

On the Status of the Chinese Pitviper *Ceratrimeresurus shenlii* Liang and Liu *in* Liang, 2003 (Serpentes, Viperidae), with the Addition of *Protobothrops cornutus* (Smith, 1930) to the Chinese Snake Fauna

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Abstract.- *Ceratrimeresurus shenlii* Liang and Liu *in* Liang, 2003 was described as a new genus and a new species on the basis of the first “horned” specimen of pitviper recorded from the People’s Republic of China. This taxon has been overlooked in the literature. The original description is here translated verbatim into English. The holotype is compared with other horned pitvipers known from Asia. On the basis of its scalation and pattern, *Ceratrimeresurus shenlii* is synonymized with *Protobothrops cornutus* (Smith, 1930). The range of this latter species, previously endemic to Vietnam, is expanded northeastwards by approximately 780 airline km. A brief comment on the zoogeography of South China is given.

Keywords.- Serpentes, *Ceratrimeresurus*, *Ceratrimeresurus shenlii*, *Protobothrops cornutus*, China, Vietnam, taxonomy, zoogeography.

Introduction

A new Chinese genus and new species of Asian pitviper, *Ceratrimeresurus shenlii* Liang and Liu *in* Liang, 2003 has remained overlooked in the literature. *Ceratrimeresurus shenlii* was not included in the latest checklist of the *Trimeresurus* complex (Gumprecht et al., 2004), nor announced in Wolfgang Wüster’s invaluable website “Venomous Snakes Systematic Alert” (<http://biology.bangor.ac.uk/~bss166/update.htm>). Lastly, this taxon was not considered by Malhotra and Thorpe (2004, 2005) in their revision on the pitvipers of the *Trimeresurus* complex.

The description of *Ceratrimeresurus shenlii* Liang and Liu *in* Liang (2003: 411; Plate 8: Fig. 13. Type locality: “Working site 02 at Wuzhishan forest, Ruyuan Xian”, Guangdong Province) appeared in a chapter of a book on the natural history of Nanling Nature Reserve, located in Nanling Mountains, in the north of Guangdong Province (Pang, 2003), a fact that may explain that the new taxon remained overlooked by the herpetological community. However, this new species was merely mentioned in September 2004 in the forum of a website dedicated to venomous snakes (<http://www.venomdoc.com/forums> - last viewed on

May 30th, 2005), where this species was regarded, without explanations, as a synonym of *Protobothrops cornutus*. It was also tentatively regarded as a synonym of *Protobothrops cornutus* by Vogel (2006).

Only three other taxa of Asian pitvipers with more or less raised supraoculars were previously known from the mainland: *Trimeresurus wiroti* (see David et al., 2006), *Protobothrops cornutus* and *Triceratolepidophis sieversorum*. In this paper, we provide a translation of the original description. The new taxon is, according to the re-examination of the holotype, compared with the currently known horned species of mainland Asia and its status is discussed.

Materials and Methods

Body and tail lengths were measured to the nearest mm. The number of ventral scales is counted according to Dowling (1951). The terminal scute is not included in the number of subcaudals. The numbers of dorsal scale rows are given at one head length behind head, at mid-body (i.e. at the level of the ventral plate corresponding to a half of the total number of ventrals), and at one head length before vent, respectively. Values for symmetric head characters are given in left/right order.

Abbreviations of measurements and other meristic characters.-

MEASUREMENTS AND RATIOS: HL: head length; SVL: snout-vent length; TaL: tail length; TL: total length; TaL/TL: ratio tail length /total length.

MERISTIC CHARACTERS: DSR: formula of dorsal scale rows; MSR: number of dorsal scale rows at midbody; IL: infralabials; SC: subcaudals; SL: supralabials; VEN: ventrals.

Museum abbreviations.- BMNH: Natural History Museum, London, UK. - FMNH: Field Museum of Natural History, Chicago, USA. - MNHN: Muséum National d'Histoire Naturelle, Paris, France. - ZFMK: Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany.

Results

Translation of the original description of *Ceratrimeresurus shenlii*.- The original description appeared in Liang (2003: 411), but is credited to Liang and Liu. It was published in Chinese with a short English summary. A poor quality, small color photograph of the holotype appears on Plate 8, Figure 13 of the book. A verbatim translation of the original description should read as follows (numbers placed in square brackets refer to our comments placed after this translation):

Jiao laotietou^[1] *Ceratrimeresurus shenlii* Liang and Liu, gen. and sp. nov. (See colour plate 13^[2])

The upper eyelid forms on each side a raised triangle covered with small scales, the base of the triangle being slightly like a three-sided pyramid; the length of the triangular horn is 1.5 times the diameter of the eye, and the height from the tip of the triangle to the edge of the upper eyelid is equal to the eye diameter. The tip of the snout is blunt, the upper snout surface is broad and flattened, with the lateral edge slightly upturned. The length of the snout is about a 1/4 of head length and 1/3 of head width. The nostril is placed near the tip of the snout, slightly directed sideward and almost rounded in shape, the opening being in the middle of a divided nasal scale; there is one upper nasal scale. There are 5 small scales between the two nostrils^[3]. The upper head surface is covered with granular scales, which become progressively larger and more keeled from the front to the back of the head. The cephalic surface is slightly convex and becomes progressively flat and broader backwards. There are 7 small interorbital scales^[4]. There are 11 small scales surrounding the base of the triangular horn. The tip of the triangular horn is one rather large scale, to

which is adjacent a smaller scale which makes the horn looking as bifurcated. The eye is rather large and the third of its volume is out of the head. The iris is a vertically elongated oval. There is a row of small scales around the orbit and many scales between the snout side and temporal region. The forward sunken part of the occiput is roughly equal to the length of the snout, with the end of the neck plunged in it. The neck is slender, its diameter being less than half of the head width. There are 14 supralabial scales^[5], among which the first and second ones are separated from the nasal scales by a row of 3 small scales, and the third to fifth ones do not enter the loreal pit^[6], but are separated from it by a row of small scales; the edge of the upper jaw is convex downwards; 14 infralabials, the fourth being the largest, the first to the fourth ones in contact with the anterior chin shields, and the posterior chin shields being rather large. One large fang is located on the anterior part of the upper jaw, followed by 2 smaller teeth. No teeth on the palatine and pterygoid^[7]. Five small teeth are present on the lower jaw. The loreal pit is placed antero-inferiorly to the eye.

The head is peach-shaped and slightly flattened, with a narrow and elongated neck; the body is rather wide but slender and long, with a long, pointed tail. The dorsal scales are strongly keeled, 23-23-21-17 rows, the rows of cervical scales are more oblique than those of the body scales. There are 187 ventral scales +77 pairs of subcaudals. The anal scale is single. The vertebral scales are normal.

The back of the body is of a grey color, which becomes light grey on the sides. On the head upper surface, there is a 'X' shaped pattern, made of a blotch extending from the nasal scale to the front of the opposite triangular, and of a blackish brown elongated blotch extending from the posterior of the horn through the rearward supraorbital scale (behind the horn) backwards up to the posterior of the head. A white streak extends from the posterior margin of the eye through the temporal up to the posterior of the head, followed by a blackish brown stripe from the corner of the mouth to the sides of the throat. The upper and lower lips are marked with blackish brown square shaped spots. Diffuse and irregular spots cover the rest of the body throughout. The dorsal side of the head and the body is brown in color. Dorsal blotches extend on each side from the middle of the body to the vent, the right and the left rows being offset and these blotches being linked together by their inner corner; they are merged together in the middle of the body and linked each other again by the inner corner on the posterior part of the body, then merged together again from the vent to the end of the tail. Light grey-brown spots on the lower part on the sides of the body, roughly square in shape or almost rounded, oval or

reduced to short crossbars. The venter is pale grayish-brown, without other spot in the middle, so that the ventral side of the body is light grey-brown color throughout. There is a pointed scale on the tip of the tail. The total length of the specimen: $362 + 78 = 440$ mm, length of the tail/total length = 0.564, weight = 24 g.

The specimen was collected in the thatch on the top of a house near a forest, coiled with the head in the middle of its body. Not very active. It was knocked down with a little stick on the ground and captured. The locality is the "Working site 02" at Wuzhishan forest, Ruyuan Xian^[8], July 1996. The specimen is deposited in the Laboratory of Zoology of the Faculty of Biotechnology, Jinan University^[9].

Comments on the original description. - In this original description, no mention of the sex of the specimen is given, although it is a female according to the shape of the base of the tail. Other comments are:

- [1]: Translation: "Horned iron-head [snake]". The vernacular name "*Laotietou*" is given in China to *Protobothrops mucrosquamatus*, due to the shape of its head, looking like an ancient iron.
- [2]: It should rather appear as Plate 8: fig. 13.
- [3]: This value includes the two supranasals plus the scales separating these latter ones.
- [4]: If one counts the cephalic scales on a line connecting the middle of the supraoculars, the value is 14 (see below).
- [5]: This value is obviously erroneous; we counted 8 SL.
- [6]: This is obviously a lapsus for the orbit.
- [7]: this lack of teeth on the palatine bones is surprising and may be an artifact. Teeth are very commonly miscounted, as they are masked by the tissues and one usually needs to peel back the gum tissues to count the sockets. All the tooth counts in this description may be unreliable (A. Malhotra, pers. comm, January 2006).
- [8]: Ruyuan County, in northern Guangdong Province, close to the Guangdong-Hunan border. The Nanling National Nature Reserve is located in the centre of Nanling Mountains, which extend from northeast Guangxi to southwest Fujian.
- [9]: Guangzhou, Guangdong Province.

Redescription of the holotype of *Ceratrimeresurus shenlii* (Figs. 1-3).- The original description includes some imprecision or mistakes. In combining data of the original description and our own data, the morphology is as follows:

Body moderately stout; head subtriangular, wide at its base, clearly distinct from the neck, thick and swollen when seen from the side, depressed between the uplifted

areas of the supraoculars. Snout average in relative length, about one quarter of HL, bluntly rounded when seen from above, depressed in its center, obliquely truncated when seen from the side, with a distinct *canthus rostralis*. Eye relatively large. Tail long and tapering. The holotype is now in average condition and somewhat desiccated:

SVL: 362 mm; TaL: 78 mm; TL: 440 mm; ratio TaL/TL: 0.177.

VEN: 187; SC: 77, paired, plus one terminal scale; anal shield entire.

DSR: 23-21-17 scales, rhomboid, distinctly keeled.

Rostral visible from above, broader than high, triangular; nasals subrectangular, divided, with a round nostril opening near the tip of the snout, directed slightly sideward and almost rounded in shape; 2 internasals on each side, separated by 2 small scales; 4/4 canthal scales, slightly larger than adjacent snout scales, bordering the *canthus rostralis*; 2 elongate upper preoculars above the loreal pit; lower preocular forming the lower margin of loreal pit; 3/3 small postoculars; 5/5 supraoculars on an uplifted triangular area, of which the two central supraocular scales are strongly enlarged, triangular and strongly obliquely erected ("horn like") and extending out of the head margin, 1.5 times the diameter of the eye, convergent and originating from the same base covered with small scales; 8 or 9 slightly enlarged scales on upper snout surface on a line between the scales separating the internasals and a line connecting the anterior margins of eyes, smooth, juxtaposed, irregular in shape; 14 cephalic scales on a line between the base of the supraoculars (including the scales covering the uplifted basal area), smooth, flat and juxtaposed; occipital scales larger than cephalic scales, distinctly keeled; temporal scales small, obtusely keeled; 9 SL, 1st SL separated from nasal; 2nd SL bordering the anterior margin of the loreal pit, 3rd SL largest, separated from the subocular by 1 scale; 4th SL much smaller than 3rd SL, separated from the subocular by 1 scale; 5th and posterior SL much smaller; 14 IL, first four pairs in contact with anterior chin shields.

The coloration and pattern agree with that of the original description. The light postocular streak is quite conspicuous, but the overall pattern of the body is rather faded.

Discussion

Nomenclatural considerations.- The combined description of the genus and species was brief and may raise some questions about its validity. Two points need to be discussed. The first one relates to the combined description of the genus *Ceratrimeresurus* and of its sole



Figure 1. *Ceratrimeresurus shenlii*, holotype. General view of body. Photograph by Tian Mingyi.



Figure 2. *Ceratrimeresurus shenlii*, holotype. General view of body. Photograph by Tian Mingyi.



Figure 3. *Ceratrimeresurus shenlii*, holotype. Lateral view of the head. Photograph by Tian Mingyi.



Figure 4. Head of the second Chinese specimen of *Protobothrops cornutus*. Photograph by Fu Jie.

included species, *shenlii*. According to Art. 13.4 of the *International Code of Zoological Nomenclature* (1999), in the present case, such a “description of a new nominal genus and a single included new nominal species is deemed to confer availability on each name under Article 13.1.1.” Art. 13.1.1 requires that every new name published be accompanied by a description purported to differentiate the taxon. This combined description is hence considered to be complying with the requirements of the *Code*.

The second point relates to the identification of the holotype. No number was cited in the description, and this specimen was still deposited in Prof. Liang Qishen’s private collection in December 2005. Nevertheless, as the name of the collection into which the specimen will be eventually deposited was clearly indicated in the original description, and as it was confirmed to us that the specimen will eventually be deposited in this collection, we consider that this point complies with Art. 16.4.2 of the *Code* and makes valid the description of

the specific nomen.

A comparison of Ceratrimeresurus shenlii with other horned species.- In the Asian mainland, only *Protobothrops cornutus* and *Triceratolepidophis sieversorum* have erected supraoculars. *Trimeresurus wiroti* has only slightly raised supraoculars (see David et al., 2006). Another species occurring in western Indonesia, *Trimeresurus brongersmai*, has erected horn-like supraoculars. However, this latter species, related to *Trimeresurus wiroti*, differs from the other horned species by several characters, including the shape of its snout (David et al., 2006). On the basis of Ziegler et al. (2001), Herrmann et al. (2002), Herrmann and Ziegler (2002), Herrmann et al. (2004) and of specimens examined by ourselves, a comparison between horned species and *Ceratrimeresurus shenlii* is given in Table 1.

Triceratolepidophis sieversorum differs by its greater number of ventral scales and a different structure of horns, free and strongly divergent. This species also



Figure 5. Distribution map of *Protobothrops cornutus*.

shows a peculiar structure of keels of dorsal scales, which is not found in other horned pitvipers (Ziegler et al., 2001). The dorsal keels of *Ceratrimeresurus shenlii* are narrow and made of a single ridge.

In contrast, *Ceratrimeresurus shenlii* cannot be distinguished from *Protobothrops cornutus* otherwise than by minor characters. In both species, the horns stem from the same base and are free only in their outermost part. All scalation characters are similar, including the keeling of the dorsal scales (see Table 1). Other characters include the keeled occipital scales, the large 3rd SL separated from the subocular by 1 scale row, 4th and 5th separated from the subocular by 1 or 2 scales, the number of internasals and of supraoculars. The sole difference bears on the numbers of pairs of infralabials in contact with the anterior chin shield, first 3 pairs in *P. cornutus* vs. first 4 pairs in *Ceratrimeresurus shenlii*. The

pattern is also similar, especially the dorsal blotches, the upper head dark pattern and the postocular streak.

On the basis of the similarities in morphological characters, we synonymize *Ceratrimeresurus shenlii* Liang and Liu in Liang (2003) with *Trimeresurus cornutus* Smith, 1930, now *Protobothrops cornutus* (see Herrmann et al. [2004] for the generic position of this species).

At the generic level, the point to be now discussed is if the horned species *Trimeresurus cornutus* Smith, 1930 should be referred to a genus distinct from *Protobothrops*, in which all other included species are hornless. In this case, the generic *nomen* *Ceratrimeresurus* is available. Pending molecular analyses that should clarify the relationships between the Chinese and the Vietnamese populations, we have to rely only on morphology. Only two currently recognized genera of mainland Asia include species with truly erected supraoculars (“horns”), namely *Protobothrops* (only for *P. cornutus*) and *Triceratolepidophis* (*T. sieversorum*). On the basis of the similarities between *P. cornutus* and *C. shenlii*, we adopt a conservative approach in considering that erected supraoculars have been convergently evolved in several lineages. Consequently, we synonymize the genus *Ceratrimeresurus* Liang and Liu in Liang (2003) with *Protobothrops* Hoge and Romano Hoge, 1983.

A second Chinese specimen of *Protobothrops cornutus* has appeared on Internet in summer 2005 (Fig. 4), from Shimentai Nature Reserve (24° 22'-24° 31' N, 113° 05'-113° 31' E), Nanling Mountains, Yingde County, Guangdong Province (see Jim and Xu [2002] for a description of the area). The characters visible on this picture of a freshly killed specimen are identical with

Table 1. A comparison between known specimens of Asian horned pitvipers.

Taxon	Sex	Tal/TL	MSR	Ven	Sc	Cep	SL	IL	Sup/Oc	SupOc
“ <i>C. shenlii</i> ”	F	0.177	21	187	77	14	9/?	14/14	5/5	convergent
<i>P. cornutus</i> (1)	M	0.203	21	189	78	16	9/9	14/14	6/6	convergent
<i>P. cornutus</i> (2)	F	0.184	21	192	71	13	9/9	13/14	6/6	convergent
<i>P. cornutus</i> (3)	F	0.182	21	193	72	13	9/9	12/13	7/7	convergent
<i>T. sieversorum</i> (4)	M	0.167	23	228	82	15	8/9	13/14	2/2	divergent
<i>T. sieversorum</i> (5)	F	0.157	22	235	79	15	8/9	13/14	2/2	divergent
<i>T. sieversorum</i> (6)	?	—	21	—	—	16	10/10	13/14	—	divergent

List of cited specimens. *Protobothrops cornutus*. (1) ZFMK 75067, Phong Nha-Ke Bang National Park, Quang Binh Province, Vietnam (not seen; after Herrmann et al., 2004); (2) BMNH 1946.1.19.25, “Fan-si-pan Mts., Tonking”, now Mt. Phang Si Pang, Lai Châu Province, Vietnam; (3) MNHN 1937.35, “Tonkin”, northern Vietnam. - *Triceratolepidophis sieversorum*. (4) ZFMK 71262 (holotype), Phong Nha village, Phong Nha-Ke Bang Nature Reserve, Quang Binh Province, Vietnam; (5) ZFMK 75066, Phong Nha-Ke Bang Nature Reserve, Quang Binh Province, Vietnam; (6) FMNH 255258, Hin Nammo NBCA, Boualapha District, Khammouan Province, Laos (specimens (5) and (6) not seen; after Herrmann et al., 2002).

those of *Ceratrimeresurus shenlii*. The pattern is much similar to that of *Protobothrops cornutus* depicted in Herrmann et al. (2004). According to the data kindly communicated to us by Mr. Fu Jie, the author of the photograph, this second specimen was seen in May 2005. It was held in alcohol in the home of a member of the Yao minority, to be most likely used as a medicinal beverage. The locality of this second specimen lies in a hilly area at approximately 75 airline km southeastwards from the type locality of *Ceratrimeresurus shenlii* in Nanling Nature Reserve. According to the Yao owner of this specimen, this snake was caught by himself while he was acting as a guide to a scientific survey of the local herpetological fauna. Several specimens were collected, but all died in captivity within some days. This species is there considered very rare.

Conclusions

The occurrence of *Protobothrops cornutus* in China makes a considerable northeastward range extension for this latter species, previously considered endemic to Vietnam (Nguyen et al., 2005) (see map on Fig. 5). Ziegler et al. (2006) recorded a specimen of *Protobothrops cornutus* from Ha Giang Province, in extreme northern Vietnam, close to the border with Yunnan and Guangxi Zhuang Autonomous Provinces. The previously northernmost known locality, Mt. Phang Si Pang (formerly Mt. Fan Si Pan) and Nanling Mountains are separated by about 980 airline kilometers. Chinese specimens are separated from the new locality cited in Ziegler et al. (2006) by about 760 airline km.

We also consider that the wide gap between the Chinese population and its Vietnamese relatives may most likely reflect a lack of appropriate collecting effort in elevated areas of Guangxi Zhuang Autonomous and Guangdong Provinces than a real geographical gap. *Protobothrops cornutus* should be searched for in forests of mountain or hill ranges such as Daming Shan and Dayao Shan (Guangxi Zhuang Autonomous Province) and in various hills of northern Guangdong located between the Nanling Mountains and the mountain ranges of Guangxi Autonomous Region. The herpetofauna of this latter province is still quite poorly known. Besides the provinces of Guangxi and Guangdong, this species should be searched for in forested areas of southern Yunnan (see Herrmann et al., 2004). Herrmann et al. (2004) also showed that, in Central Vietnam, *P. cornutus* also occurs in the lowlands. However, lowland areas of southern China are quite dry (Anonymous, 1998). These lowlands separate the hill or mountain ranges of southern China which share a subtropical humid climate with

high annual amounts of rainfall (above 2000 mm), a situation which leads to the isolation of the populations of *P. cornutus* in this region.

A discussion on the zoogeographical affinities between North Vietnam and various regions of South China are outside the scope of this paper, but a mere comparison between the snake faunas of northern Vietnam and the hills of Guangxi and Guangdong suggests strong similarities. The occurrence of *Protobothrops cornutus* in northern Guangdong, as well as of *Shinisaurus crocodilurus* and *Amphiesma bitaeniatum* in northern Vietnam (David et al., 2005; respectively Le and Ziegler, 2003) reinforces the zoogeographical relationships of these areas connected by more or less contiguous hill or mountain ranges receiving high annual amounts of rainfall.

Acknowledgments

We are indebted to Q. Liang (Guangzhou, China), who was instrumental in letting TM re-examine the holotype of *Ceratrimeresurus shenlii*. We are grateful to A. Malhotra (Bangor, United Kingdom), M. W. Lau (Hong Kong, China) and T. Ziegler (Köln, Germany) for their comments on the draft of this paper; we especially thank T. Ziegler who made available and permitted us to cite his paper in press. Lastly, we thank J. Fu (Guangzhou, China) and N. Wu (Beijing, China) for their kind permission to use in our paper the picture of the second Chinese specimen of *Protobothrops cornutus*.

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