupil vertically oval; nasal divided; the internasal scale is single, and touches the loreal scale; loreal 1/1, not touching the eye; preocular 1/1; postoculars 2/2; anterior temporals 1/1; posterior temporals 2/2; supralabials 8/8, fourth entering orbit; infralabials 9/9, first to fourth bordering chin shields; second pair of chin shields longer than the first; dorsal scale rows 21/23–21–21, all smooth, vertebral scales relatively enlarged; ventrals 153–155; cloacal paired; subcaudals 56–58, all paired; coloration preserved: dorsal surface is brown above with a pair of pale brown lines continuous with dorsolateral body stripes which converge; ventral surface white or yellow with a blackish median line or row of dots.

Ecological notes: The specimens were found on the ground near small ponds in rice-field, between 14:00–16:00. The surrounding habitat consists of mixed grass and bush.

Distribution. Vietnam: from Phu Yen, Khanh Hoa, Dong Nai in the Central southwards to Kien Giang and Ca Mau provinces [1]. Elsewhere: India, Sri Lanka, Nepal, Bangladesh, China,

Myanmar, Laos, Thailand, Cambodia, Malaysia [9].

***Enhydris subtaeniata* (Bourret, 1934)**

Mekong Mud Snake / (Rắn bông mê kông) (Fig. 2d)

Specimens examined ($n = 2$): CLBH 13308 (adult female) collected by LDD et al. on 15 March 2013, in Nhon Khanh Commune, An Nhon District (13°41.718'N, 109°10.277'E, elevation 15 m asl.); CLBH 13321 (adult female) collected by LDD et al. on 5 May 2013, in Bong Son Commune, Hoai Nhon District 14°25.321'N, 109°00.501'E, elevation 7 m asl.)

Description: Morphological characteristics of the specimens from Binh Dinh province agree well with the descriptions of [9]: CLBH 13308 (SVL 410.8 mm, TL 79.4 mm); CLBH 13321 (SVL 312.6 mm, TL 57.43 mm); body stout; head indistinct from neck; eye moderate; pupil vertically oval; nasal divided; the internasal scale is single, and touches the loreal scale; loreal 1/1, not touching the eye; preocular 1/1; postoculars 2/2; anterior temporals 1/1; posterior temporals 2/2; supralabials 8/8, fourth entering orbit; infralabials 9/9, first to fourth bordering chin shields; first pair of chin shields longer than second pair; dorsal scale rows 21–21–21, all smooth; ventrals 141–143; cloacal paired; subcaudals 45–46, all paired; coloration preserved: dorsal surface is broad dark vertebral stripe, with lateral spots above scale row four; ventral surface white.

Ecological notes: The specimens were found on the ground near small lakes, between 9:00–12:00. The surrounding habitat consists of mixed grass and bush.

Distribution: Viet Nam: Kon Tum, Tay Ninh, Ho Chi Minh, Soc Trang, Kien Giang, Ca Mau provinces [1]. Elsewhere: Laos, Thailand, Cambodia [9].

Family Pareatidae

Pareas hamptoni (Boulenger, 1905)

Hampton's Slug Snake / (Rắn hổ mây ham ton)
(Fig. 2e)

Specimens examined ($n = 1$): CLBH 14307 (adult female) collected by LDD et al. on 11 January 2014, in Canh Lien Commune, Van Canh District (13°36.305'N, 108°51.041'E, elevation 545 m asl.).

Description: Morphological characteristics of the specimens from Binh Dinh province agree well with the descriptions of [12], [13]: SVL 386.1 mm, TL 126 mm. Body elongated, strongly compressed; head distinct from neck; eye large; pupil vertical; nasal undivided; loreal 1/1, touching the eye; preocular 1/1; postoculars 1/1; subocular 1, long and slender, separating the eye from the labials; anterior temporals 2/2; posterior temporals 3/3; supralabials 7/7, fourth and fifth below the eye, seventh very long; infralabials 8/8, first to fifth bordering chin shields; mental groove absent; chin shields in 3 pairs, large, anterior ones longer than wide; dorsal scale rows 15–15–15, all smooth except posterior upper dorsal scales slightly keeled, anterior vertebral scales slightly enlarged; ventrals 180; cloacal entire; subcaudals 82, all paired; coloration preserved: light brown dorsally, with dorsolateral rows of alternating spots, forming a zigzag line, spots absent at the margin of the ventrals.

Ecological notes: The specimen was found on wrap-around a tree branch in a forest, at 20:30. The surrounding habitat consists of a mixed secondary forest composed of medium to small hardwood and shrub.

Distribution: Vietnam: from Lao Cai, Ha Giang, Bac Kan, Thai Nguyen, Vinh Phuc, Hai Duong, Ha Tinh southwards to Lam Dong and Dong Nai provinces. Elsewhere: China, Myanmar, Laos, and Cambodia [1].

Family Xenopeltidae

Xenopeltis unicolor Reinwardt, 1827

Sunbeam Snake / (Rắn mống) (Fig. 2f)

Specimens examined ($n = 1$): CLBH 12303 (adult female) collected by LDD et al. on 27 July 2014, in Bong Son Town, Hoai Nhon District (14°25.325'N, 109°00.505'E, elevation 7 m asl.).

Description: Morphological characteristics of the specimens from Binh Dinh province agree well with the descriptions of [8], [10], [12], [13]: SVL 677.0 mm, TL 73.1 mm; body cylindrical; head scarcely distinct from neck; eyes small; nasal divided; loreal absent; preocular 1/1, large; postoculars 3/3; anterior temporals 2/2; posterior temporals 2/2; supralabials 8/8, third to fourth entering orbit; infralabials 8/8, first to third bordering chin shields; dorsal scale rows 15–15–15, all smooth, vertebral scales relatively enlarged; ventrals 194; cloacal paired; subcaudals 28, all paired; coloration in life: dorsal surface uniform purple above; ventral surface cream.

Ecological notes: The specimen was found in soft, spongy soil of a small lake at about 20:30. The surrounding habitat is small shrubs and rice fields after harvest.

Distribution: Vietnam: from Yen Bai, Lang Son, Thai Nguyen in the North southwards to Kien Giang, and Ca Mau provinces. Elsewhere: India, China, Myanmar, Laos, Thailand, Cambodia, Malaysia, Singapore, Indonesia, and Philippines[1].

4 Discussion

Our new records of the six snakes bring the total number of 26 species of snakes from 21 genera and 8 families in Binh Dinh province (Table 1). The most diverse family is Colubridae with 11 recorded species, followed by Elapidae and Homalopsidae (4 species). The snakes from

Table 1. List of snake species recorded from Binh Dinh Province, Vietnam (*:new provincial records). Data sources: 1: According to the author Nguyen et al. (2009) [1], 2: According to the author Duong & Ngo (2016) [4], 3: According to the author Ngo & Duong (2016) [5], 4: This study; IUCN (2017) [15]: The IUCN Red List of Threatened Species: CR: Critically Endangered, EN: Endangered, VU: Vulnerable, NT: Lower Risk/Near Threatened; RBVN (2007) [16]: Vietnam Red Data Book: CR: Critically Endangered, EN: Endangered, VU: Vulnerable; Decree.32 (2006) [17]: Governmental Decree No. 32/2006/ND-CP (2006): IB: It is strictly forbidden to exploit and use for commercial purposes, IIB: Limit extraction and use for commercial purposes

Taxon	Previos record	IUCN (2019) [15]	RBVN (2007) [16]	Decree 32 (2006) [17]
Order Serpentes				
Acrochordidae				
<i>Acrochordus granulatus</i> (Schneider, 1799)	1			
Colubridae				
<i>Amphiesma stolatum</i> (Linnaeus, 1758)*	4			
<i>Boiga multomaculata</i> (Boie, 1827)	3, 4			
<i>Chrysopelea ornata</i> (Shaw, 1802)	3, 4			
<i>Coelognathus flavolineatus</i> (Schlegel, 1837)	3, 4			
<i>Coelognathus radiatus</i> (Boie, 1827)	1, 3, 4		EN	IIB
<i>Dendrelaphis pictus</i> (Gmelin, 1789)	3, 4			
<i>Fowlea flavipuncta</i> (Hallowell, 1860)	1, 4			
<i>Hebius leucomystax</i> (David, Bain, Nguyen, Orlov, Vogel, Vu & Ziegler, 2007)*	4			
<i>Lycodon laoensis</i> Günther, 1864	3, 4			
<i>Oligodon cf. deuwei</i> David, Vogel & van Rooijen, 2008	3, 4			
<i>Ptyas korros</i> (Schlegel, 1837)	1, 3, 4		EN	
<i>Ptyas mucosa</i> (Linnaeus, 1758)	3, 4		EN	IIB
Elapidae				
<i>Bungarus fasciatus</i> (Schneider, 1801)	2, 4			
<i>Naja cf. atra</i> Cantor, 1842	2, 4	VU	EN	IIB
<i>Naja kaouthia</i> Lesson, 1831	4		EN	
<i>Ophiophagus hannah</i> (Cantor, 1836)	4	VU	CR	IB
Homalopsidae				
<i>Enhydris enhydris</i> (Schneider, 1799)*	4			
<i>Enhydris subtaeniata</i> (Bourret, 1934)*	4			
<i>Homalopsis buccata</i> (Linnaeus, 1758)	1			
<i>Hypsiscopus plumbea</i> (Boie, 1827)	1			
Pareatidae				
<i>Pareas hamptoni</i> (Boulenger, 1905)*	4			
Pythonidae				
<i>Malayopython reticulatus</i> (Schneider, 1801)	1		CR	IIB
Viperidae				
<i>Trimeresurus albolabris</i> (Gray, 1842)	2, 4			
<i>Trimeresurus vogeli</i> David, Vidal & Pauwels, 2001	2, 4			
Xenopeltidae				
<i>Xenopeltis unicolor</i> Reinwardt, 1827*	4			

Binh Dinh province also contain a high level of species of conservation concern with numerous globally and nationally threatened species. Two species of snakes are listed in the IUCN Red List (2019), 7 species of reptiles are listed in the Red Data Book of Vietnam (2007), and 6 species of reptiles are listed in the Governmental Decree No.

32/2006/ND-CP (2006). Our findings contribute to filling the knowledge gaps concerning herpetofauna occurrences and distribution in central-southern Vietnam. The present checklist of species will serve as baseline data for future research in the area. Such further research will also be essential for evaluating the conservation

status of Binh Dinh forest areas; in particular, protected areas have not yet been established in this province until today.

Acknowledgements

We are grateful to the directorates of the Forest Protection Department of Binh Dinh province for the support of our fieldwork and issuing relevant permits. We thank T. T. V. Nguyen, T. V. Le, N. T. Nguyen, P. T. Phan, U. M. La, G. V. Le, and C. Q. Nguyen (Binh Dinh) for their assistance in the field.

References

1. Nguyen SV, Ho CT, Nguyen TQ. Herpetofauna of Vietnam. Chimaira, Frankfurt. 2009;768 pp.
2. Vassilieva AB, Galoyan EA, Poyarkov NA, Geissler P. A photographic field guide to the amphibians and reptiles of the lowland monsoon forests of southern Vietnam. Edition Chimaira, Frankfurt am Main. 2016:324 pp.
3. Nguyen TQ, Phung TM, Scheneider N, Botov A, Tran DTA, Ziegler T. New records of amphibians and reptiles from southern Vietnam. Bonn zoological Bulletin. 2014;63(2):148-156.
4. Duong LD, Ngo CD. New record of venomous snakes' composition (Reptilia: Squamata: Serpentes) in Binh Dinh Province, Vietnam. Journal of Science Hue University. 2016;117(3):135-146 (in Vietnamese).
5. Ngo CD, Duong LD. Species composition of the family water snake (Reptilia: Squamata: Serpentes: Colubridae) in Binh Dinh Province, Proceedings of the Third National Workshop on Herpetology of Vietnam. 2016;143-146 (in Vietnamese, abstract in English).
6. Campden-Main S. A field guide to the snakes of South Vietnam. Washington: U.S. Nat. Mus.;1970.
7. David P, Bain RH, Truong NQ, Orlov NL, Vogel G, Thanh VN, Ziegler T. A New Species Of The Natricine Snake Genus *Amphiesma* From The Indochinese Region (Squamata: Colubridae: Natricinae). Zootaxa. 2007; 1462: 41-60. <https://doi.org/10.5281/ZENODO.176453>
8. Kizirian D, Nguyen TQ, Eriksoon A, Vora N. Taxonomic status of *Xenopeltis hainanensis jidamingae* Zhao. Journal of Herpetology. 2003; 37(2): 438-440.
9. Murphy JC, Voris HK. A checklist and key to the Homalopsid snakes (Reptilia, Squamata, Serpentes), with the description of new genera. Fieldiana: Life and Earth Sciences. 2014; (8): 1-43.
10. Orlov NL. Distribution, biology and comparative morphology of the snakes of *Xenopeltis* genus (Serpentes: Macrostromata: Xenopeltidae) in Vietnam. Russian Journal of Herpetology. 2000; 7: 103-114.
11. Pauwels OSG, Kunya K, David P, Waengsothorn S, Sumontha M. On the occurrence of *Amphiesma khasiense* (Serpentes: Natricidae) in Thailand. Hamadryad. 2009; 34(1): 75-79.
12. Smith MA. The Fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese Sub-region, Reptilia and Amphibia, Vol III - Serpentes. London: Taylor and Francis. 1943: 583 pp.
13. Taylor EH. The serpents of Thailand and adjacent waters. University of Kansas Science Bulletin. 1965; 45 (9): 609-1096.
14. Uetz P, Freed P, Hošek J (eds.). The Reptile Database. 2019. <http://www.reptile-database.org> (accessed in April 2019).
15. IUCN. The IUCN Red List of Threatened Species. 2019. <https://www.iucnredlist.org>. accessed in April 2019.
16. Tran K, Ho CT, Nguyen SV, Pham T. Reptiles and Amphibians, In: Dang NT, Tran K, Dang HH, Nguyen C, Nguyen TN, Nguyen YH, Dang DT (eds.). Vietnam Red Data Book, Part 1 Animals, Natural Science and Technology Publishing House. 2007: 219-276 (in Vietnamese).
17. The Government of Vietnam. 32/2006/NĐ-CP Decree (2006), About management plants, animals forest, endangered valuable and rare (in Viet Nam). 2006:14 pp.