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A NEW SPECIES OF ANGULAR-TOED GECKO OF THE GENUS *Cyrtopodion* (SQUAMATA: SAURIA: GEKKONIDAE) FROM SOUTH-EAST IRAN (SISTAN-BALUCHISTAN PROVINCE)

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A new angular-toed gecko was found in South-East Iran. *Cyrtopodion sistanensis* sp. nov. is referred to *C. watsoni* (Murray 1892), *C. scaber* (Heyden, 1827), *C. potoharensis* Khan, 2001 group but differs from these species by morphometric and pholidosis characters as well as color patterns.

Keywords: a new species,angular-toed gecko, *Cyrtopodion* genus, Gekkonidae. South-East Iran.

INTRODUCTION

Nikolai Szczerbak and Mikhail Golubev (1986) made a considerable contribution to taxonomy of the Palearctic angular-toed geckos as 4 distinct group: *Tenuidactylus* Szczerbak et Golubev, 1984; *Cyrtopodion* Fitzinger, 1843; *Mediodactylus* Szczerbak et Golubev, 1984; and Tibeto-Gimalayan group. The validity of genus *Mediodactylus* also have confirmed by genetic analysis (Macey et al., 2000). In 20th – 21th centuries many new species of angular-toed geckos were described mostly from Pakistan (Khan, 1980, 1988, 1993, 2001; Baig, 1998).

Another division scheme of this group was proposed by Khan (2003): genus *Altigekko* Khan, 2003 with *stoliczkai* group; genus *Cyrtodactylus* Gray 1827 with complex *pulchellus*; genus *Siwaligekko* Khan, 2003 with group *tibetanus* (which included some species of genus *Gonydactylus*); genus *Indogekko* Khan, 2003 with *indusoani* (Khan, 1988) group; genus *Cyrtopodion* Fitzinger, 1843 with *scaber* group.

However the majority of modern specialists continue to use the names of two combined genera — *Cyrtopodion* and *Cyrtodactylus*. In our study we will not touch the issues of genera group taxonomy and phylogeny, consolidated under name "*Cyrtopodion*". Conditionally the described taxon we have also placed among genus *Cyrtopodion*.

The generic assignments of the angular-toed geckos of South and Central Asia have undergone a great deal of revision over the last few decades (see Anderson, 1999). In this paper we follow the simplified arrangement presented by Anderson (1999) on Iranian species of this group and we assign new species of angular-toed geckos to the genus *Cyrtopodion*. We also prefer, considering the current taxonomic confusion, not to allocate subgenera.

MATERIAL AND METHODS

The specimens (6 individuals: 3 males and 3 females) collected by authors in South-East Iran from April 18 till May 15, 2005, served as the material for the present study. Collections of Zoological Museum of Moscow State University, Russia (ZMMU); Zoological Institute of St. Petersburg, Russian Academy of Sciences, Russia (ZISP); California Academy of Sciences, San Francisco, USA (CAS); and Museum of Vertebrate Zoology, University of California, Berkeley, California, USA (MVZ) were examined for comparative analysis. Additional 2 males and 2 females damaged by ants are not included into the type series.

For morphological analysis the following characters were used: snout-vent length (SVL, from snout to vent); tail length (Lcd, from vent to the tip of the tail); head length (HeadL, from rostrum to occipital sinus); head width (HeadW, maximum width), head height (HeadH, maximum height); snout to eye distance (SnEye, dis-

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Fig. 1. Holotype of *Cyrtopodion sistanensis* sp. nov. ZMMU R-12390.

Fig. 2. *Cyrtopodion sistanensis* sp. nov. Head, lateral view.

tance between anterior most point of eye and tip of snout); orbital diameter (OrbD, greatest diameter of orbit); ear length (EarL, longest dimension of ear); eye to ear distance (EyeEar, distance from anterior edge of ear opening to posterior corner of eye); trunk length (TrunkL, distance from axilla to groin measured from posterior edge of forelimb insertion to anterior edge of hindlimb insertion); humerus (HL); forearm length (LRU); thigh length (LF); tibia length (LT); fourth finger length (LD4A); fourth toe length (LD4P).

Furthermore, the following characters of pholidosis were used:

number of scales across middle of belly (SAB); number of midventral scales along belly (SLB, between mental and vent); number of subdigital lamellae on fourth finger (SDL4A); number of subdigital lamellae on fourth toe (SDL4P); number of preanal pores (PP); number of supralabials (SL); number of infralabials (IL); number of longitudinal rows of trihedral tubercles on middorsum (RMD); number of trihedral tubercles in longitudinal row (RLD, between occiput sinus and middle of sacrum); number of scales along head (between rostrum and occiput sinus); number of scales across head (between upper border of ears).

The data on vocalization and breeding data are obtained in the laboratory.

Cyrtopodion sistanensis sp. nov.

Holotype. ZMMU R-12390 (Fig. 1). Iran, prov. Sistan-Baluchistan, 90 km W from Zahedan, Nosratabad. 29°50′ N 59°53′ E; 1300 m a.s.l. coll. Roman A. Nazarov and Khosro Radjabizadeh on April 30, 2005.

Paratypes. ZMMU R-12391; ZISP 23954; CAS 233382, 233383. Iran, prov. Sistan-Baluchistan, 90 km W from Zahedan, Nosratabad. 29°50′ N 59°53′ E; 1300 m a.s.l. coll. Roman A. Nazarov and Khosro Radjabizadeh April 30, 2005; ZISP 23953 Iran, prov. Sistan-Baluchistan, 100 km N, N-W from Iranshahr, near Bazman, coll. Roman A. Nazarov and Khosro Radjabizadeh on May 4, 2006. Measurements of holotype and paratypes are presented in Table 1.

Description of holotype. ZMMU R-12390. Adult male. Snout-vent length 56.2 mm. Head relatively long (HeadL/SVL ratio 0.27), wide (HeadW/HeadL ratio 0.69), not markedly depressed (HeadH/HeadL ratio 0.41), distinct from slender neck. Snout elongate (SnEye/HeadL ratio 0.43), pointed; longer than eye diameter (OrbD/SnEye ratio 0.58); scales on snout and forehead small, rounded, granular, homogeneous; scales on snout larger than those on occipital region.

Eye large (OrbD/HeadL ratio 0.25); pupil vertical with crenellated margins; supraciliaries short, bearing tiny conical spines posteriorly. External auricular opening is small (EarL/HeadL ratio 0.11) oval, vertical; eye to ear distance more than diameter of eye (EyeEar/OrbD ratio 1.13).

Width of rostral scale (2.0 mm) is more than its height (1.2 mm), it is divided up to the middle by longitudinal groove; two supranasals are divided by one large scale; rostral in contact with first supralabial, two supranasals; nostrils round, each surrounded by supranasal, rostral, first supralabial, and two enlarged postnasals, about the same size as supranasals.

One row of small scales separates orbit from supralabials (Fig. 2). Mental triangular, height (2, 4 mm) and

width (2.5 mm) are equal; three pairs of enlarged postmentals, first pair in broad contact (Fig. 3); supralabials 10; infralabials 9.

Body is slightly flattened and elongated (trunk/SVL ratio 0.47) with developed ventrolateral folds. Dorsal surface is covered with small granular to weakly conical scales, among which regularly distributed tubercles (10 – 12 times more than adjacent scales) are situated extending from occipital and temporal region on to back and tail base; tubercles in approximately 14 rows at midbody, absent from flanks. Lateral edges of these tubercles are bent; the keel is pronounced.

Ventral scales much larger than dorsal, smooth, subimbricate, with rounded free margins; in precloacal region scales have almost the same size as in the belly; 36 midbody scale rows across belly to base of ventrolateral folds; 142 scales from mental to cloacal opening; gular region with relatively homogeneous, smooth scales. 6 precloacal pores located in a regular row, each pore is situated within a scale of size equal with surrounding scales; no femoral pores and enlarged femoral scales (Fig. 4).

Fig. 3. *Cyrtopodion sistanensis* sp. nov. Mental region.

Fore and hindlimbs moderately long, slender (LRU/SVL ratio 0.46; LT/SVL ratio 0.56); digits are moderately long and thin; on IV finger are 20 subdigital lamellae; on IV toe are 25 subdigital lamellae.

Original tail long, slender, gently tapering to tip; much longer than SVL (Lcd/SVL ratio 1.28); tail with

TABLE 1. Measurement and Pholidosis of Type Series of *C. sistanensis* sp. nov.

	ZMMU R-12390 Holotype	ZMMU R-12391 Paratype	ZISP 23953 Paratype	ZISP 23954 Paratype	CAS 233382 Paratype	CAS 233383 Paratype	RAN-300	RAN-303	RAN-302	RAN-301
Sex	m	f	m	f	f	m	m	f	f	m
SVL	56.2	56	57	55	56	45	55	56	55	56
Lcd	72	58 (1/2reg)	78	*	55 reg.	54	76	60	*	*
HeadL	15.1	15.7	15.2	15.4	15.5	12.9	15.5	15.2	15.2	16.2
HeadW	10.4	10.7	10.7	9.2	10.1	8.7	10.3	10.4	10.3	10.5
HeadH	6.2	6.4	6.4	6.2	6.2	5.2	6.5	6.6	6.4	6.6
SnEye	6.5	7	6.9	6.4	6.5	5.7	6.3	6.5	6.5	6.7
OrbD	3.8	3.8	3.7	3.9	3.6	3.4	3.8	3.8	3.7	3.9
EarL	1.7	1.7	1.5	1.4	1.4	1.4	*	1.4	*	1.7
EyeEar	4.3	4.2	4.3	4	4	3.5	3.8*	4	4*	4.2
TrunkL	26.6	25.4	26.3	23	24	23	23	24.5	24	23.5
HL	10.2	10.6	10	10.1	10.5	6.8	10	10.2	10	10.2
LRU	9.8	10	9.3	9.7	10	8.3	9.9	9.8	9.5	9.5
LF	13.8	14.4	14.5	13.4	13.8	11.8	13.4	13.9	13.3	14.3
LT	10.7	12	11.7	12	12.1	10.2	11.7	12	12	12.4
LD4A	6	5.8	6.2	5.7	5.9	5	5.7	5.7	5.6	5.7
LD4P	7.3	7.4	7.1	7.4	7.8	6.4	7.5	7.5	6.4	7.6
SAB	36	34	44	31	34	36	26*	26*	24*	25*
SLB	142	132	156	132	135	123	143	143	136	120
SDL4A	20	20	19	18	20	20	18	20*	18	*
SDL4P	25	26	23	21	25	23	24	24*	22	23
PP	6	0	6	0	0	6	6	0	0	6
SL	10	10	12	11	10	12	12	11	10	10
IL	9	9	8	9	9	10	6*	10	9	8
RMD	15	14	14	15	14	14	*	14	14*	15*
RLD	24	26	27	26	26	26	29	28	28	28

RAN 300 – 303, field number.

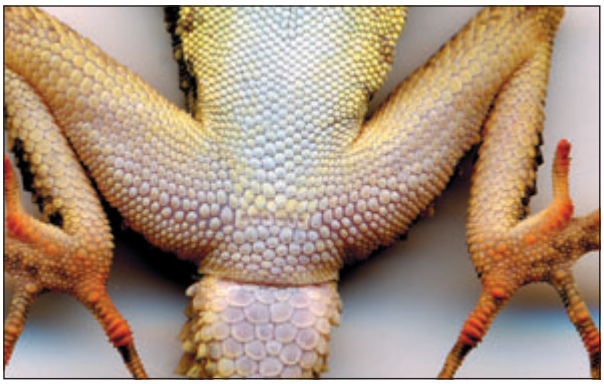

Fig. 4. *Cyrtopodion sistanensis* sp. nov. Preanal pores.

Fig. 6. *Cyrtopodion sistanensis* sp. nov. Ventral side of tail.

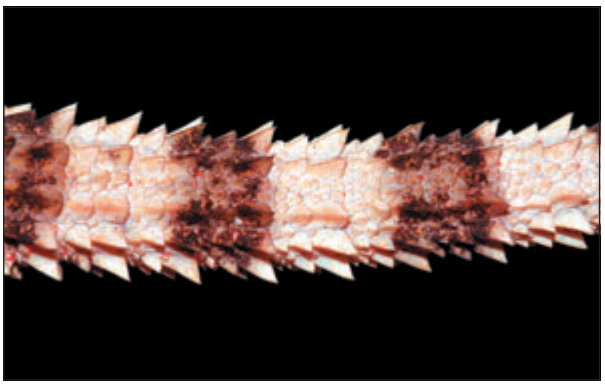

Fig. 5. *Cyrtopodion sistanensis* sp. nov. Dorsal side of tail.

pronounced segments, that were formed by semi-rings of large greatly keeled oblong tubercles, each segment is presented by two such semi-rings — one is main, another (less advanced) is additional (Fig. 5), inferior tail surface is covered with one row of dilated scales, which width is not much larger than its height (Fig. 6), in the ultimate one-third of non- regenerated tail the subcaudal scales are bifid.

Diagnosis. Snout-vent SVL 54 – 57 mm, tail length Lcd 68 – 78 mm; large strongly keeled trihedral dorsum tubercles forming 14 – 16 longitudinal rows at midbody, 24 – 29 tubercles from occiput to the middle of sacrum; tail with pronounced segments, that were formed by semi-rings of large greatly keeled oblong tubercles, on each segment there are by two such semi-rings — the main, and additional (less advanced), subcaudal plates are situated in single median series, width is not larger than its height, in the ultimate one-third of non-regenerated tail the subcaudal scales are bifid; 24 – 42 abdominal scales across middle of belly, 120 – 156 midventral scales along trunk. Males have 6 highly pronounced preanal pores that are located in a regular row on scales, having in a practical manner no size difference from not large and uniform surrounding scales. 9 – 10 infralabial scales, 10 – 12 supralabial. Mental plate is large, 3 – 4 pairs submental scales, first pair in broad contact.

Coloration. The lower body surface is white or yellowish; there are 7 – 8 transverse dark bands on the dorsum, made by separate oblong spots. There are 12 dark stripes on tail, interspaces between which are something bigger or equal to the width of stripes themselves. The head pattern is usually not so clear pronounced and formed by small dark spots of irregular form. From back edge of eye above auricular opening there is a close-cut dark stripe, which closes from both sides in occipital region. Sometimes this stripe is modified into separate spots and not clearly visible. Dorsal body coloration alters from deep-brown to light gray depending on physiological state of an individual, particularly on body temperature. Preserved specimens usually have light gray color.

Distribution (Figs. 7 – 8). We found new species in two localities: in type locality and in 100 km N, N-W from Iranshehr, near Bazman.

Localities of *C. sistanensis* are situated in the mountains separating Sistan depression and Lut desert. The same mountain system is connecting the south part of Khorasan. Apparently, this species is distributed throughout whole S-E Iran, and it is possible to be found in the central provinces of Iran (Kerman, Yazd) and in bordering regions of Pakistan as well.

Variability. The only male found in surroundings of Bazman, differs from individuals from Nosratabad by reddish coloration and smaller scales in the belly. No other considerable differences were recorded.

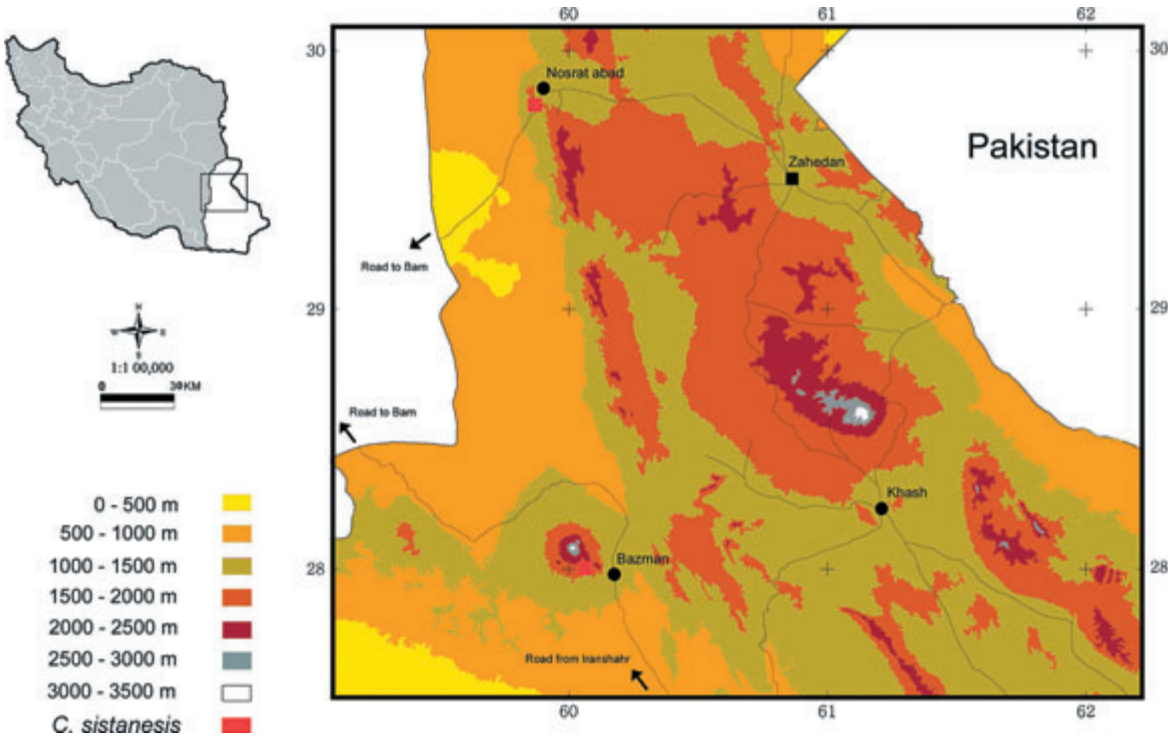

Fig. 7. Distribution of *Cyrtopodion sistanensis* in Iran.

Habitat (Fig. 9). The habitat of *C. sistanensis* is represented by very dry low clay hills with poor shrubby vegetation typical for Southern Iran. They were mainly compounded by sedimentary rocks.

In the area of Bazman its habitat differs from the type locality and represented by small, more humid intermountain valley, filled by coarse-grained alluvium and covered with rather dense shrub vegetation. One of the valley's sides was formed by clayey hills composed by sedimentary soil with rocky outcrops.

Natural history. A little is known about natural history of new species as well as about other reptiles of this region. Geckos inhabit vertical surfaces with plenty of refuges. They were registered at the daytime, just before the sunset and in the morning at 10 – 12 a.m. Activity was decreased at night.

In the same biotope we found following sympatric reptiles: *Trapelus agilis* (Oliver, 1804); *Laudakia nupta* (De Filippi, 1843); *Mesalina watsonana* (Stoliczka, 1872); *Eumeces shneideri zarudnyi* (Nikolsky, 1900); *Pseudocerastes persicus* (Duméril and Bibron, 1854). (Ident. R. A. Nazarov), and *Cyrtopodion* cf. *agamuroides*.

Cyrtopodion cf. *agamuroides* is a species which occupied the same ecological niche with *C. sistanensis*, living sympatrically and symbiotopically. However, these two species have different daily activity. *C. agamuroides*' activity is significantly shifted in a night time, on the surface these geckos appear in darkness, till the midnight the activity falls down, and in the morning

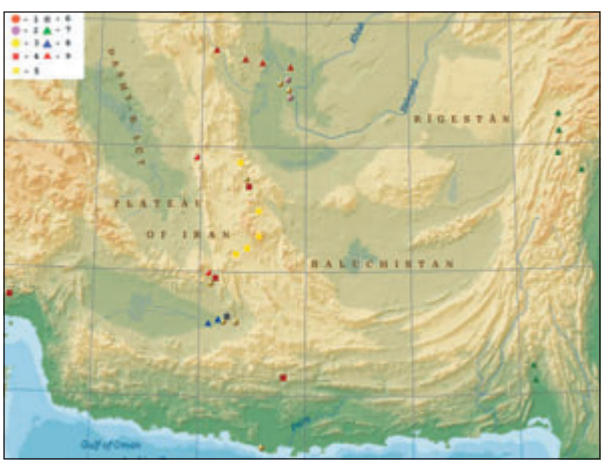

Fig. 8. Distribution of angular-toed gecko of genus *Cyrtopodion* in South Iran and South Pakistan: *1*, *C. sistanensis* sp. nov.; *2*, *C. r. zarudnyi*; *3*, *C. scabrum*; *4*, *C. agamuroides*; *5*, *C. kirmanensis*; *6*, *C. brevipes*; *7*, *C. watsoni*; *8*, *C. sagittifer*; *9*, *C. l. longipes*.

Fig. 9. Habitat of *Cyrtopodion sistanensis*, near Nosratabad, Sistan-Baluchistan province.

(3 – 4 a.m.) is again increasing for a short period. In a day time we have not noticed this species. Most likely, that the activity of that species as well as others can vary during the year.

C. sistanensis have poorly developed acoustic signals — it is short series of quiet clicks, hearing only on 1 – 2 m distance.

During a reproduction period male's vocalization is most active, because they use acoustic signals for marking individual territory and attracting female.

The structure of acoustic signals is not constant, that testifies to the poor development of this communication channel.

On the base of preliminary data we select two main types of signals which are resulted in Fig. 10.

DISCUSSION

C. sistanensis undoubtedly belongs to "*scaber*" group but has a number of differences from close related species (*C. scaber*, *C. kachhensis*, *C. brevipes*) and other species of angular-toed geckos that can be found in this region:

1, largeness of trunk and tail, respectively;

2, smaller scales in the bottom;

3, a relatively longer extremities, than "*scaber*";

4, a line of preanal pores is located in one regular diametrical line;

5, a well-developed additional semi-ring in tail segments.

Table 2 shows the results of comparison of all the species of angular-toed geckos of this region. Besides, the new species strongly differs from *C. scaber* (Heyden, 1827) by its behavior and locomotion: *C. sistanensis* moves not fast raising body a little above the substrate, while *C. scaber* on the contrary, moves much swiftly, pressing oneself close to the substrate.

Unfortunately, we had no opportunity to familiarize in details with *C. watsoni* (Murray, 1892), but according to the data published we consider *C. watsoni*, *C. potoha-*

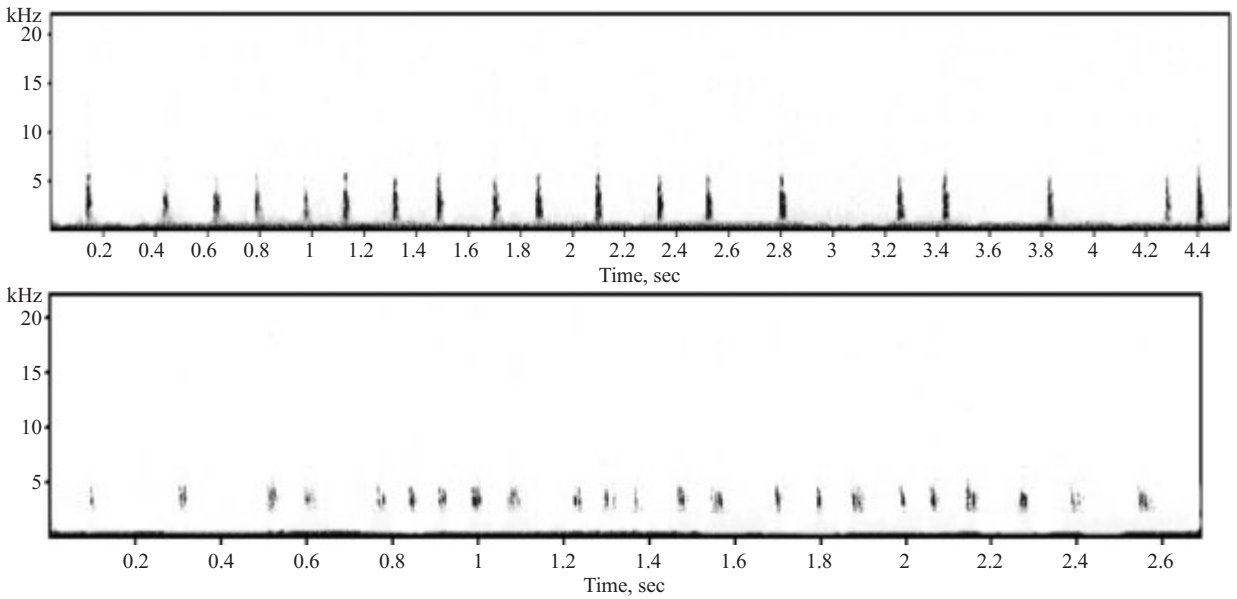

Fig. 10. Sonograms of two different type of signals *C. sistanensis*.

TABLE 2. Comparison of Morphological Characters of Palearctic Bent-Toed Gekkonids from Iran and Neighboring Countries

Species	1	2	3	4	5	6	7	8
C. sistanensis sp. nov.	57/78	31 – 44/120 – 156	6	14 – 15	S	2	3 – 4C	5 – 8/11 – 12
C. potoharensis (Khan, 2001)	52/64	25 – 35/121 – 145	5 – 12	12 – 15	S	2 (?)	(?)	5 – 8/10 – 12
C. watsoni (Murray, 1892)	53/63	30 – 40/140 – 170	5 – 9	12 – 13	S	2	2 – 3C	5 – 8/10 – 12
C. kachhensis (Stoliczka, 1872)	46/45	28 – 35/100 – 128	4 – 8	12 – 14	D	3	3C	4 – 5/7 – 10
C. k. ingoldbyi (Khan, 1997)	53/65	32 – 40/149 – 156	4 – 6	14 – 16	D	3	3C	4 – 6/7 – 10
C. scaber (Heyden, 1827)	53/62	16 – 23/85 – 120	4 – 7	12 – 13	S	2	2 – 3C	5 – 8/7 – 10
C. brivipes (Blanford, 1874)	44/*??*	20 – 22/(?)	4	10	S	2 (?)	(?)	8/12
C. kirmanensis (Nikolsky, 1900)	51/40	26 – 30/120 – 132	4	8 – 10	D-M	3	3 – 4C	8/10
C. sagittifer (Nikolsky, 1899)	32/40	19 – 24/83 – 98	4	10 – 12	D	2	1 – 2C	5 – 6/(?)
C. russowii zarudnyi (Nikolsky, 1900)	34/45	25/102	2	10 – 12	*??*	2	2D	6 – 8/10 – 12
C. agamuroides (Nikolsky, 1900)	40/50	28 – 30/120	2	10 – 12	M	3	2C	7/13
C. cf. *agamuroides*	52/73	23 – 28/115 – 126	4	10	S	2	2 – 3C	5 – 7/7 – 8
C. gastropholis (Werner, 1917)	50/55	14 – 18/84 – 94	4	10	S-D?	2 (?)	3D	6 – 8/10 – 13

Abbreviations. 1, snout-vent length/tail length (mm); 2, scales across belly/midventrals; 3, preanal pores; 4, number of longitudinal rows of dorsal tubercles; 5, subcaudals (M — small scales; S, single row of transversally enlarged subcaudals; D, double row of subcaudals); 6, number of subcaudal per segment; 7, postmentals (C, first pair in contact; D, first pair divided); 8, number of transversal stripes on trunk and tail.

rensis (Khan, 2001), and *C. sistanensis* to be the closest species.

In description of *C. watsoni* (Murray, 1892) it is indicated that "the fore leg laid forward reaches the tip of the snout, and the hind leg to the occiput". The laid forward forelimb of *C. sistanensis* is significantly longer and it reaches the tip of the snout by its carpus. According to the description and illustration, *C. watsoni* differs from a new species by the dorsum pattern (all the literature data indicate M-shaped stripes). On the picture, provided in the monograph of Szczerbak and Golubev (1986, p. 189), these stripes are evident and they differ from the dorsum pattern of a new species.

Unlike *C. potoharensis* (Khan, 2001), possessing V-shaped pores row (pores are located within enlarged scales), a new species has pores located in a regular line and on scales, that has no size difference from the surrounding.

Natural habitat of *C. sistanensis* and *C. potoharensis* are geographically separated, *C. potoharensis* distributed in the N-E, E Pakistan, in ~1500 km from our species. As for other species of this group *C. kachhensis* (Stoliczka, 1872), *C. scaber* (Heyden, 1827), and *C. brivipes* (Blanford, 1874), the first species, in contrast to *C. sistanensis* is something smaller and possesses a double of subcaudals (pholidosis differences can be found in Table 2).

C. scaber (Heyden, 1827) is also something smaller, extremities are shorter, abdominal scales are larger, additional ring on tail segments or absent, or poorly developed, and the last scales row in femur inferior surface is obviously larger than others.

C. brevipes (Blanford, 1874) — this enigmatic species, known only from the type locality in Iran Baluchistan (Jaz Murian), obviously differs by pholidosis and size from our species.

It's is interesting to note that *C. sistanensis* was shown in the book "The lizards of Iran" (plate 8, Photograph Milan Kaftan) like *C. turcmenicum* Szczerbak.

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