
Research Article**A Study of the Nomino typic Form of Saw Scaled Viper, *Echis carinatus*, (Schneider 1801), (Squamata: Ophidia: Viperidae) in Southern Iraq****Fadhil Abbas Rhadi^{1,2,3*}, Nasrullah Rastegar-Pouyani^{1,2}, Rihab Ghaleb Mohammed^{1,2,3}, Khalid Al-Fartosi⁴, Robert K Browne⁵, Rasoul Karamiani^{1,2}**¹Department of Biology, Faculty of Science, Razi University, 6714967346 Kermanshah, Iran²Iranian Plateau Herpetology Research Group (IPHRG), Faculty of Science, Razi University, 6714967346 Kermanshah, Iran.³Al-Qasim Green University, Babylon, Iraq⁴Department of Biology, Faculty of Science, Thi-Qar University, Thi-Qar, Iraq⁵Sustainability America, Corozal District, Belize***Corresponding author**

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Abstract: Study was carried out in two localities in southern Iraq, in Al-Basra province Shat Al-Arab District, At Tannumah town close to the Iraqi-Iranian border from the place called Al-Salhiya, Kut al Kawam (30° 30' 33.6" to 30° 29' 0.96" N, 47° 53' 12" to 047° 58' 9.21" E; alt.1 - 4 m.), and in Thi-Qar province, Al- Nasiriyah district Said Dekheel sub district (31° 08' 43.8" to 31° 07' 51.7" N, 46° 19' 50.5" to 46° 26' 3.9" E; alt. 6 m.). Morphological examination of 18 specimens (were collected during two of our scientific excursion which was carried out from 13th of August to 17th of October 2014, and from 17th December to 19th May 2015.) revealed complete blending between them. Because of there is no hiatus in the studied saw-scaled viper two populations of the southern Iraq, *Echis carinatus* is the name available for this species, and the nominate form is *Echis carinatus sochureki*.**Keywords:** Saw scaled viper, *Echis carinatus sochureki*, Iraq, Al-Basra Province, Thi-Qar, distribution, color pattern.

INTRODUCTION

The genus *Echis* Merrem 1820 includes snakes commonly known as saw-scaled or carpet vipers; "Saw-scaled" is derived from the obliquely keeled and serrated lateral body scales. When threatened, the body coils into parallel loops that are rubbed together to produce a "sizzling" warning noise which becomes stronger and quicker in proportion to the degree of threat. The saw-scaled vipers are relatively small, but they are very aggressive and quick to strike, and produce highly virulent hemotoxic venom, and expansion in places among the most common venomous snakes. Saw-scaled vipers are often not kept in captivity because of their highly virulent venom, or if kept only by experienced breeders[1-2]. These traits, coupled with their extensive geographic distribution, especially in heavily populated regions, make them some of the most dangerous snakes in the world[1]. The head of saw-scaled vipers are short, somewhat spade shaped, and widen slightly posterior to eyes as distinct from then arrow neck. 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. The body is cylindrical and moderately slender; the keeled body scales are in 25-40 rows, middorsal

scales in straight, longitudinal rows, and the lateral scales distinctive, being small, strongly oblique, and keeled with minute serrations. Subcaudals are undivided, the anal plate single and the tail is short[1,3,4]. *Echis* species are distributed North India, Bangladesh, South Afghanistan, Pakistan, Iran, in North Africa, in the Middle East and western Asia, South Iraq, United Arab Emirates and Northern Oman on the Arabian Peninsula[4-6]. The taxonomy of *Echis* is unsettled, and *Echis* is one of the most taxonomically complex genera of snakes in Africa[1,2,7]. Traditionally, until the 1950's only two species were recognized: *E. coloratus* Gunther 1878 and *E. carinatus* Schneider 1801. *Echis carinatus* first described as *Pseudo boa carinatus* by Schneider (1801) from specimens collected at Arni, Madras, India[1,2]. Constable[8] suggested that the Pakistan and other, populations should be referred to as *E. carinatus pyramidum* (Geoffroy 1827; type loc. Egypt). Stemmler [9] modified this arrangement by placing all Pakistan's and some other, populations in *E. carinatus sochureki* (Stemmler 1969, type locality Ban Kushdil Khan, Pishin, Baluchistan, Pakistan), and *E. carinatus pyramidum* has been returned to *E. pyramidum*. In 1969 Mertens described *E. c. astolea* from the Mekran Coast of Pakistan (type locality: Astola Island, Baluchistan).

Following additional analysis, Cherlin [10] raised Stemmler's *sochureki* to full species and restricted *E. carinatus* to peninsular India. *Echis carinatus* was divided into two subspecies: *Echis c. carinatus* on the Indian peninsula mainland and *E. c. sinhaleyus* on Sri Lanka. All mainland Pakistan populations, except those in northwestern Chagai were to be called *E. sochureki sochureki* Stemmler 1969; the form was now *E. sochureki asteolae* Mertens 1970 [11]. In the last 50 years, the taxonomy of these vipers increased enormously. Currently ten to twelve species with 20 subspecies are recognized and very little information is available for this taxon [1,2,5]. Cherlin [12] distinguished three subgenera within the genus *Echis*: *Echis*, *Turanechis* and *Toxicoa*, which are not congruent with current molecular and morphological data. Therefore, there is no single view on taxonomy of the genus *Echis* [2]. Consequently the genus *Echis* needs a major taxonomic revision based on more specimens across their range and along with increased molecular analysis. Three species or subspecies that belong to this genus are found in the Arabian Peninsula, *E. pyramidum*, *E. carinatus sochureki* and *E. coloratus*. The painted saw-scaled viper *E. coloratus* is widely distributed from eastern Egypt through Palestine, Jordan, Lebanon and north, south, east, and west Saudi Arabia. The Egyptian saw-scaled viper *E. pyramidum*, described from Egypt, and is widely distributed from southern Arabia, Somalia, Ethiopia, Sudan, Libya, and Tunisia. Current taxonomy defines the saw-scaled viper *E. carinatus* as an Asian species with four recognize subspecies: *E. c. carinatus* from peninsular India, *E. c. astolae* from Astolae Island, Pakistan; *E. c. sinhaleyus*, from Sri Lanka; and *E. c. sochureki* Stemmler 1969 from Afghanistan, Pakistan, northern India, south and central Iran, Iraq, Oman and U.A.E. [1,2, 13,14].

In Iraq, Corkill [15] described a snake under the name *E. carinatus* and mentioned it from Al-Diwaniyah province southern Iraq. Corkill's records from the lower Tigris –Euphrate drainage are believed to be *E. c. sochureki* [6]. Since that time, no further specimens recorded, and it was regarded rare snake in Iraq. Afrasiab *et al.*; [16] collected two specimens from the village of Said Dakheel near Alnasiriyah province southern Iraq (31°07'53''N, 46°26'10''E), in 2011, and mentioned a particularly dry winter that may have caused an exodus of the snake from the drying marsh land in the south caused by drought due to reduced water supply of the river Euphrates and Tigris. Prolonged drought together with late rain at the end of a hot April (possibly the impact of global warm cause an increase of humidity and, and as a consequence obviously mass reproduction of *Echis* at Said Dakheel. Rhadi *et al.* [17], collected a single specimen of *E. c. sochureki* in a scrublands close to the river Shatt al Arab as Saghir, on the outskirts of the Shat Al-Arab District, At Tannumah town in eastern region of Basra Province, close to the Iraqi-Iranian border from the place called Al-Salhiya, Kut al Kawam (30° 30' 33.6" N, 47°

53' 12" E; alt. 4 m.), as a first record and range extension of this snakes in southern Iraq, This new locality is about 150 km away from the village of Said Dakeel (Alnasiriyah province), the nearest previously published record for this subspecies by Afrasiab *et al.*; [16]. The importance of this record is the distribution of *E. c. sochureki* in Iraq is not limited to the historical locations. This report shows that *E. c. sochureki* has a potential much wider distribution than the previously thought and suggest the existence of continuous populations. This is a group of vipers in which morphology and coloration are very similar and therefore difficult to distinguish on the basis of these characters. The top of head and nape of genus *Echis* is always marked with a distinct pattern. These marking vary from arrow to cross – shaped mark (trident mark, arrow mark, the broad cross, the narrow cross) [1,11].

In their treatment Stemmler [9] and Cherlin [18] used a light colored, narrow, cross like dorsal head marking (a spear or broad cross), as one of the characters which have been used to separate *Echis carinatus sochureki* from congeners and *Echis multi squamatus* from *Echis carinatus* respectively. According to the principle of priority, there is no evidence to suggest that more than one species of *Echis* occur within the boundaries of Iraq. To the best of our knowledge this is the first paper to further elucidate: Ventral color pattern, Dorsal and lateral body color pattern, and dorsal head marking categories of saw-scaled vipers which have been collected from the southern Iraq.

MATERIALS AND METHODS

This study is based on 18 specimens were collected during two of our scientific excursion which was carried out from 13th of August to 17th of October 2014, and from 17th December to 19th May 2015. Study was carried out in two localities in southern Iraq, in Al-Basra province Shat Al-Arab District, At Tannumah town close to the Iraqi-Iranian border from the place called Al-Salhiya, Kut al Kawam (30° 30' 33.6" to 30° 29' 0.96" N, 47° 53' 12" to 47° 58' 9.21" E; alt. 1 - 4 m.), and in Thi-Qar province, Al- Nasiriyah district Said Dekheel sub district (31° 08' 43.8" to 31° 07' 51.7" N, 46° 19' 50.5" to 46° 26' 3.9" E; alt. 6 m.) Localities are presented on a map in Fig. 1. Most specimens were captured by pinning the neck with forked stick. Locality data recorded for all species.

Most specimens were anaesthetized with ether, fixed with 96% ethanol and later preserved in 70% ethanol. Voucher specimens were deposited in the Razi University Zoology Museum (RUZM) at Razi University of Kermanshah Iran, under museum number RUZM-VE 12.1–12.18. Specimens were identified according to Corkill [15] and Khalaf [3], Using morphometric measurements, coloration, and pholidosis features (including the number, structure, and range of scales and plates). Morphometric characters were taken

by using ruler and digital caliper to the nearest 0.01 mm. The geographical coordinates of the sampled specimens computed with a Garmin GPS device.

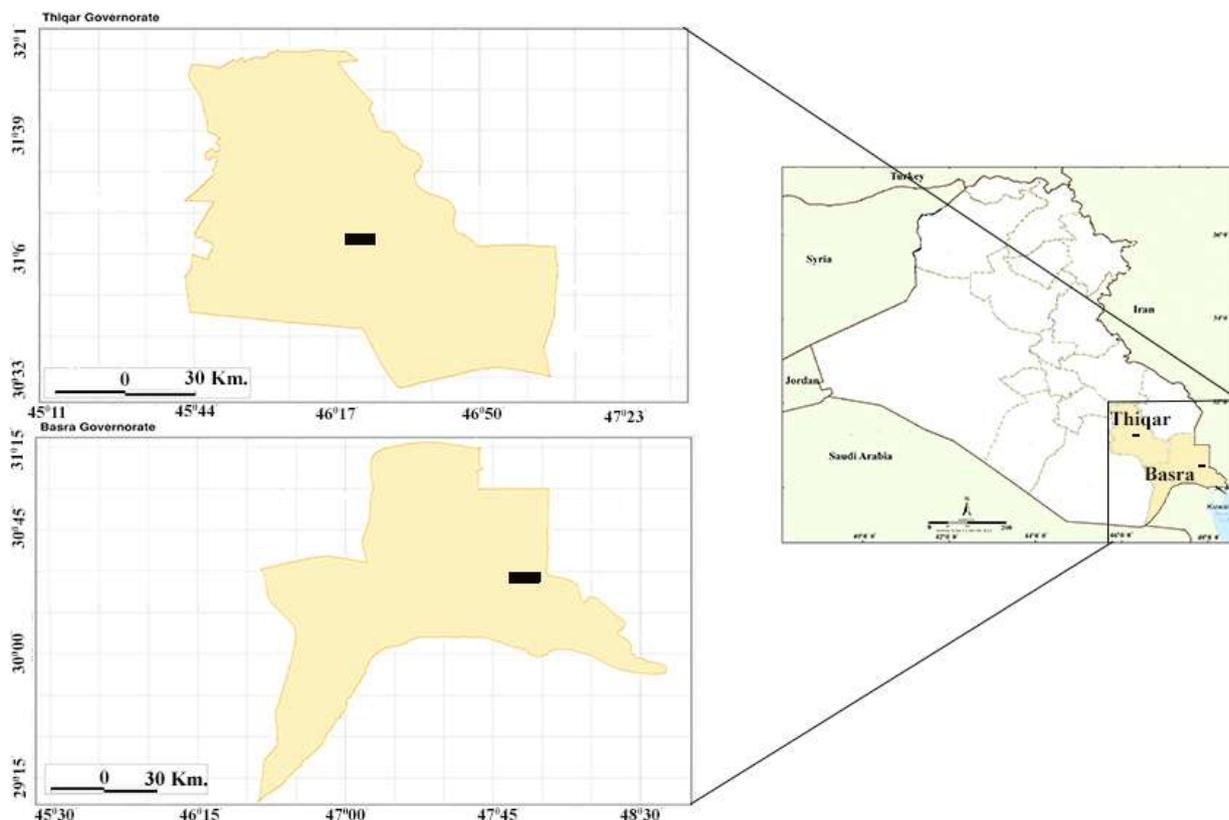


Fig. 1: Map of the localities from which materials were collected. Indicated as black rectangular.

Characters used in this study with their abbreviation:

The following characters were tabulated for all the specimens:

1. number of ventral scales(VS),
2. number of sub caudals (ScdS),
3. number of dorsla scale rows (DS),
4. number of scales around eyes (SAE),
5. number of upper labials (SL),
6. number of lower labials (IL),
7. snout vent length (SVL),
8. tail length (TL),
9. head width (HW),
10. head length (HL),
11. eye-nostril distance (END),
12. nostril-nostril distance (NND),
13. eye-rostral distance (ERD),
14. ventral color pattern,
15. head and nape pattern,
16. dorsal color pattern, and
17. number of dorsal patches(DP).

RESULTS

As shown in Table 1. *Echis carinatus sochureki* (Schneider 1801) populations which collected from Thi-Qar province and Al-Basra Province show overlap in 9 morphometric and meristic characters. The

analysis of variance (ANOVA) was performed for meristic and metric characters to show significantly variable characters of these two populations. The result of the ANOVA shows that the number of supralabials (SL), number of infra labials (IL), scales around eyes (SAE) and sub caudals (ScdS) were significantly different $P \leq 0.05$. Number of ventral scales (VS), number of dorsal scales (DS), snout-vent length (SNL), tail length (TL), head length (HL), head width (HW), eye nostril distance (END), nostril distance (NND), and eye rostral distance (ERD) with $P > 0.05$ were not significantly different.

Ventral color pattern:

In the populations studied this character ranges from dim, small spots; medium intensity, large markings; and darker, larger markings in Thi-Qar province population (Fig.2 C-F), to dim, small, high intensity spots; and deeply pigmented, high intensity spots in Al-Basra Province population (Fig.2 A-B).

Head and nape color pattern:

The top of head and nape is always marked with a distinct pattern. These markings vary from an arrow to a cross-shaped mark (Fig.3).

Dorsal and lateral body color pattern:

Figure 3 both mid dorsal and lateral color pattern elements are indicated, the dorsal portion is comprised of a series of short, dark, transverse, oval spots, separated by inter-blotch patches, both of which are located on a ground color of intermediate density. The number of dark dorsal blotches was counted from the first one immediately after the light colored marking on the head and nape containing the last one over the cloaca (or immediately anterior of it if no spot above it).

The lateral color pattern is constructed around two longitudinal rows of smaller spots, each spots usually covering only a few scales. The lower row of smaller, usually dimmer spots is designated as I, the upper row of larger, often darker spots is designated as II, a series of white crescentic marks in association with spots II, and in some pattern the crescent tips join to form a zig-zag line (Fig.4).

DISCUSSION

The most geographically sensitive characters in Thi-Qar province population and Al-Basra Province population we analyzed are the mean the number of supralabials, the mean number of infra labials, the mean scales around eyes and the mean sub caudals. The highest mean values of supra labials, infra labials, scales around eye are found in Al-Basra population. Other all studied morphometric and meristic characters have been tabulated in table 1. showed complete blending. There is no significant difference in the mean number of ventrals, dorsals, dorsal spots, snout-vent length, tail length, head length, head width, eye-nostril distance, nostril- nostril distance, and eye-rostral distance between two populations. Our results agree with Auffenberg and Rehman [11], with one exception around the mean number of ventrals, in their treatment the number of ventrals was one of the most geographically sensitive characters. Cherlin[10] suggested there is an important positive relationship between the mean number of body scales (longitudinal ventral rows and transverse dorsal rows) of *Echis* species and climate. Auffenberg and Rehman [11] mentioned the correlation between ventrals and mean annual daily maximum temperature is not significant. Ventral color pattern character ranges from dim, small spots; medium intensity, large markings; and darker, larger markings in Thi-Qar province population (Fig.2 C-F) to dim, small and deeply pigmented spots in Al-Basra Province population (Fig.2 A-B), our result agree with Auffenberg and Rehman 1991, in their treatment, mention that *Echis* individuals along Persian Gulf coast with dim, small spots occur in 50 percent; medium intensity, large markings occur in 21 percent and individuals with darker larger markings belly pattern occur in 21 percent. Figure 3 illustrates pattern categories seen on the head and nape of studied *Echis* populations in southern Iraq. The most common pattern has been seen in Thi-Qar province population is a modification of the cross (Fig.3 F), and the patterns

have been seen in Al-Basra Province population are a modification of the wide arrow type, the cross and narrow cross (Fig.3 A-E). In his treatment Mazuch [2] described according to Cherlin [12] different head marking of *Echis*, and mentioned the wide arrow pattern attributed to *E. carinatus sochureki*, and a modified wide arrow, cross and narrow cross attributed to *E. carinatus multi squamatus*, and *Echis pyramidum*. The dorsal portion is comprised of a series of short, dark, transverse, oval spots, separated by inter-blotch patches, both of which are located on a ground color of intermediate density. The density and distribution of melanin in the dorsal blotches varies, for the colors are least intense in Al-Basra Province population (Fig.4 B) and most intense in Thi-Qar province population (Fig.4 A), but there is no significant difference in the mean number of dorsal blotches between the two populations. *E. carinatus multi squamatus* is distributed from Uzbekistan to Iran in the south and east to western Pakistan. *E.pyramidum* described from Egypt by Geoffroy and Saint-Hillaire. It was later placed into *E. carinatus* and has recently returned to *E.pyramidum*. Three subspecies are recognized; *Echis p. pyramidum* (Geoffroy and Saint-Hillaire) from southern Arabia, Somalia, Ethiopia, Sudan, Egypt, Libya, and Tunisia; *Echis p. aliaborri* Drewes and Sacherer, from northern Kenya; and *Echis p. leakeyi* Stemmler and Sochurek from northwestern Kenya. According to the principle of priority, there is no evidence to suggest that more than one species of *Echis* occur within the boundaries of Iraq[3,4,15,16, 17,16].

Table 1: Descriptive table including minimum, maximum, mean, standard deviation, and standard error in 13 morphometric and meristic characters and ANOVA of all morphometric and meristic characters morphometric and meristic characters in *Echis carinatus sochureki* in two localities included in this study. Significant values ($P < 0.05$) are shown in bold.

Locality (N)		SL	IL	SAE	DS	VS	ScudS	DP	SVL mm.	TL mm.	HL mm.	HW mm.	END	NND	ERD
Thi-Qar province(12)	Range	10-12	12-13	16-19	27-34	171-179	19-30	36-38	280-550	23-50	18.2- 28.7	11.8- 20.7	2.9-4.4	5.06-2.81	4.3- 7.2
	Mean	11.0	12.3	16.8	31.4	173.9	26.5	37.6	402.3	38.9	23.4	15.8	3.6	4.0	5.7
	Std. Deviation	0.4	0.5	0.9	2.5	3.1	2.8	0.65	158.1	8.6	3.8	3.0	0.5	0.6	1.0
	Std. Error	0.1	0.1	0.3	0.7	0.9	0.8	0.18	45.6	2.5	1.1	0.9	0.2	0.2	0.3
Al- Basra(6)	Range	11-13	12-14	16-19	27-34	158-178	30-34	36-38	330-467	33-50	19.2- 23.6	13.6- 19.4	2.5-3.9	2.3-4.7	3.9- 5.9
	Mean	11.8	13.0	18.0	30.3	171.0	32.0	37.6	388.8	39.6	21.0	16.2	3.1	3.7	5.1
	Std. Deviation	0.8	0.7	1.2	2.8	8.2	1.7	0.81	59.2	7.1	1.7	2.4	0.6	1.0	0.8
	Std. Error	0.4	0.3	0.5	1.1	3.7	0.7	0.33	26.5	3.2	0.8	1.1	0.3	0.4	0.4
P		.018	.018	.049	.413	.292	.000	1.0	.477	.878	.201	.801	.161	.431	.260

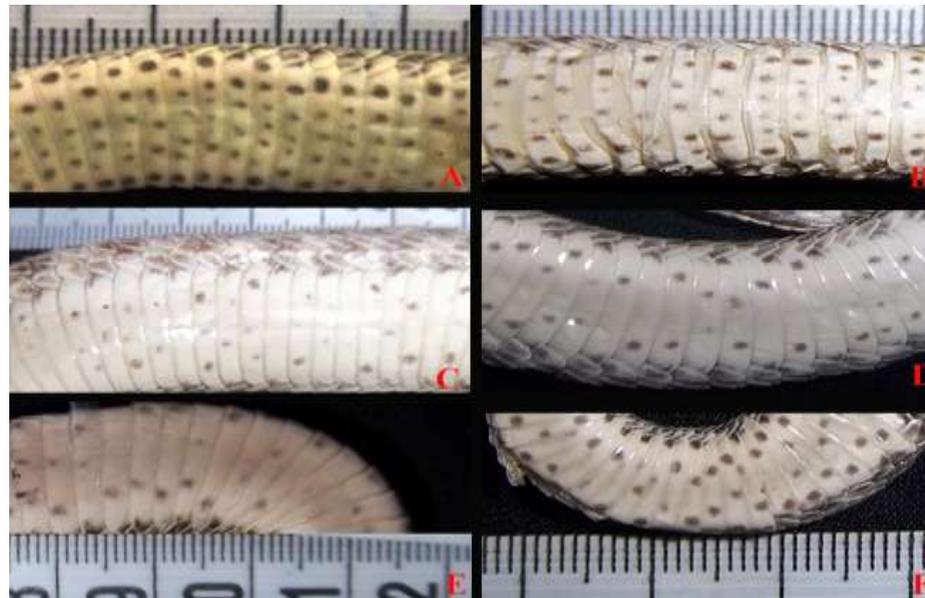


Fig. 2: Ventral pattern categories. (A) deeply pigmented, high intensity spots; (B) dim, small, high intensity spots; (C) no obvious pattern ; (D) medium intensity, large markings; (E) dim, small spots; (F) , large markings; and dark, large markings



Fig. 3: Head pattern categories. (A-B) a modification of the wide arrow type; (C-F) a modification of the cross and narrow cross.



Fig. 4. Dorsal body color pattern. (A) Typical pattern, the density and distribution of melanin in the dorsal blotches most intense; (B) Typical pattern, the density and distribution of melanin in the dorsal blotches least intense; (C) color pattern elements on lateral body surface of Echis

CONCLUSION

As a result, because of there is no hiatus in the studied saw-scaled viper two populations of the southern Iraq and most of the characters we have studied blend completely between them, our conclusion regarding *Echis carinatus* is the name available for this species, and the nominate form is *Echis carinatus sochureki*. More comprehensive study is needed using morphology, ecology and molecular data to clarify the real taxonomic status of this taxon. Our findings also show that taxonomy and distribution of snakes in Iraq need more attention and deserve further studies.

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