

The snake fauna of Khabr National Park, southeast of Iran

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Khabr National Park and Ruchun Wildlife Refuge are situated in the southeast of Iran, Kerman Province. Although snakes are an important group in the studied area, little is known regarding their diversity. The present study was carried out from March 2009 to late summer 2010. In this study, 74 specimens were collected (or observed) and identified, belonging to four families, 14 genera, and 17 species, including Typhlopidae: *Typhlops vermicularis*; Colubridae: *Boiga trigonatum melanocephala*, *Hemorrhois ravergieri*, *Lytorhynchus diadema gaddi*, *Lytorhynchus ridgewayi*, *Platyceps rhodorachis ladacensis*, *Platyceps ventromaculatus ventromaculatus*, *Psammophis schokari*, *Pseudocyclophis persicus*, *Spalerosophis diadema cliffordii*, *Spalerosophis microlepis*, *Telescopus rhinopoma*, *Eirenis punctatolineatus*; Viperidae: *Echis carinatus sochureki*, *Macrovipera lebetina cernovi*, *Pseudocerastes persicus*; Elapidae: *Walterinnesia morgani*. The records of *Spalerosophis microlepis*, *Lytorhynchus diadema gaddi*, *Pseudocyclophis persicus* and *Walterinnesia morgani* are reported for the first time from southeast of Iran.

Key words: Diversity, Snake fauna, Khabr National Park, Conservation, Iran

INTRODUCTION

The definition and establishing of the protected areas in different categories (national parks, protected, natural and non-hunting areas) is one of the initially and important step in conservation policy of biological diversity. Therefore, understanding the different characteristics of these areas such as; biological diversity, ecological capacity, and gene pools seem to be an essential background in order to applying a better conservational management (Dixon and Sherman, 1990). Several researchers have surveyed the snakes of Iran; among them Mahmoud Latifi (1991, 1992, 2000) compiled a handbook "The Snakes of Iran". Latifi has published on venoms and Iranian venomous snakes (Latifi and Manhoury, 1966; Latifi and Farzanpay, 1973; Latifi, 1975, 1984). Mehdi Rai (1965) wrote his dissertation on Iranian Colubrid snakes. Nilson and Andren, (1984) published a study of the Iranian ratsnakes of the *Elaphe longissima* complex, systematic of the *Vipera xanthina* complex in Iran and herpetofauna of Kavir-Schutzgebietes, and Kavir-Wüste (1981). In recent years, Iranian researchers such as Karimi et al. (2001), Esmaceli (2003), Shafiei et al. (2004), Hojjati et al. (2005), Rajabizadeh et al. (2006, 2007), Kazemi et al. (2007), Bostanchi et al. (2006), Kami et al. (2007), Rastegar-Pouyani et al. (2008), Fathinia et al. (2010), have done valuable surveys on the snake fauna of the Iranian Plateau. The present study was the second carried out on the herpetofauna of Khabr

National Park, southeastern Iran and its purpose was to determine the snake fauna, their habitats and distributions.

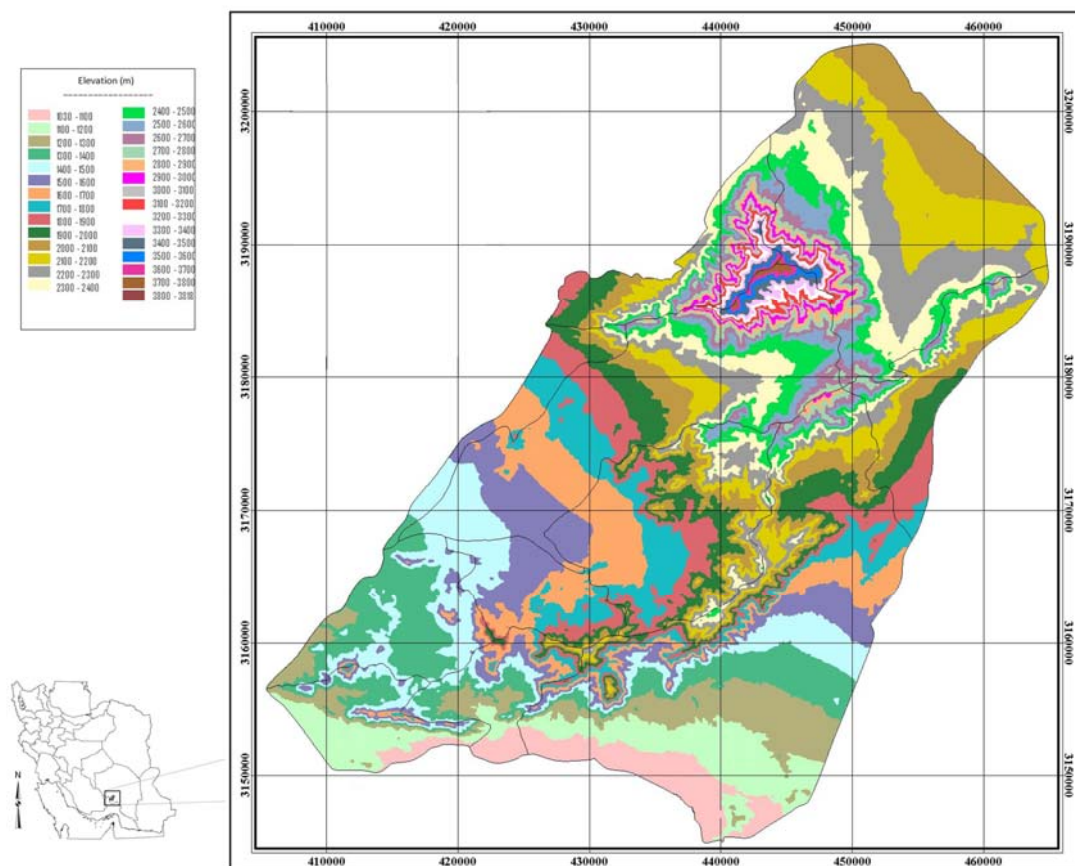


FIGURE 1. Khabr National Park in Kerman province, southeast of Iran.

MATERIAL AND METHODS

Geographical and Ecological Situation of Khabr National Park

The Khabr National Park and Ruchun Wildlife Refuge with a total area of 1799.52 km² are located in the southeast of Iran, Kerman Province (Fig. 1). These areas extend from 28° 28' to 28° 58' N and from 56° 02' to 56° 38' E. Based on Najmizadeh 2006, the highest point is the Great Mount Khabr (c. 3845 m asl) and its lowest point around c. 1000 m asl, in the south of the area, also the terrains comprise of 50% plain, 42% mountainous and 8% hillsides and four types of climates were recognized: cold and arid, semi-arid cold, temperate arid and moderate hot desert. The most widespread climate type belongs to the semi-arid cold climate (Najmizadeh, 2006). Climate variability and elevation diversity of the region led to the formation of various ecological systems, the emergence of different and suitable habitats and, consequently, animal and plant diversity is significant.

Field and Laboratory Methods

The studied area was divided into seven stations, so that all existent habitats were covered (Fig. 2). Sampling was performed during March 2009 to September 2010. Snakes were collected using snake hook and their photos were taken. In the field, coordinates of the sampling location was determined using the Global Positioning System (GPS) and information regarding weather conditions, habitat

profile, hours of activity and behavior of species were recorded. Specimens were preserved in 80% ethanol in the Zoological Museum of Shahid Bahonar, University of Kerman (ZMSBUK). Meristic characters were counted using stereo-microscope. Morphometric characters were measured using a ruler (to the nearest 1 mm). Species identification was performed using identification keys of snakes (Latifi, 2000; Leviton et al., 1992; Bagherian et al., 2008; Bostanchi et al., 2006; Göçmen et al., 2006; Kark et al., 1997; Rai, 1978; Rastegar-Pouyani et al., 2008; Schätti et al., 2009).

Abbreviations Used In The Text:

Metric characters: SVL: snout-vent length; TL: tail length.

Meristic characters: When counting dorsal scales, numbers are often given for three points along the body, for example 19:21:17. These numbers correspond to the number of dorsal scales around the body at a head's length behind the head, at midbody and at a head's length before the vent (Campbell et al., 2004).

RESULTS

A total of 74 specimens were collected or observed in the study area comprising 17 species belonging to 14 genera and four families. Captured species are as follows: Ten species aglypha, four venomous, and three are opisthoglypha. The record of *Lytorhynchus diadema gaddi*, *Pseudocyclophis persicus*, *Spalerosophis microlepis* and *Walterinnesia morgani* from the study area is the first report of these species from southeastern Iran. The distribution of the studied species and their habitat are presented in Figs. 2 and 5. In this study, two specimens [*Eirenis punctatolineata*? (Fig. 4E), and *Walterinnesia morgani*] just observed and taken images by two gameguards in a stony-graveled plain, southwest of the study area (Fig. 5A).

SYSTEMATIC ACCOUNT

Family Typhlopidae

Typhlops vermicularis Merrem, 1820 (Fig. 3A)

Description: Head not distinct from neck, with large rostral, nasal, ocular and preocular shields; ventral scales do not differ from dorsals; the tail is very short, with a spinous sharpening at the tip. 4 supralabials; 1 preocular; 24:24:22 smooth scales around the body; SVL: 235 mm; TL: 5 mm. Body color is pink.

Distribution: Khabr village in west, and eastern foothills (Fig. 5B).

Habitat: Two specimens were observed and one collected, at 1900-2000 m asl. This species lives under stones and its habitat comprises sandy, clay plains, alluvial fans and mountainside. The vegetation dominated by *Pistacia atlantica*, *Artemisia sp.*, and *Amygdalus scoparia* (Figs. 2 S₁, 2S₂).

Family Colubridae

Boiga trigonatum melanocephala (Annandale, 1904) (Fig. 3B)

Dipsadomorphus trigonata melanocephala Annandale, 1904: 209 (Type locality: Baluchistan, Iran).

Description: The head is distinctly separated from the compressed body. One supraocular; one preocular; 2 postoculars; 21 scales at midbody; 8 supralabials; 11 infralabials; temporals in 2+2; anal undivided; subcaudals: 82. SVL: 180 mm; TL: 70 mm. Body color like *E. carinatus* with black head.

Distribution: Southeast of study area (Fig. 5C).

Habitat: One young specimen was collected in stony-graveled plains; at c. 1100 m asl. Average Annual temperature is c. 21°C. The vegetation is dominated by xerophytic plants, such as *Zizyphus spina* (Fig. 2S₃).

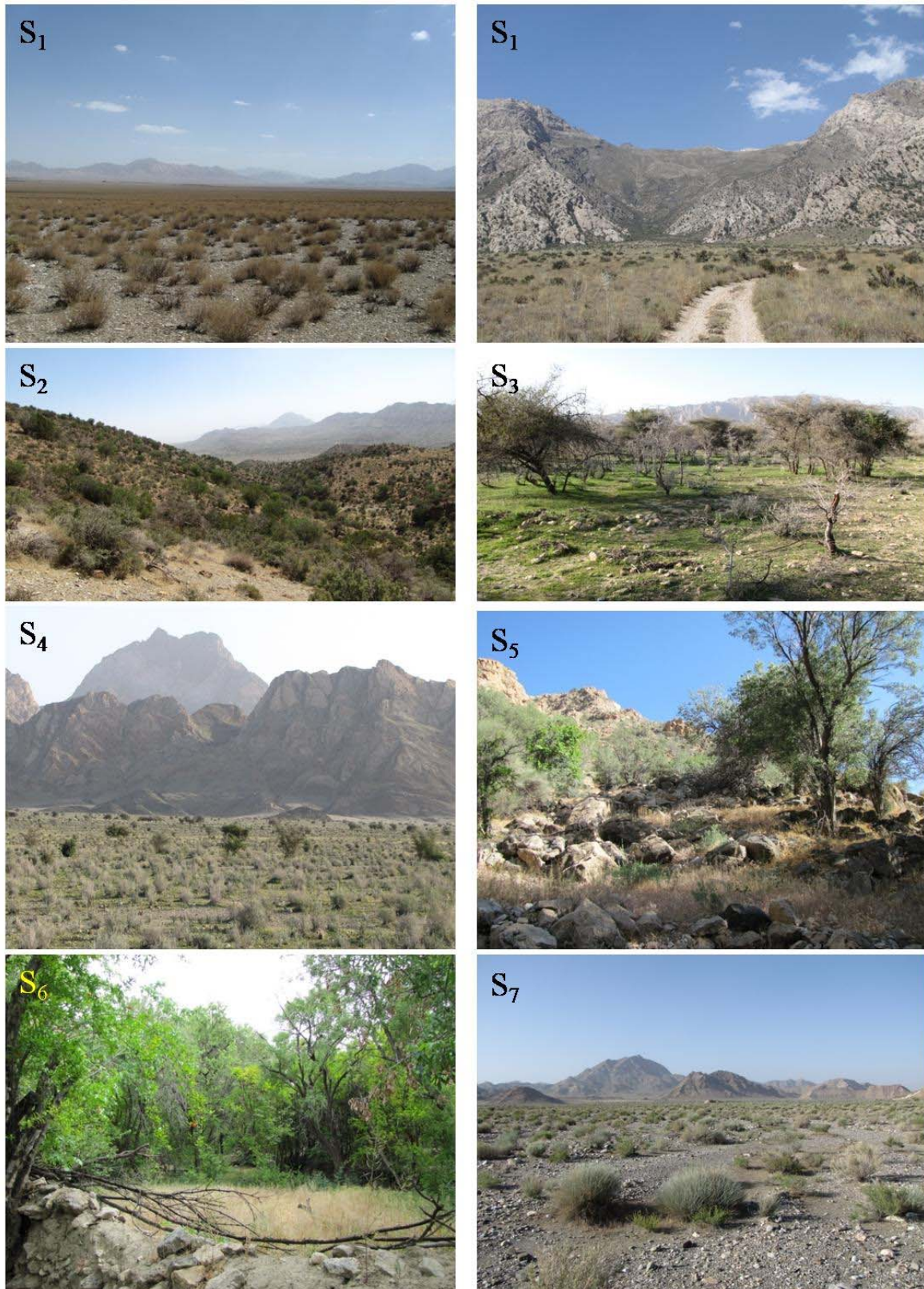


FIGURE 2. Sampling stations and habitats.

***Hemorrhoids ravergeri* (Ménétriés, 1832)** (Fig. 3C)

Coluber ravergeri Ménétriés, 1832: 62 (Type locality: Baku).

Description: Head elongated and distinct from the neck. Dorsal scales in 21:21:15 longitudinal rows; 9 and 8 supralabials at left and right respectively; 10 infralabials; the loreal scale is divided (loreal scale and 2 transversely arranged subloreal); 2 postoculars; 2 preoculars; 1 subpreocular; 4 rows of gulars between the posterior chin shields and the first ventral; ventrals: 204; anal divided; subcaudals: 84. SVL: 750 mm; TL: 195 mm. Dorsal color is grayish-brown with darker spots, venter whitish.

Distribution: Northern foothills and mountainsides (Fig. 5D).

Habitat: Four specimens were observed and one was collected, at 1800-2300 m asl. Their habitat consisted of graveled and sandy clay soil. The vegetation dominated by *Pistacia atlantica*, *Artemisia sp.*, and *Amygdalus elaeagnifolia* (Figs. 2S₁, 2S₃).

***Lytorhynchus diadema gaddi* Nikolsky, 1907** (Fig. 3D)

Lytorhynchus gaddi Nikolsky, 1907: 294 (Type locality: Dezful, Khuzistan, Iran).

Description: Rostral narrowly truncate anteriorly. Dorsal scales in 23:19:17 longitudinal rows; 2 prefrontals; 7-8 supralabials left and right respectively; 10 infralabials; temporals in 3+3 at right and 2+3 scales in left; ventrals: 176; anal undivided; subcaudals: 48. SVL: 330 mm; TL: 65 mm.

Dorsal is brownish pink with brown spots, venter whitish.

Distribution: Northern plain (Dashtab plain) (Fig. 5E).

Habitat: One female specimen was collected at c. 2100 m asl. in the transitional area between a mountainside and alluvial fans. This area belongs to the Irano-Turanian steppe with desert climate and sandy clay soil. The vegetation is dominated by *Artemisia aucheri* (Fig. 2S₁).

***Lytorhynchus ridgewayi* Boulenger, 1887** (Fig. 3E)

Lytorhynchus ridgewayi Boulenger, 1887: 413 (Type locality: Chinkilok, Afghanistan).

Description: Rostral shield broadly truncate, as broad at its base as its width at its anterior most projection; 1 prefrontal; dorsal scales in 21:21:17 longitudinal rows; 8-7 supralabials left and right respectively; 12-11 infralabials left and right respectively; temporals in 2+3; ventrals: 176; anal undivided; subcaudals: 48. SVL: 365 mm; TL: 70 mm. Dorsal is brownish-pink with brown spots, venter whitish.

Distribution: Northern plain (Dashtab plain) (Fig. 5F).

Habitat: One male specimen was collected in sandy clay plains, at c. 2200 m asl. The vegetation is dominated by *Artemisia aucheri* and *Cousinia stocksii* (Fig. 2S₁).

***Platyceps rhodorachis ladacensis* (Jan, 1865)** (Fig. 3F)

Zamenis rhodorachis Jan, 1865: 356 (Type locality: Persia).

Description: Long, narrow, and cylindrical body with distinct elongated head, long tail with very gradual taper with a fine tip. Dorsal scales in 19:19:13 longitudinal rows; 1 loreal; 1-3 postoculars; 2 preoculars; 9 supralabials; 10-11 infralabials, the first 4-5 in contact with anterior chin shield; temporals in 2+2 or 2+3; 3-5 rows of gulars between the posterior chin shields and the first ventral; ventrals: 220-222; anal divided; subcaudals: 102. SVL: 830-875 mm; TL: 270 mm (the second specimen with incomplete tail). Anterior of dorsum is gray with dark mottles; posterior is uniformly light gray, venter whitish.

Distribution: The species is distributed throughout the study area (Fig. 5G).

Habitat: Five specimens were observed and two were collected in graveled and sandy clay plains, at 1100-2100 m asl. The vegetation is dominated by xerophytic plants, such as, *Artemisia sp.*, *Acantholimon sp.*, and *Zizyphus spina* (Figs. 2S₁, S₃, S₄, S₇).

***Platyceps ventromaculatus ventromaculatus* (Gray, 1834)** (Fig. 3G)

Coluber ventrimaculatus Gray, 1834: pl. 80. (Type locality: not stated).

Description: Body shapes the same as *P. rhodorachis ladacensis*. Dorsal scales in 21:19:13 longitudinal rows; 1 loreal; 2 pre and 2 postoculars; 9 supralabials; 10 infralabials, the first 4 in contact with anterior chin shield; temporals in 2+3; 6 rows of gulars between the posterior chin shields and the first ventral; ventrals: 213; anal divided; subcaudals: 122. SVL: 640 mm; TL: 255 mm. Anterior of dorsum is light olive with dark mottles; posterior is uniformly light olive, venter whitish.

Distribution: Central and northern foothills (Fig. 5H).

Habitat: Six specimens were observed and one was collected, at 2000-2500 m asl. Their habitat consisted of boulders, graveled and sandy clay soil. The vegetation is dominated by *Pistacia atlantica*, *Artemisia sp.*, and *Cousiniga stocksii* (Fig. 2S₂).

***Psammophis schokari* (Forsskal, 1775)** (Fig. 3H)

Coluber schokari Forsskal, 1775: 14 (Type locality: Yemen).

Description: Slender, long, cylindrical body with distinct narrow head. Stripe pattern is "Rear-Striped". Dorsal scales in 17:17:13 or 17:17:11 longitudinal rows; 2 internasals; 2 postoculars; 9-10 supralabials; 11 infralabials, the first 5 in contact with anterior chin shield; temporals in 2+2; ventrals: 182-183; anal divided; subcaudals: 120-121. SVL: 750-800 mm; TL: 340-350 mm. Dorsal color is brown, non-striped, dotted, light dotting, venter whitish yellow.

Distribution: The species is distributed throughout the study area (Fig. 5I).

Habitat: Six specimens were observed and two females were collected. Its habitat comprises stony-graveled plains, alluvial fans, foothills and mountains, at 1200-3500 m asl. Vegetation type consists of *Artemisia aucheri*, *Cousinia stocksii*, *Amygdalus elaeagnifolia*, *Pistacia atlantica*, and *Amygdalus scoparia* (Figs. 2S₁, S₂, S₃, S₄, S₇).

***Pseudocyclophis persicus* (J. Anderson, 1872)** (Fig. 4A)

Cyclophis persicus J. Anderson, 1872: 392 (Type locality: Bushir, Iran).

Description: Rostral nearly twice as broad as deep, just visible from above. 1 pre- and 1 postocular; dorsal scales in 15:15:11 longitudinal rows; loreal absent; 7 supralabials; 7 infralabials; Temporals in 1+1; ventrals: 196; anal divided; subcaudals: 41. SVL: 225 mm; TL: 40 mm. Dorsal color brick-whitish with dark transverse bands from nape to the tip of tail reaching the venter.

Distribution: The species is distributed throughout the study area (Fig. 5J).

Habitat: Six specimens were observed and one male was collected. Habitat looks like *P. schokari*. This species is widely distributed in the study area, at 1100-2300 m asl (Fig. 2S₁, S₇).

***Spalerosophis diadema cliffordii* (Schlegel, 1837)** (Fig. 4B)

Coluber cliffordii Schlegel, 1837: 63 (Type locality: Tripoli, Libya).

Description: One row of scales located between prefrontal and frontal shields. Nine scales round the eye; dorsal scales in 25:27:17 longitudinal rows; 10-13 supralabials; 12-13 infralabials; ventrals: 226-227; anal divided; subcaudals: 83-85. SVL: 875-1120 mm; TL: 230-250 mm. Dorsal brown with quadrilateral spots, venter light buff.

Distribution: Southern foothills and plains (Fig. 5K).

Habitat: Six specimens were observed and two males were collected in stony-graveled plains, at 1000-1100m asl. Average Annual temperature is c. 22°C. The vegetation is dominated by xerophytic plants, such as *Zizyphus spina* and *Artemisia aucheri* (Fig. 2S₇).

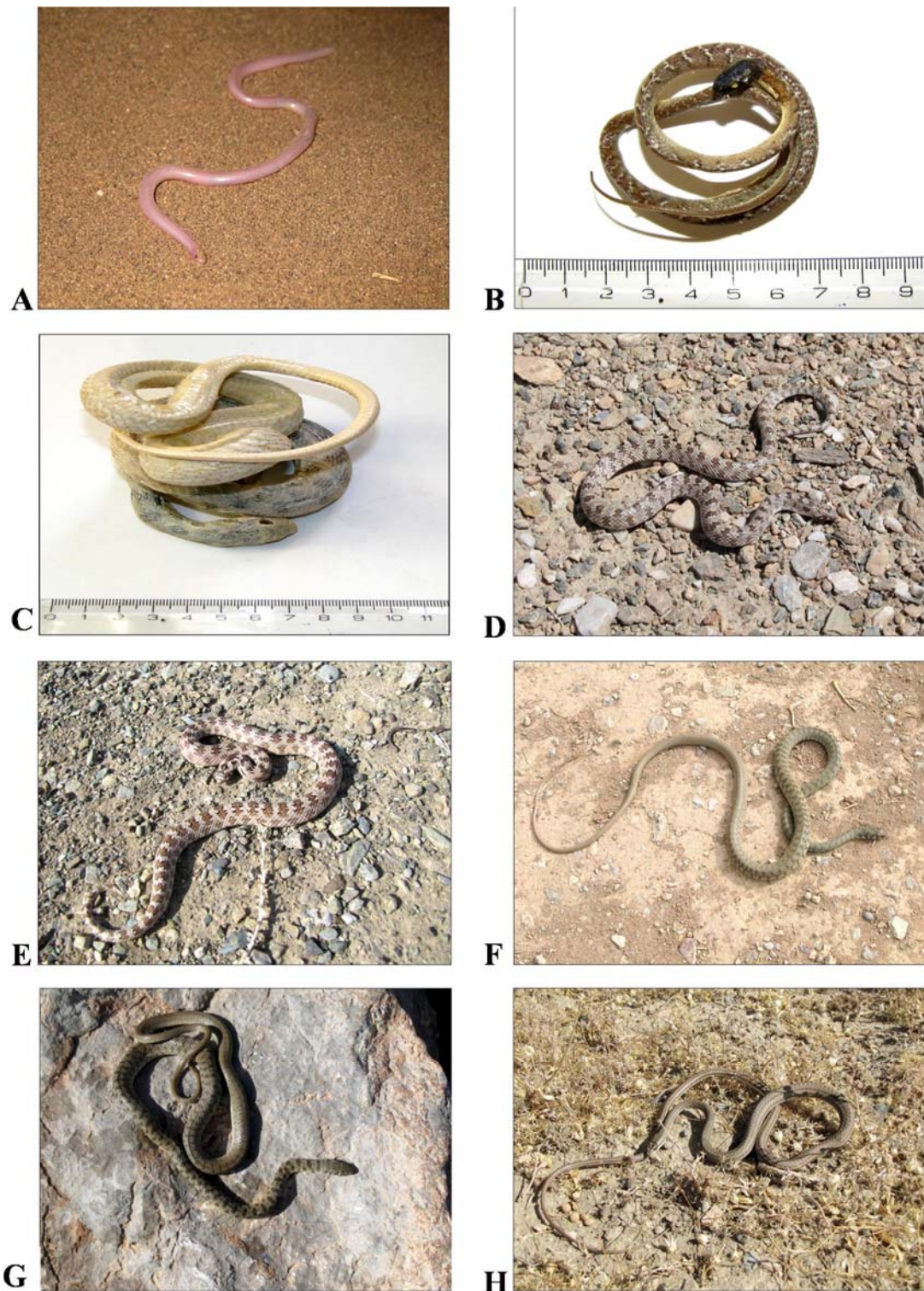


FIGURE 3. Photographs of the species in Khabr national park: (A) *Typhlops vermicularis*, (B) *Boiga trigonatum melanocephala*, (C) *Hemorrhois ravergieri*, (D) *Lytorhynchus diadema gaddi*, (E) *Lytorhynchus ridgwayi*, (F) *Platyceps rhodorachis ladacensis*, (G) *Platyceps ventromaculatus ventromaculatus*, (H) *Psammophis schokari*.

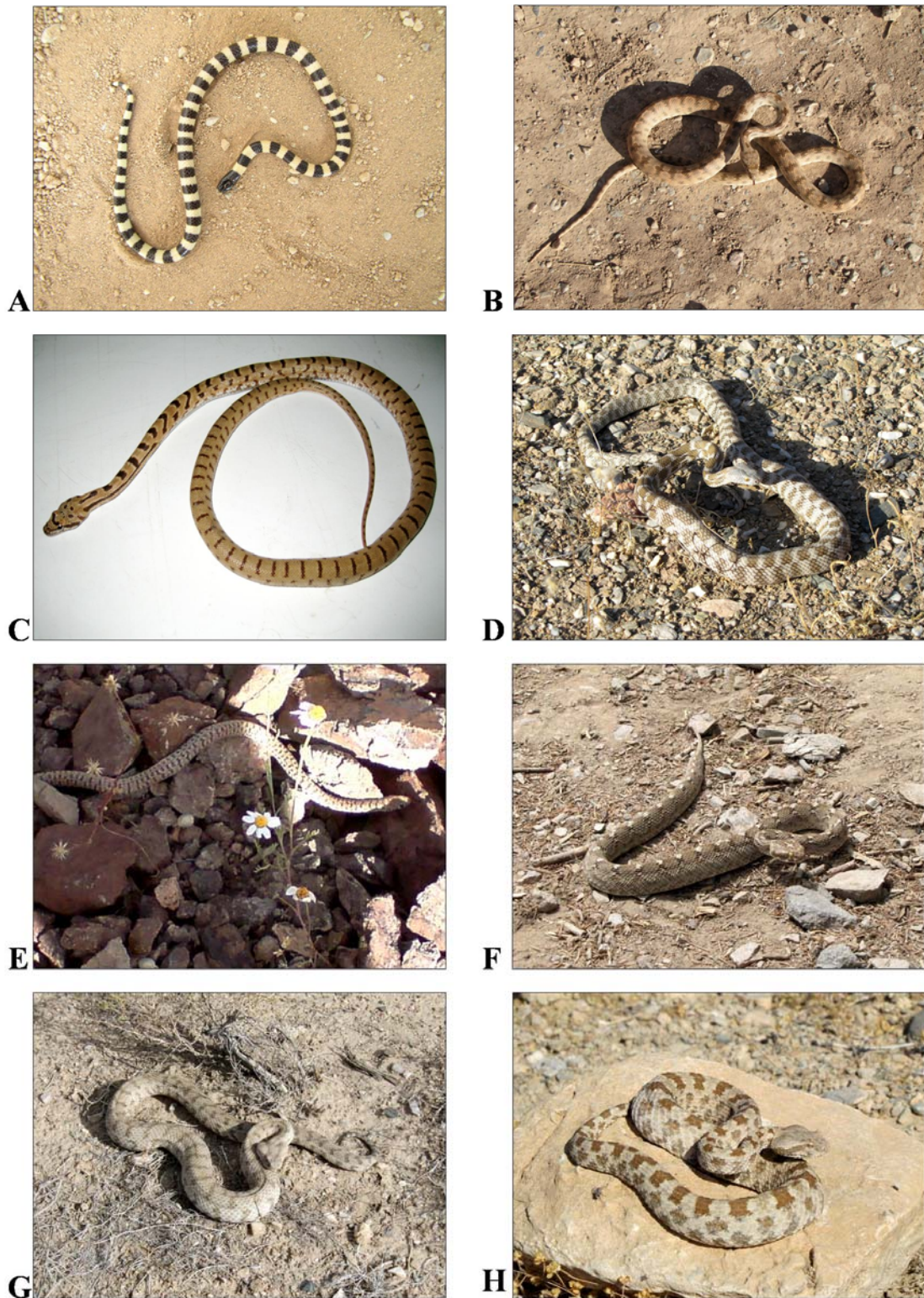


FIGURE 4. Photographs of the species in Khabr national park: (A) *Pseudocyclophis persicus*, (B) *Spalerosophis diadema cliffordii*, (C) *Spalerosophis microlepis*, (D) *Telescopus rhinopoma*, (E) *Eirenis punctatolineatus*? (Photo by Amin Shamsavan) (F) *Echis carinatus sochureki*, (G) *Macrovipera lebetina cernovi*, (H) *Pseudocerastes persicus*.

***Spalerosophis microlepis* Jan, 1865** (Fig. 4C)

Spalerosophis microlepis Jan, 1865: 356 (Type locality: Larestan, Iran).

Description: Internasal-prefrontal area covered with several scales including two enlarged internasals. Dorsal smooth scales in 38:41:24 rows; 14-13 scales (right and left) round the eye; loreal 8-7 left and right respectively; 13-14 supralabials left and right respectively; 14 infralabials, the first 5 in contact with anterior chin shield; 8 anterior temporals; ventrals: 255; anal undivided; subcaudals: 90. SVL: 685 mm; TL: 140 mm. Dorsal color is light brown with dark transverse spots, two dark strips on the side of neck, venter light yellow.

Distribution: Eastern foothills and mountainside (Fig. 5L).

Habitat: One young specimen was found at c. 2345 m asl. This habitat is located in the east of study area with graveled-loamy soil. The vegetation is dominated by *Pistacia atlantica*, *Artemisia sp.*, and *Amygdalus scoparia* (Fig. 2S₂).

***Telescopus rhinopoma* (Blanford, 1847)** (Fig. 4D)

Dipsas rhinopoma Blanford, 1874: 34 (Type locality: Kerman, Iran).

Description: The head is covered with large regular shields and clearly distinct from the body. Dorsal scales in 23:23:17 longitudinal rows; 8-9 supralabials left and right respectively; 12 infralabials; temporals 3+4 in left and 2+3 in right; ventrals: 270; anal divided; subcaudals: 83. SVL: 630 mm; TL: 140 mm. Dorsal color is brownish-gray with dark rhomboid spots, venter sleek gray.

Distribution: Northern plain (Dashtab plain) (Fig. 5M).

Habitat: One male specimen was collected at c. 1950 m a-s-l, in the transitional area between a mountainside and alluvial fans. This area has desert climate and sandy clay soil. The vegetation is dominated by *Artemisia aucheri* (Fig. 2S₁).

Family Viperidae***Echis carinatus sochureki* Stemmler, 1969** (Fig. 4F)

Echis carinatus sochureki Stemmler, 1969: 118 (Type locality: Pishin, Pakistan).

Description: Head distinct from the neck, covered with small and imbricate scales. Dorsal scales keeled in 27:29:19 or 27:29:21 or 25:29:19 or 27:33:21 longitudinal rows; 10-11 supralabials; 12 infralabials; 6 scales connected to rostral; 7 scales round the nostril; 2-3 scale rows between eye and supralabials; 14-18 scales round the eyes; One supraocular large or in some specimens split and small; 11-13 scales on a line between the eyes; 2-4 rows of gulars between the posterior chin shields and the first ventral; ventrals: 160-176; anal undivided; subcaudals: 27-31. SVL: 255-495 mm; TL: 20-50 mm. Dorsal is pinkish-brown with light spots, lateral with dark crinkle strip from nape to vent, venter buff with little dark speckling.

Distribution: The species is distributed throughout the study area (Fig. 5N).

Habitat: Fourteen specimens were observed and five (4 adults and 1 juvenile) were collected, at 1100-2700 m asl. Their habitat consisted of stony areas, graveled plains to mountainside with sandy clay soil (Figs. 2S₁, 2S₇).

***Macrovipera lebetina cernovi* (Chikin et Szczerbak, 1992)** (Fig. 4G)

Vipera lebetina cernovi Chikin et Szczerbak, 1992 (type locality: Marijsky district, Turkmenistan).

Description: The head is large; body is massive, slightly flattened in the dorso-ventral plane. Body scales keeled in 25:25:19 or 25:27:19 or 23:25:19 longitudinal rows; 6-8 scales contact to rostral; 9-10 scales round the nostril; 10-11 supralabials; 15-17 infralabials; 3 scale rows between eye and supralabials; 11-14 scales round the eyes; 9-12 scales on a line between the eyes; supraocular semi-divided and large; 2-3 apicals; 2-3 canthals; 3-4 rows of gulars between the posterior chin shields and the first ventral; ventrals: 174-176; anal undivided; subcaudals: 42-46. SVL: 640-1360 mm; TL: 80-

150 mm. Dorsal color sandy-gray with dark mottles on the lateral and dorsal regions, venter whitish with black tiny spots.

Distribution: Khabr mountainsides in north, and eastern foothills (Fig. 5O).

Habitat: Fourteen specimens were observed and Four (3 adults and 1 juvenile) were collected, at 2100-3000 m asl. Their habitat consisted of rocky areas with boulders and graveled soil. The vegetation dominated by *Pistacia atlantica*, *Amygdalus sp.*, and *Acer monspesulanum* (Figs. 2S₁, S₂, S₃).

***Pseudocerastes persicus* (Duméril, Bibron, and Duméril, 1854) (Fig. 4H)**

Cerastes persicus Duméril, Bibron and Duméril, 1854: 1443 (Type locality: Pers [=Iran]).

Description: Scales on the top of the head small, imbricate, smooth on the snout, tuberculate and strongly keeled in the adult; an erect hornlike scale above the eye surrounded by small scales. Two scales between the nasal and the rostral; 12 scales on a line between the horns; 17-19 scales round the eyes; 12-14 supralabials, 3-4 series of scales between them and the eye; scales in 25:23:17 rows, striated and strongly keeled; ventrals 152-154; anal undivided; subcaudals 45-46. SVL: 435-550 mm; TL: 63-80 mm. Dorsal color is light brown with brown mottles, venter light yellow.

Distribution: The species is distributed throughout the study area (Fig. 5P).

Habitat: Five specimens were observed and two were collected, in graveled plains, at 1100-1900 m asl. The vegetation dominated by *Artemisia sp.*, *Amygdalus sp.*, and *Pistacia atlantica* (Figs. 2S₁, S₄, S₅, S₇).

DISCUSSION

During the present study, 74 specimens belonging to four families: Colubridae, Elapidae, Typhlopidae and Viperidae were studied results. The high diversity of genus and species was found for the family Colubridae. Two species, *Macronipera lebetina cernovi* and *Echis carinatus sochureki*, showed the high frequency compare to other species. The presence of *Spalerosophis microlepis*, *Lytorhynchus diadema gaddi*, *Pseudocyclophis persicus* and *Walterinnesia morgani* indicated a broader distribution of these species in east of the Zagros Mountain range, southeastern Iran.

Lytorhynchus diadema gaddi is considered as a Saharo-Sindian element (Madjnoonian et al., 2005) and is generally distributed in the southwest of Iran (Latifi, 2000), but the present study indicated that this species was able to reach to the east of the Zagros mountain range. The following four species, *Spalerosophis microlepis*, *Eirenis punctatolineata*, *Lytorhynchus ridgewayi* and *Boiga trigonatum* are listed as Least Concerned (LC) in the IUCN Red List in the category of IUCN (<http://iucnredlist.org> 2011). Since *S. microlepis* is an endemic element, we propose that a special conservation program about this species be performed.

Pseudocyclophis persicus had different color pattern; dorsal color brick-whitish with dark transverse bands from nape to the tip of tail reaching the venter, in some specimens the abdominal surface is clear and without spots. Also the number of scales beneath the surface of tail shows significant differences with valid identification keys. This could be due to the difference between east/southeast specimens with west/southwest specimens. Therefore it is recommended that a population study using molecular phylogenic methods be conducted in the future.

Species such as *Lytorhynchus diadema gaddi* and *Lytorhynchus ridgewayi* are fossorial and refuge under the soil during the day, so these species are generally observed in areas with sandy clay soil and soft tissue.

Because of the good adaptation with a variety of habitat types and different climatic conditions, *Echis carinatus sochureki* occupies wide range of habitats, from tropical areas with stony-graveled plains and low vegetation to high and rocky areas with thin layer of soil. During the present research, one specimen from eastern elevations of the studied area was obtained and after dissection, it was observed that the specimen has hunted a toad, *Bufo viridis*, which is indicative of high diversity in the diet of this species.

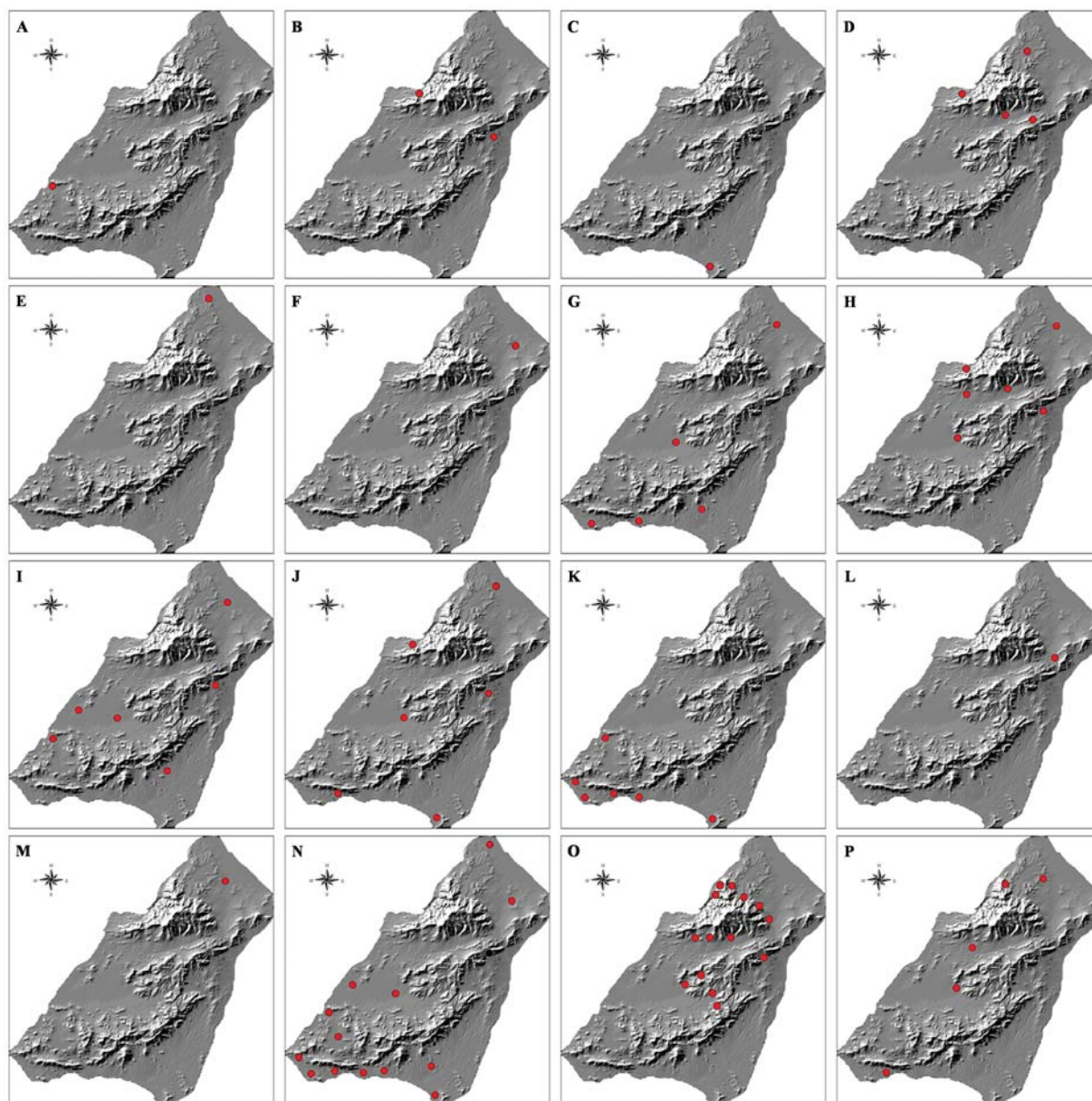


FIGURE 5. Distribution of the snakes in Khabr National Park: A- *Eirenis (punctatolineata ?)* and *Walterinnesia morgani*, B- *Typhlops vermicularis*, C- *Boiga trigonatum melanocephala*, D- *Hemorrhois ravergieri*, E- *Lytorhynchus diadema gaddi*, F- *Lytorhynchus ridgewayi*, G- *Platycephalus rhodorachis ladacensis*, H- *Platycephalus ventromaculatus ventromaculatus*, I- *Psammophis schokari*, J- *Pseudocyclophis persicus*, K- *Spalerosophis diadema cliffordii*, L- *Spalerosophis microlepis*, M- *Telescopus rhinopoma*, N- *Echis carinatus sochureki*, O- *Macrovipera lebetina cernovi*, P- *Pseudocerastes persicus*.

Macrovipera lebetina has four subspecies: *lebetina*, *obtusa*, *turanica* and *cernovi* (Stümpel et al., 2009). Specimens of *Macrovipera lebetina cernovi* were usually found in the northern and eastern elevations of the studied area and this species generally hunt birds beside the springs in the morning. Within the study area, it was found that the main prey of this snake was partridge, *Alectoris chukar*, and also it was observed that this species hunted a wood pigeon, *Columba livia*. In general, *M. lebetina* is active during the daylight; however because of the massive body and being hunted by hunting birds, it displaces a considerable distance at night.

Thermal range of activity of the studied species usually varies between 20°C and 30°C. However *Macrovipera lebetina cernovi* is resistant to the cold and has been observed in 15°C due to the massive body and having layers of fat under the skin.

Species Key for the Snakes of Khabr National Park

- 1a. scales around body of uniform size (no enlarged scales on venter), arranged in 24 rows *Typhlops vermicularis*
 1b. scales on venter greatly enlarged, much larger than dorsal scales 2
- 2a. Head covered with small scales, Neck distinct, moveable fangs present 3
 2b. Head covered by large shields 5
- 3a. Subcaudals undivided, head covered with small and imbricate scales. Dorsal scales keeled, 2-3 scales between supralabials and eye *Echis carinatus sochureki*
 3b. subcaudals divided 4
- 4a. Elevated projection (horn like) over eye composed of several scales, 23 dorsal scale rows at midbody, 2 series of scales between nasal and rostral *Pseudocerastes persicus*
 4b. Elevated projection absent, eye among the ring of several scales, 25 or 27 dorsal scale rows at midbody, ventral: 174-176 *Macrovipera lebetina cernovi*.
- 5a. Loreal absent; third & fourth supralabial scales in contact with eye; 15 dorsal scale rows; subcaudals: 41 *Pseudocyclophis persicus*
 5b. Loreal present 6
- 6a. Posterior maxillary teeth enlarged, grooved; pupil vertically elliptical; neck distinct from head; lateral scales compressed and oblique; 21 dorsal scale rows at midbody; ventrals less than 250 *Boiga trigonatum melanocephala*
 6b. Pupil vertically elliptical; 23 scale rows at midbody; ventrals: 270; subcaudals: 83 *Telescopus rhinopoma*
 6c. Head narrow and lengthy; pupil circular; 2 supralabials in contact with eye; subcaudals: 120-121 *Psammophis schokari*
 6d. posterior maxillary teeth absent 7
- 7a. Supralabials distinct from eye with one row of scales; 41 dorsal scale rows; 13-14 scales round the eye *Spalerosophis microlepis*
 7b. Dorsal scales less than 35 8
- 8a. Supralabials distinct from eye; 9 scales round the eye; 27 dorsal narrow scales; subcaudals: 83-85 *Spalerosophis diadema cliffordii*

- 8b. One or more supralabials in contact with eye..... 9
- 9a. Rostral shield narrowed or pointed; 2 prefrontals; fifth supralabial in contact with eye; 19 dorsal scale at midbody..... *Lytorhynchus diadema gaddi*
- 9b. Rostral shield broadly truncate; one prefrontal; supralabials distinct from eye; 21 dorsal scales at midbody..... *Lytorhynchus ridgewayi*
- 10a. 21 dorsal scales; tail with 4 longitudinal dark strips; subcaudals: 84 *Hemorrhhois ravergieri*
- 10b. 19 dorsal scales 11
- 11a. Body with dark spots; sometimes dorsum with one longitudinal orange strip from neck to end; gular scales in 4 rows; subcaudals: 122 *Platyceps rhodorachis ladacensis*
- 11b. Neck with large dark spot; fifth and sixth supralabials in contact with eye; gular scales in 6 rows; subcaudals: 102..... *Platyceps ventromaculatus ventromaculatus*

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LITERATURE CITED

- Bagherian, A., Kami, H.Gh., 2008. On taxonomic status of the saw-scaled Viper genus *Echis* (Viperidae: Reptilia) in Iran. *Iranian Journal of Biology* 21(3), 501–508. [In Persian].
- Bostanchi, H., Anderson, S.C., Kami, H.G., Papenfuss, T.J., 2006. A new species of *Pseudocerastes* with elaborate tail ornamentation from western Iran (Squamata: Viperidae). *Proceeding of the California Academy of Sciences* 57(14), 443–450.
- Campbell, Ja., Lamar, WW., 2004. The Venomous Reptiles of the Western Hemisphere. 2 volumes. *Comstock Publishing Associates, Ithaca and London*. 870 pp. 1500 plates.
- Dixon, J.A., Sherman, P.B., 1990. *Economics of Protected Areas: A New Look at Benefits and Costs*. Covelo, California, Island Press.
- Esmacili, H.R., 2003. Snakes in desert and semi-desert areas of the Hormozgan Province of southern Iran. *7th International Conference on Development of Dry Lands*. 14–17 Sep: Tehran, Iran.
- Fathinia, B., Rastegar-Pouyani, N., Darvishnia, H., Rajabizadeh, M., 2010. The snake fauna of Ilam Province, southwestern Iran. *Iranian Journal of Animal Biosystematics* 6(1), 9–23.
- Göçmen, B., Arikan, H., Mermer, A., Langerwerf, B., Bahar, H., 2006. Morphological, hemipenial and venom electrophoresis comparisons of the Levantine viper, *Macrovipera lebetina* (Linnaeus, 1758), from Cyprus and southern Anatolia. *Turkish Journal of Zoology* 30, 225–234.
- Hojjati, V., Kami, H.Gh., Faghiri, A., Ahmadzadeh, F., 2005. The snake fauna of Damghan. *Environmental Sciences* 6, 1–13. [In Persian].
- Kami, H.Gh., Najafi, S., 2007. Study on characters of the versicolored wood snake, *Coluber ravergieri* in Iran. *2nd National Conference of Animal Science* pp. 161–162. Gilan, Iran.

- Karimi, O., Tabatabaei S.M., Akbari, A.A.F., 2001. A survey on snakes and scorpions fauna in Yazd Province. *Pajouhesh-va-Sazandegi* 13(4), 113–115. ([In Persian], abstract in English).
- Kark, S., Warburg, I., Werner, Y.L., 1997. Polymorphism in the snake *Psammophis schokari* on both sides of the desert edge in Israel and Sinai. *Journal of Arid Environments* 37, 513–527.
- Kazemi, M., Rajabizadeh, M., 2007. A report on snake fauna of western part of Ghom Province, Iran. *2nd National Conference of Animal Science* pp. 184–185. Gilan, Iran.
- Latifi, M., Farzanpay, R., 1973. Yield of venom and distribution of Iranian venomous snakes. *Pablavi Medical Journal* 4, 556–564.
- Latifi, M., 1975. Commercial production of anti-snakebite serum (antivenin), In: Carl Gans and K. A. Gans (Eds.). *Biology of the Reptilia* vol. 8: Physiology B. Academic Press., New York and London), pp. 561–588.
- Latifi, M., Manhoury, H., 1966. Antivenin production. *Memorias do Instituto de Butantan* 33(3), 893–897.
- Latifi, M., 1984a. [The snakes of Iran]. *Iran Department of the Environment*, Tehran, 221pp. [In Persian].
- Latifi, M., 1984b. Variation in yield and lethality of venoms from Iranian snakes. *Toxicon* 22(3), 373–380.
- Latifi, M., 1991. *The Snakes of Iran*. Oxford, Ohio, USA: Society for the Study of Amphibians and Reptiles (Contributions to Herpetology), 159 pp.
- Latifi, M., 1992. *The Snakes of Iran*. Iran Department of the Environment, 2rd Edition, Tehran, 231 pp. [In Persian].
- Latifi, M., 2000. *The Snakes of Iran*. Iran Department of the Environment, 3rd Edition, Tehran, 478 pp. [In Persian].
- Leviton, A.E., Anderson, S.C., Adler, K., Minton, S.A., 1992. *Handbook to Middle East Amphibians and Reptiles*. Oxford, Ohio, USA: Society for the Study of Amphibians and Reptiles, 252 pp.
- Madjnoonian, H., Kiabi, B.H., Danesh, M., 2005. *Readings in Zoogeography of Iran*. Tehran: Department of the Environment, Part II. 371pp. [In Persian].
- Najmizadeh, S., Yavari, A., 2006. Zoning and planning of Khabr national park with the aid of GIS. *Journal of Environmental Studies* 31(38), 47–58. [In Persian].
- Nilson, G., Andren, C., 1981. Die Herpetofauna des Kavir-Schutzgebietes, Kavir-Wüste, Iran. *Salamandra* 17(3-4), 130–146.
- Nilson, G., Andren, C., 1984a. A taxonomic account of the Iranian ratsnakes of the *Elaphe longissima* species-group. *Amphibia-Reptilia*, 5(2), 157–171.
- Nilson, G., Andren, C., 1984b. Systematics of the *Vipera xanthina* complex (Reptilia: Viperidae). An overlooked viper within xanthina species-group in Iran. *Bonner Zoologische Beiträge*, 35(1-3), 175–184.
- Rai, M., 1965. *Recherches sur les colubrides d'Iran*. Thesis, Docteur des Sciences Naturelles, Faculté des Sciences de Montpellier, 85 pp.

- Rai, M., 1978. Une nouvelle récolte de *Telescopus rhinopoma* Blanford, 1874 (Serpentes: Colubridae), une espèce très rare. *Canadian Journal of Zoology* 56, 146–149.
- Rajabizadeh, M., Rastegar-Pouyani, N., 2006. Additional information on the distribution and morphology of *Coluber (s.l.) andreanus* (Werner, 1917) (Reptilia: Colubridae) from Iran. *Zoology in the Middle East* 39, 69–74.
- Rajabizadeh, M., Rastegar-Pouyani, N., 2007. Two new records of reptiles (Reptilia: Squamata) from southeastern Iran. *Turkish Journal of Zoology* 33, 103–104.
- Rajabizadeh, M., Kami, H.Gh., 2007. Population study of *Gloydius halys caucasicus* (Nikolsky, 1916) (Reptilia: Viperidae) in central and eastern Elburz, Iran. *2nd National Conference of Animal Science*, pp. 189–190. Gilan, Iran.
- Rajabizadeh, M., Stümpel, N., Hasanzadeh Kiabi, B., 2007. Taxonomy of the *Vipera raddei* species group (Reptilia: Viperidae) in Iran. *2nd National Conference of Animal Science*, pp. 187–188. Gilan, Iran.
- Rastegar-Pouyani, N., Kami, H.Gh., Rajabzadeh, M., Shafiei, S., Anderson, S.C., 2008. Annotated checklist of amphibians and reptiles of Iran. *Iranian Journal of Animal Biosystematics* 4(1), 43–66.
- Schätti, B., Tillack, F., Helfenberger, N., 2009. A contribution to *Spalerosophis microlepis* JAN, 1865, with a short review of the genus and a key to the species (Squamata: Serpentes: Colubridae). *Herpetozoa* 22, 115–135.
- Shafiei, S., Sehati Sabet, M.E., Moghaddas, D., 2004. Major vertebrates fauna of Bidoieh Protected Area, Kerman Province. *Journal of Environmental Studies* 34, 71–88. [In Persian].
- Stümpel, N., Joger, U., 2009. Recent advances in phylogeny and taxonomy of near and middle eastern vipers—an update. *Zookeys* 31, 179–191.
- IUCN. Red List of Threatened Species. Version 2010.4. [Online]. Available: <http://www.iucnredlist.org> [Accessed: 24 Feb 2011].