ISSN: 2538-2152; ECOPERSIA 2022;10(3):173-177.

A new Record of Persian Krait *Bungarus persicus* Abtin, Nilson, Mobaraki, Hosseini, Dehgannejhad 2014 (Serpentes: Elapidae: Bungarinae) from Hormozgan Province, Southern Iran

ARTICLEINFO

Article Type
Original Research

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How to cite this article
Shahi M., Jaberhashemi SA., Hosseinzadeh MS,. Kazemi SM. A new Record of Persian Krait *Bungarus persicus* Abtin, Nilson, Mobaraki, Hosseini, Dehgannejhad 2014 (Serpentes: Elapidae: Bungarinae) from Hormozgan Province, Southern Iran. ECOPERSIA 2022;10(3): 173-177

DOR:
20.1001.1.23222700.2022.10.3.1.8

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Article History
Received: February 23, 2022
Accepted: June 9, 2022
Published: September 01, 2022

ABSTRACT

Aims: In this study, more expedition work has been done to clarify the distribution map of the *Bungarus persicus*. In addition, providing more specimens to confirm the occurrence of the species.

Materials & Methods: The Persian Krait, *Bungarus persicus,* was described based on two specimens from Baluchistan, southeastern Iran. On 5 September 2020, collected from the Tidar region, Bashagard, Hormozgan Province, southern Iran. Also, another road-killed individual was found at the same location.

Findings: Shreds of evidence provided indicate the local population of *Bungarus persicus* in southeastern Iran belongs to the *Bungarus sindanus* complex.

Conclusion: Further molecular studies on Iranian *Bungarus* are necessary to clarify the species validity of *Bungarus persicus* and evaluate its similarity with the other congeners.

Keywords: Hormozgan Province; Persian krait; Record; Venomous.

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[DOR: 20.1001.1.23222700.2022.10.3.1.8]

Introduction

Snakes of the genus *Bungarus* Daudin, 1803, commonly referred to as "kraits," are moderate to large-sized (to 2 m), highly venomous elapids distributed from Afghanistan and Iran in the west, to South Asia and eastwards throughout the Indo-Chinese sub-region and adjacent areas into tropical Southeast Asia [1, 2]. Kraits are easily recognized from other elapids with a mid-dorsal row of enlarged, hexagonal scales [3]. Moreover, kraits have unique vertebrae with laterally expanded prezygapophysial and postzygapophysial processes and unusually high neural processes [4]. Externally, these high neural processes result in a raised middorsal ridge giving kraits a distinctive triangular appearance in the cross-section. These mentioned traits are implied that *Bungarus* is monophyletic [4,5]. As of now, 16 species of *Bungarus* are currently recognized [2, 5].

The majority of *Bungarus* species have black-and-white cross bands and have been the most taxonomically problematic taxa and are difficult to identify in the field due to overlapping diagnostic characteristics [5-10]. The genus *Bungarus* has been considered problematical in terms of taxonomic status, as many of the species are irregularly collected and sparsely distributed and concerning the westernmost taxa occurring in Pakistan and India, opinions have diverged over time [5-9]. In the western part of the distribution, the Sindhi krait, *Bungarus sindanus*, as well as the common krait, *B. caeruleus* (Schneider, 1801) are found in Pakistan, Afghanistan, and India [2,5,6]. The Sindhi krait distinguished *B. sindanus* into two subspecies: *Bungarus sindanus sindanus* from the western Thar Desert and *Bungarus sindanus razai* Khan, 1985 from northwestern Punjab in Pakistan. In addition, also include the Indian *Bungarus sindanus walli* Wall, 1907 as a subspecies, a taxon that has recently been considered a full species [2].

To date, only a single species of *Bungarus* has been recorded from Iran: *Bungarus persicus* (Abtin, Nilson, Mobaraki, Hosseini, Dehgannejhad 2014) from north of Sarbaz in Baluchistan, southeastern Iran, which represents the westernmost record for the genus as a whole [6]. The special characteristics of the species are a clear black spot in the loreal region and an occasionally developed loreal plate (on both sides of the head in the holotype) [6]. The holotype of this Iranian specimen of *Bungarus* is unique by the occurrence of a small loreal on each side of the head which is extraordinary amongst elapid snakes. The paratype lacks loreals but both specimens have a characteristic black area in the loreal region and this in combination with morphological peculiarities, such as the shape and place of the prenasal plate as well as the high number of ventral and subcaudal plates makes us believe that it must be considered as a unique taxon [6].

Among Middle Eastern countries, Iran has been considered to harbor the greatest number of venomous snake species [11, 12]. Snakes in Iran territory including the land and coastal water are represented by 89 snake species distributed among nine different families [13-18]. Venomous snakes comprise nearly 30% of the total serpent diversity and mainly belong to two families: Viperidae, represented by the genera *Gloydius*, *Cerastes*, *Echis*, *Eristicophis*, *Macrovipera*, *Montivipera*, *Pseudocerastes*, and *Vipera*, and Elapidae, represented by *Bungarus*, *Naja*, *Walterinnesia*, *Hydrophis*, and *Microcephalophis* [13, 19]. In this study, more expedition work has been done to clarify the distribution map of the *Bungarus persicus* and provide more specimens to confirm the occurrence of the species.

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Materials & Methods

On 5 September 2020, Seyed Aghil Jaberhashemi collected a specimen of *Bungarus* (BVMUMB. 01 (Biology and Vector Control Museum, University of Medical Sciences, Bandar Abbas), ethical code: IR.HUMS.REC.1399.568) from the Tidar region, Bashagard, Hormozgan Province, southern Iran (26.750999N, 57.841887E) (Figure 1). The gender of the specimen is female, determined via making an incision at the base of the tail. The new location is 472.87 km far from the type locality of *Bungarus persicus* which is the easternmost record of that genus within its entire range. The specimen was identified according to the description [6, 20]. All metric and meristic characters were taken using digital calipers to the nearest 0.01 mm accuracy. The meristic characters include the number of supralabials, loreal, infralabials, dorsals, ventrals, anal plate, and subcaudals scales. The metric characters include measuring snout-vent length, tail length, and total length of the body.

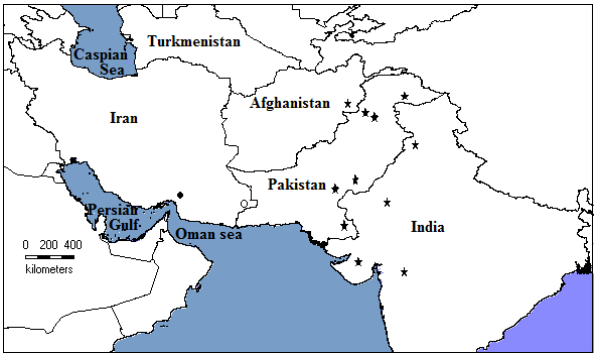

Figure 1) Map of the locality of *Bungarus* in Iran. Empty circle: type locality of *Bungarus persicus,* solid circle: new record of *Bungarus persicus*, solid star: *Bungarus sindanus*.

Findings

The specimen was examined and found to have the following characteristics of the body: 7/7 supralabials, the 3rd, and 4th in contact with the eye; one loreal; 7/7 infralabials; 17 smooth dorsals at midbody; 227 ventrals; anal plate undivided; 49 subcaudals; Snout-vent length 835 mm; tail length 115 mm, the total length of the body 950 mm (Figure 2). The head is black above and yellowish white below with a sharp border between the colors along the upper edge of the supralabials. The preocular region and postnasal are yellowish-white, whereas the small loreal area is black. The eyes are large and black with a grayish oval pupil. The belly is yellowish in the specimen. These characters are fully consistent with *Bungarus persicus* [6].

Figure 2) Images of *Bungarus persicus.* A: in dorsal view. B: in ventral view. Photographed by Mehran Shahi. Habitat of *Bungarus persicus* Tidar region, Bashagard, Hormozgan Province in southern Iran, Photographed by Hassan Eidzadeh (the specimen BVMUMB. 01; right).

Another specimen, a road-killed individual, was found on 15 June 2021 (Figure 3, BVMUMB. 02). The specimen was damaged hard, and counting the scales was not possible, which wasn't collected.

A holotype specimen of *Bungarus persicus* has 17 dorsal midbody scale rows with the vertebral row enlarged. A high number of ventral (236 – 238) and subcaudal (50 – 53) plates. The Preocular region and postnasal are white, while the small loreal area is black in the holotype. The triangular

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pairs all end in pairs of rectangular whitish dots or short crossbars crossbar along the vertebral section. The head is black above and yellowish white below with a sharp border between the colors along the upper edge of the supralabials. The specimen of this study is congruent with the description of *Bungarus persicus.*

Figure 3) Images of damaged Persian Krait, *Bungarus persicus,* by local farmers.

The habitat of the snake is a flat plain, where plants including *Nerium indicum* and *Rhazya stricta* occur (Figure 2). The habitat of *Bungarus persicus* holotype is mainly flat plains as well as seasonal rivers bed with dispersed vegetation compromising mainly with shrubs and some trees. The main plant species of the area are: *Lycium edgeworthii*, *Rhazya stricta, Nerium indicum, Hammada salicornia, Nannorrhops ritchiana, Prosopis spicigera, Tamarix sp., Salsola drummondii, Phragmites australis,* and *Peganum harmala*.

Discussion

The locality is near agricultural and rural areas. Our specimen was captured in xeric dune habitat similar to that reported by Ali *et al*. [23]. Sympatric reptile species observed in the same habitat as *Bungarus persicus* include *Trapelus agilis, Bunopus tuberculatus*, *Cyrtopodion scabrum*, *Mesalina watsonana*, *Varanus griseus caspius*, and *Spalerosophis diadema.* The habitat of *Bungarus persicus* is in the Nubo-Sindian desert and semi-desert of south Iran, one of 16 terrestrial ecoregions [13]. According to Safaei-Mahroo *et al*. [13] the ecoregions, Nubo-Sindian desert, and semi-desert of south Iran occupy 17.3% of the whole Iran territory and are one of the great ecoregions among 16 terrestrial ecoregions [13].

Concerning venom, members of the genus *Bungarus* are a group of deadly snakes and understanding their species diversity, species boundaries, and geographic distribution is vital for public health. Generally, snakebites from kraits are known to have high mortality, and then the toxicology of their venom has been the subject of numerous publications. *B. persicus* is a well-known and very dangerous venomous snake for local people. The bite of the snake is very painful and mortal. The snake is well recognized in the Baluchistan area with the local name "Siah Mar" which means Black snake.

With this discovery, two species of *Bungarus* have been confirmed from Iran. According to Rajabizadeh [18] and Dr. Ulrich Kuch (pers. comm. 2020), it is probable that the local population of *Bungarus persicus* in southeastern Iran belongs to the *Bungarus sindanus* complex. According to Abtin *et al*., there is a loreal scale in the holotype specimen of the *Bungarus persicus* but the paratype specimens don't observe a loreal scale and the character has been considered a variable character.

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Conclusion

Consequently, the loreal scale is not a certain character in all specimens of *the Bungarus persicus* population and we cannot use this trait to identify *Bungarus persicus* specimens. However, further molecular studies on Iranian *Bungarus* are necessary to clarify the species validity of *Bungarus persicus* and evaluate its similarity with the other congeners.

Acknowledgments

The authors appreciate Hassan Eidzadeh for providing images and assisting with sampling and Dr. Ulrich Kuch for his comment. We also thank Prof. Mohammad Kaboli and Dr. Behzad Fathinia for providing the required literature, and Prof. Aaron M. Bauer for editing the English of the manuscript as a native speaker.

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[DOR: 20.1001.1.23222700.2022.10.3.1.8]