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Case Study

First Case Report of an Unusual Echis genus (Squamata: Ophidia: Viperidae) Body Pattern Design in Iran

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ABSTRACT

Three families of venomous snakes exist in Iran including Viperidae, Elapidae, and Hydrophidae. Viperidae family is the only family with a widespread distribution. Saw-scaled vipers are important poisonous snakes in Asia and Africa. This name is given to this snake due to the presence of obliquely keeled and serrated lateral body scales. Distribution of this genera is mostly reported in the central and southern regions of Iran. This genus has four main clades: the *Echis carinatus*, *E. coloratus*, *E. ocellatus,* and *E. pyramidum*. Design pattern in Echis species plays an important role in camouflage and variety of habitat. In the present report, we investigated a specimen from the eastern region of Iran; we examined 25 specimens of Echis that were collected from the eastern region of our country. Among them, only one specimen with a different pattern was found compared with the other 24 specimens by surveying meristic, mensural, and design pattern characters using valid key identifiers. The similarities between the specific Echis with a different pattern and other 24 specimens were also studied and compared. The results of this investigation clearly showed that although the pattern of the lateral white line and block on dorsal body of the specific Echis snake was different, since the meristic and mensural characters were similar to other Echis snakes it can be concluded that this specimen is not a different species; the difference in these patterns may be due to a minor genetic mutation of that specimen. It is the first case report of *Echis carinatus sochureki* Stemmler, 1969 from Iran with a different pattern.

Keywords: Echis, Design pattern, Viperidae, Iran

Premier Rapport d'un Cas de Motifs Corporels Inhabituels du Genre Echis (*Squamata: Ophidia: Viperidae*) en Iran

Résumé: Il existe trois familles de serpents venimeux en Iran: *Viperidae*, *Elapidae* et *Hydrophidae*. La famille Viperidae est la seule famille à avoir une distribution étendue. Les vipères en écailles de scie sont des serpents toxiques importants en Asie et en Afrique. Ce nom est donné à ce serpent en raison de la présence d'écailles latérales à corps caréné et à carénage oblique. La distribution de ce genre est principalement signalée dans les régions centrale et méridionale de l'Iran. Ce genre comprend quatre clades principaux: *Echis carinatus*, *E. coloratus*, *E. ocellatus* et *E. pyramidum*. La conception des motifs corporels des espèces d'Echis joue un rôle important dans le camouflage et la variété de l'habitat. Dans ce rapport, nous avons étudié un spécimen provenant de la partie orientale iranienne. Parmi les 25 spécimens d'Echis prélevés, un spécimen présentait un motif différent selon les caractères méristiques, mensuels et la comparaison des motifs à l'aide d'uneclé d'identification validée. Les similitudes entre le spécimen montrant un motif spécifique et les 24 autres spécimens ont également été étudiées. Nos résultats démontraient clairement que malgré les différences au niveau du motif de la ligne blanche latérale et du bloc sur le corps dorsal du serpent, les caractères méristiques

et mensuraux étaient similaires à ceux des autres serpents appartenant au genre Echis. On peut donc en conclure que ce spécimen n'est pas une espèce différente; les différences observées peuvent être due à une mutation génétique mineure de ce spécimen. Il s'agit du premier cas signalé de l'espèce *Echis carinatus* sochureki Stemmler (1969) en Iran, montrant un motif corporel différent.
Mots-clés: Echis, Design pattern, Viperidae, Iran

INTRODUCTION

Three families of venomous snakes including Viperidae, Elapidae, and Hydrophidae exist in Iran. Viperidae family is the only family with a widespread distribution. This family has a rotating fang apparatus allowing the development of long fangs that are erected when biting and folded against the palate when the mouth is closed. Most viperids have robust bodies and distinctly triangular heads (Scansen et al., 2014). *Echis Merrem* 1820 is a genus of the Viperidae family. Echis genus are medically important poisonous snakes in Asia and Africa. This genus has four main clades: the *Echis carinatus*, *E. coloratus*, *E. ocellatus,* and *E. pyramidum*. The genus Echis includes snakes commonly known as saw-scaled or carpet vipers; the "Saw-scaled" name is derived from the obliquely keeled and serrated lateral body scales. The heads of saw-scaled vipers are short, somewhat spade-shaped, and widen slightly posterior to eyes as distinct from their arrow necks. The snout is short and rounded, and the eyes are relatively large with vertically elliptical pupils. Dorsally, the head is covered with small irregular imbricate scales that may be either keeled or smooth (Abbas Rhadi et al., 2015). When the snake is coiled in its characteristic horseshoe-shaped position, these keels are in contact with each other such that when the snake rubs its coils together, they produce a loud rasping sound. Some other desert species also produce sounds in this manner (Mattison, 2014). Echis species is distributed in northern India, Bangladesh, South of Afghanistan, Pakistan, Iran, northern Africa, the Middle East and western Asia, South of Iraq, United Arab Emirates, and northern Oman on the Arabian Peninsula (Abbas Rhadi et al., 2015). Cherlin and Borkin (1990) took a major step to resolve the taxonomic problems within Echis concluding that Echis comprises 12 species totaling 20 forms (Babocsay, 2003a). Taxonomy of this genera is very important for zoology and medical sciences. The taxonomy of this medically important genera in unclear (Lenk et al., 2001). Until the 1970s, only two species were recognized, *E. coloratus* from the Middle East and the Arabian Peninsula, and *E. carinatus* from the vast remainder of the range of the genus (Pook et al., 2009). Design pattern in Echis species plays an important role in camouflage, and habitat variety can be a reason for the difference in patterns of a species. Interestingly we found a specimen that was different in body's design pattern from our other specimens of Echis that we present in this report.

CASE HISTORY

In the present study, we investigated 25 specimens of Echis which were collected from the eastern region of Iran. Our observation of the Echis specimens was based on the key identification recommended by (Sherman and Minton, 1962; Latifi, 1991; Mohammadian, 2003; Mazuch and Hejduk, 2007; Amr and M Disi, 2011). In the present study, the specimens were identified through determination of meristic characters, mensural characters and design pattern (Babocsay, 2003b) (Table 1). On the other hand, the standards as mentioned in Table 1: DS1 (one-head length behind the head), DS2 (rows of scales at mid-body), and DS3 (five ventral

scales anterior to anal plate) were considered as other subjects for identification (Babocsay, 2003b). To identify our case report specimen, we also studied the interorbital scales (IOS) of the dorsal head, circumorbital scales (COS), as well as upper labial scales (ULS) along with lower labial scales (LLS) of lateral head. We also studied genial scales (GS) of the throat. For the ventral body, we considered ventral scales (VS), while lateral oblique scales (LOS) were determined for identification of the lateral body. The scales of the dorsal body and subcaudals were counted in order to identify the specimens (Figures 1A-G).

Case presentation. In the present study, the important issue is the design pattern of our specimen. *Echis multisquamatus* Cherlin, 1981 has a lateral wavy white line of continuous pattern, while *Echis carinatus sochureki* Stemmler, 1969 has a lateral wavy white line divided in separate arcs. In our Echis case report, the lateral wavy white line was found to be a continuous and straight pattern. The straight white line on the lateral body of an Echis is very rare and is an unusual design pattern. Unlike the Echis genus in Iran that has

Table 1. Characters that investigated on the specimen

Meristic characters	Mensural	Design pattern
Ventral scales (VS)	Body length (BL)	Colour body (CB)
Subcaudal scales (SS)	Tail length (TL)	Ventral color (VC)
Dorsal scales (DS1:DS2: DS3)	Head length (HL)	Ventral pattern (VP)
Lateral oblique scales (LOS)	Head width (HW)	Dorsal blocks (DB)
Circumorbital scales (COS)		Lateral white line (LWL)
Interorbital scales (IOS)		Arrow on head (AH)
Upper labial scales (ULS)		
Lower labial scale (LLS)		
Genial scales (GS)		

Table 2. Specimen characters that were investigated

Meristic	DS	27: 35: 23
	VS	188
	SS	29
	COS	15
	ULS	11
	LLS	14
	GS	Anterior contact with 3 ULS
	IOS	11
	LOS	6
Mensural	BL	62 cm
	TL	4.5 cm
	HL	3.2 cm
	HW	2.5 cm
Design pattern	VC	Whitish
	VP	Dim small spots to sporadic
	AH	Narrow
	LWL	Continuous straight line
	CB	Brownish
	DB	White blocks contact with each other by black blocks

white blocks on dorsal vertebral column line that connect white blocks surrounded with black blocks or black blocks arranged to zigzag (Figure 1 H-I), the black and white blocks on dorsal pattern of the present case report specimen was unusual (white blocks on dorsal vertebral column line connect to each other by black blocks) (Figure 1D). No difference was observed in meristic and mensural characters presented in Table 2 between our case report specimen and the other ordinary Iranian Echis specimens.

DISCUSSION

Our specimen has been all of *E. multisquamatus* characters than others. Average of scale The results of characters analysis showed the present specimen has all of typical *E. multisquamatus* characters. Average scale count in *E. multisquamatus* reported from the Middle East and Pakistan is more than that of *E. c. sochureki.* The scale count of *E. c. sochureki* population in the southern part of Iran was reported to be less than that of the Echis in the central-North part of the country (Bagherian and Kami, 2009). It is a well-established fact that lateral wavy white line in *E. multisquamatus* is continuous along with a narrow arrow on the head (Cherlin, 1981), which is similar to our case report. On the other hand, the forms of rostral scale and nasal scale

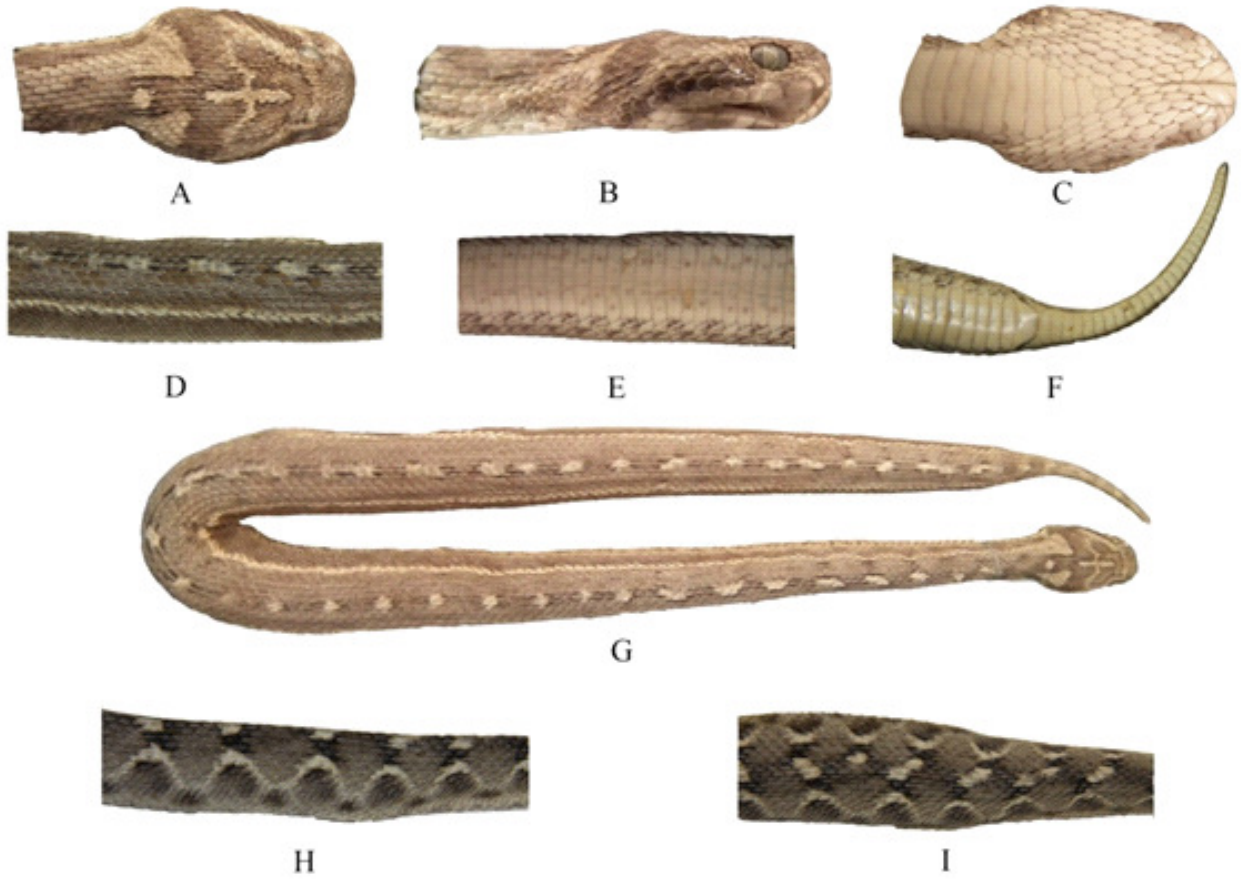

Figure 1. Aspects of Echis case report: Dorsal head (A), Lateral head (B), Ventral head (C), Lateral straight line and Dorsal blocks of body (D), Ventral body (E), Subcaudals (F), Full view of Echis case report (G), Usual eastern Echis specimens: Lateral wavy line (H), Dorsal blocks (I).

in our specimen is also identical to *E.multisquamatus* reported by Cherlin and Borkin (Cherlin, 1981). In the *E.carinatus* group three species are recognized including *E.carinatus* (southern India, Sri Lanka), *E. sochureki* (northern India to Pakistan), and finally *E. multisquamatus* (Central Asia, Iran) (Cherlin, 1981).

The results of our study showed that our case report specimen has a dorsal pattern of 27:35:23. These numbers are less than our specimen's. Based on the report presented by Bagherian and Kami (2009), the two species of Echis in Iran are *E. c. sochureki* and *E.* multisquamatus. Our specimen is very close to *E.multisquamatus* rather than the *E. c. sochureki* species. However, the results of the molcular study showed that the populations of the Echis genera fall into four main clades: the *E. carinatus*, *E. coloratus*, *E. ocellatus*, and *E. pyramidum* groups. Two of the species including *E. carinatus* and *E. multisquamatus* have conspecificity (Pook et al., 2009). *E.c. sochureki* is reported from Oman, UAE, Iran, Central Asia, Afghanistan, Pakistan (Pook et al., 2009) and this Echis species was only found in Iran. In the latest checklist of Iranian reptiles, only *E.c sochureki* is recognized to be from Iran (Safaei-Mahroo et al., 2015).

Hence based on the results obtained in the present work it can be concluded that since we did not find this pattern in the Echis snake population, this specimen can be a case report of unusual body pattern design of *E. c. sochureki*.

Ethics

We hereby declare all ethical standards have been respected in preparation of the submitted article.

Conflict of Interest

The authors declare that they have no conflict of interest.

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