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A Preliminary Study on the Biology of the Bedriaga's Plate-tailed Gecko, *Teratoscincus* *Bedriagai* in Iran

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Abstract

The Bedriaga's Plate-tailed Gecko, *Teratoscincus bedriagai*, Nikolsky, 1900 belongs to the Gekkonidae family. Iranian specimens are rare in collection and are distributed in the northern and eastern desert basins of the Central Plateau of Iran, Sistan, and the desert regions of southern Afghanistan as far east as Kandahar. In this research, biological studies including diet, morphology, behavior and habitat of this species were conducted from April to September, 2013. A total of 30 adult specimens including 15 adult males and 15 adult females were collected by hand at midnight from southern parts of Damghan County, located in Semnan Province of Iran. Results show that the animal activities begin from early April to early October, and it hibernates from October to March. They are insectivores and their main food items belong to eight families including: Formicidae, Myrmeleontidae, Pyralidae, Acrididae, Sphecidae, Culicidae, Tenebrionidae and Mantidae. This gecko stays on clay and loamy soils. Most of them were observed on highly saline, loose soil covered with a thin salt crust, and were common near *Tamarix* bushes. *T. bedriagai* is a fairly understudied subspecies in the Near-East and Middle-East regions and this study presents useful information about this poorly known animal.

Keywords: Lizard, Gekkonidae, *Teratoscincus bedriagai*, Diet, Morphology.

1. Introduction

The Gekkota is a suborder of Squamata, consisting of seven families: Gekkonidae, Carphodactylidae, Diplodactylidae, Eublepharidae, Phyllodactylidae, Pygopodidae and Sphaerodactylidae^[1, 2]. Gekkonidae is the largest family of lizards consisting of over 950 described species in 51 genera^[3]. The Gekkonidae family with 43 species in 12 genera is the largest family of lizards in Iran^[4]. *Teratoscincus* is a genus of geckos under Gekkonidae family^[4]. In fact, *Teratoscincus* has long been a genus that was distinctive in morphological studies^[5], and recent molecular work has placed it with the expanded family Sphaerodactylidae rather than the Gekkonidae^[1, 2]. Sphaerodactylidae is a family of geckos distributed in North and South America and the Caribbean, as well as Southern Europe, North Africa, the Middle East, and Central Asia. Over 200 species are described in these genera including *Teratoscincus*^[3]. *Teratoscincus* is found from the Arabian Peninsula in Qatar, the United Arab Emirates, and Oman, west across southern Asia to Iran, Afghanistan, and Pakistan, north to Russia, Kazakhstan, Turkmenistan, Uzbekistan, and Tajikistan to Mongolia and China. The genus consists of seven species where four of them: *T. bedriagai* Nikolsky, 1900, *T. keyserlingii* Strauch, 1863, *T. microlepis* Nikolsky, 1900 and *T. scincus* (Schlegel, 1858) have been reported from Iran^[4, 6, 7, 8].

The Bedriaga's plate-tailed gecko (Bedriaga's wonder gecko or Skink gecko), *Teratoscincus bedriagai* is distributed in northern and eastern desert basins of the Central Plateau of Iran, Sistan, and desert regions of southern Afghanistan as far east as Kandahar. Iranian populations of this species are distributed in Sistan and Baluchistan, Khorasan, Semnan, Tehran and Yazd Provinces. Iranian specimens are rare in collection. Type locality of this species has been reported in Zirkuch in Sistan and Baluchistan Province in eastern Iran^[9]. Since Zaurudny collected the types in 1898, the species was not found again until 1962- 63 Street Expedition, when a single specimen was collected near Zabol and Ranck, and the mammal survey of the National Museum of Natural History (Washington), when Hermann collected two specimens from the Sistan area in 1962. Tuck and Anderson collected 10 specimens from Sistan area in

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1975^[10]. A description of this species was given by Anderson (1999), based on five specimens. In a previous study, further data has been reported based on 50 specimens collected in Semnan Province of Iran^[11].

Like many other species of reptiles in the Middle East, the Bedriaga's plate-tailed gecko is a fairly understudied species. As such, it is currently unclear if there are many major threats to the species. Since no enough information is available regarding the biology of this subspecies, this research was performed to conduct preliminary studies on this subspecies' biology including diet, morphology, behavior and habitat in Iran.

2. Materials and Methods

2.1 Study Area

All specimens were collected from the four following stations: Hassan Abad, Saleh Abad, Alian and Yazdan Abad villages located in south of Damghan County, Semnan Province (54°19'E, 35°55'N). Damghan is situated 1170 m above sea level and north of Central Kavir Desert (Figures 1 and 2).

2.2 Sampling

Since there were legal restrictions in collection of rare reptiles even for scientific projects within the country; the authors obtained a permit of scientific collection from Department of Environment of Damghan County for collecting a few

specimens.

Accordingly, sampling was conducted periodically during the activity period of this species from April to September, 2013. All specimen collections were done by hand, from 9 PM to 12 PM. A total of 30 specimens (15 adult males and 15 adult females) were captured. To study the morphology, food habits and their behavior, some specimens were kept in terrariums.

2.3 Methods

The specimens were transferred alive to the Zoology Laboratory of Islamic Azad University, Damghan Branch. Their food habits and behaviors were studied both in terrarium and in the environment. Then, they were anaesthetized by chloroform and their morphological characters including W (Weight), SVL (South-Vent Length), LCD (Tail Length) and HL (Head Length), HW (Head Width), RIS (Right Infralabial Scales), LIS (Left Infralabial Scales), RSS (Right Supralabial Scales), LSS (Left Supralabial Scales) and SMB (Scales around the Middle of the Body) were measured. Length, width and diameter measurements were conducted by a dial caliper with an accuracy of 0.02 mm. Weight was measured by a scale with an accuracy of 0.001 g. Then, animals were dissected and food items in their stomach containing were fixed in 10% formalin. The data was analyzed by SPSS 18 software, one-way ANOVA and Tukey test were done to compare biometric data among monthly samples ($P < 0.05$).



Fig 1: Map showing the sampling site (Damghan County) in northern Iran



Fig 2: Hassan Abad station located in south of Damghan County, Semnan Province, Iran

3. Results

3.1 Morphology

There were enlarged scales of dorsum that do not extend forwards beyond the shoulder. Their neck was covered by small granular scales. Ventral scales were slightly smaller than or subequal to dorsals. Large cycloid scales did not extend forward beyond shoulders. There were 36-52 scales around the middle of body, 9-11 supralabials and 9-10 infralabials. Males were ranged from 56.19 to 66.45 mm SVL and females from 55 to 68.62 mm. Dorsum was light sandy or creamy. Their heads had a brown crescentic mark from eyes on to occiput.

There were dark vertical bars on snout, below eyes, and on temporal region.

Their backs had four or five brown caudally-directed chevrons, lighter and broken up in adults. Tail had two or three brown crossbars, becoming lighter and indistinct in adults. Their limbs didn't have dark patterns; and Venter was white. Males had larger and more embossed base of tail because of the presence of the hemipenes. The smallest juvenile was observed in early August (W= 2.29 g, SVL= 36.73 mm, HL= 10.84 mm, LCD= 19.96 mm). Its morphometric and meristic characters are shown in Table 1.

Table 1: Descriptive statistics of characters in males (M) and females (F) of *T. bedriagai*

Characters	Sex	N	Minimum	Maximum	Mean		Std. Deviation	Variance
					Statistic	Std. Error		
W (g)	M	15	4.97	9.23	7.39	0.355	1.373	1.886
	F	15	5.99	11.01	7.89	.4452	1.724	2.973
SVL (mm)	M	15	56.19	66.45	62.69	0.921	3.569	12.735
	F	15	55.00	68.62	63.24	1.053	4.079	16.638
LCD (mm)	M	15	23.70	35.41	31.17	0.807	3.127	9.778
	F	15	22.75	37.14	31.21	0.937	3.629	13.176
HL (mm)	M	15	13.93	18.12	15.82	0.278	1.076	1.159
	F	15	11.09	15.89	13.47	0.372	1.441	2.077
HW (mm)	M	15	11.50	15.40	13.66	0.287	1.113	1.239
	F	15	14.36	17.14	15.53	0.219	0.848	0.790
RIS	M	15	9	10	9.53	0.133	0.516	0.267
	F	15	9	10	9.40	0.1309	0.507	0.257
LIS	M	15	9	10	9.67	0.126	0.488	0.238
	F	15	9	10	9.40	0.1309	0.507	0.257
RSS	M	15	9	11	9.60	0.190	0.737	0.543
	F	15	9	11	9.93	0.228	0.883	0.781
LSS	M	15	9	11	10.20	0.223	0.862	0.743
	F	15	9	11	10.00	0.169	0.654	0.429
SMB	M	15	42	51	44.67	1.267	4.909	24.095
	F	15	36	52	44.07	1.608	6.227	38.781

3.2 Behavior

Animal activities began from early April to early October and its hibernation from October to March. *T. bedriagai* was nocturnal and active from evening to midnight. They inhabited in areas of fine sand in the desert. In captivity, females produced one or two clutches a year, each consisting of 1-2 eggs. In nature, however, they may lay only once a year, depending on their food supply which in turn depends on the annual rain fall, from May to July. The eggs were oval-shaped and the largest size was about 15 × 9 mm in diameters. They were soft at first, but they arden gradually within 10 hours.

Males of this species were territorial and live in holes in the desert sand. They couldn't blink, but they often licked their eyes to keep them clean and moist. They had a fixed lens within each iris that enlarges in darkness to let in more light. They used chirping sounds in social interactions with other geckos especially by rubbing the large supracaudal plates together. Molting occurred from May to early August in males and females (Figure 3). Autotomy occurred in danger position in males and females (Figure 3).

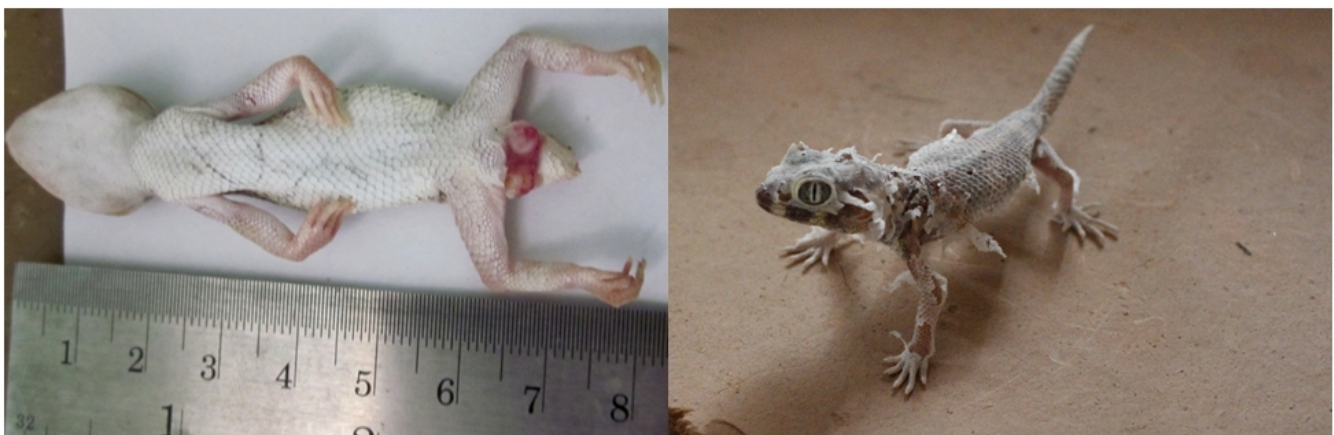


Fig 3: Autotomy and molting in *T. bedriagai*

3.3 Diet

T. bedriagai was insectivore and prey items identified in their stomach and in the environment are shown in Table 2. There is no significant difference in prey items of males and females. Larger and adult specimens could take larger insects. They were sit-and-wait predators. The most abundant prey items

observed in the locality and found in their stomachs were ants belonging to Formicidae and Myrmeleontidae families. Figures 4 to 9 demonstrate the identified prey items in *T. bedriagai*. Antlions were their other favorite items (Figure 10).

Table 2: Prey items in *Teratoscincus bedriagai*

Order	Family	Name	Frequency of Prey Items (%)	
			Male	Females
Hymenoptera	Formicidae	Ants	36	38
Neuroptera	Myrmeleontidae	Antlions	20	18
Lepidoptera	Pyalidae	Snout Moths	12	14
Orthoptera	Acrididae	Grasshoppers	8	6
Hymenoptera	Sphecidae	Wasps	7	6
Diptera	Culicidae	Mosquitoes	6	8
Coleoptera	Tenebrionidae	Darkling Beetles	6	6
Mantodea	Mantidae	Praying Mantises	5	4



Fig 4: Ant



Fig 7: Grasshopper



Fig 5: Antlion



Fig 8: Darkling Beetle



Fig 6: Praying Mantis



Fig 9: Wasp



Fig 10: Antlion-hunting in *Teratoscincus bedriagai* in Hassan Abad, Iran

3.4 Habitat

The study area was composed of alkaline saline soils containing clay and sand. The lizards stayed on clay and loamy soils. Most of the lizards were observed on highly saline, loose soil covered with a thin salt crust, and were common near *Tamarix* bushes. The vegetation in this locality was scanty, mostly herbaceous. The dominant plant species were *Tamarix* sp., *Salsola* sp., *Alhaji* sp., *Peganum* sp., *Atriplex* sp. and *Astragalus* sp. The annual average temperature was 17.2 °C. Summer temperatures ranged from 22-28 degrees centigrade and winter temperatures were much lower. July was the hottest and January was the coldest month of this region. Figure 11 shows *T. bedriagai* in its natural habitat at Hassan Abad. Moreover, the other lizards collected with it in this region were: *Bunopus tuberculatus* and *Tenuidactylus caspius* from Gekkonidae family, *Eremias fasciata*, *Eremias intermedia*, *Eremias persica*, *Eremias velox velox*, *Mesalina watsonana* from Lacertidae family; *Phrynocephalus scutellatus*, *Phrynocephalus maculatus* and *Trapelus agilis* from Agamidae family.



Fig 11: *Teratoscincus bedriagai* in south of Damghan County, Semnan Province, Iran

4. Discussion

Anderson (1999) recorded the SVL of specimens between 35 and 72 mm. This species is most closely allied to *Teratoscincus przewalskii* differing according to published descriptions, in its large head scales and smaller ventral scales proportionate to the dorsal scales, and in the color pattern^[10]. There are not more than 60 scales round middle of body in *T.*

bedriagai while there are about 100 scales round middle of body in *T. microlepis*^[10]. In a previous study performed on this species, the morphological characters were recorded: SVL in males ranged from 41.7 to 71.7 mm and in females from 40.7 to 73.8 mm; LCD: 21.5-39.8 mm; HL: 10.2-16.7 mm; HHW: 64.9-113.4 mm; EED: 37.1-80 mm; supralabials and infralabials: 8-12; scales across head: 30-55; scales along head: 60-88; scales around midbody: 42-57; large supracaudal plates: 9-12 and lateral fringe scales on 4th toe: 19-25^[11].

All geckos, excluding the Eublepharidae family, lack eyelids and instead have a transparent membrane, which they lick to clean^[12]. Nocturnal species have excellent night vision; their eyes are 350 times more sensitive to light than the human eye^[13].

All geckos shed their skin at fairly regular intervals, with species differing in timing and method. When shedding begins, the gecko will speed the process by detaching the loose skin from its body and eating it^[14].

Earlier, it was reported that the ants were the most common prey item for most of insectivorous lizards of Iran^[10], and also in this research, the authors observed that ants were the favorite and preferred food item for this species. It's probably because ant-hunting is very comfortable, and the lizards stand near ants and just bring out their tongue. Also, little energy is required for preying them. On the other hand, the mass distribution of ants decreases the pursuing energy^[15]. The identified ants in Damghan County belong to 23 species from twelve genera and three subfamily including: *Cataglyphis* sp., *Cataglyphis nodus*, *Cataglyphis* sp., *Cataglyphis* sp., *Cataglyphis emeryi*, *Camponotus* sp., *Camponotus* sp., *Camponotus turkestanus*, *Proformica* sp., *Plagiolepis* sp., *Lepisiota semenovi*, *Lepisiota* sp., *Tetramorium* sp., *Tetramorium* sp., *Crematogaster* sp., *Crematogaster* sp., *Messor* sp., *Messor intermedius*, *Messor* sp., *Cardiocondyla* sp., *Pheidole* sp., *Monomorium kusenovi* and *Tapinoma erraticum*^[11]. *Cataglyphis nodus* was the most common species in the steppe region and *Monomorium kusenovi* was the most common species in desert regions of Damghan^[11]. There were more species with high abundance in desert regions of Damghan similar to those of the study area^[11]. Blandford (1876) chiefly found ants in specimens collected from Iran in^[16], and Minton (1966) reported beetle and other insect remains, as well as seeds and other plant materials^[17]. However, vegetation diet was not observed in this study.

5. Conclusion

Based on the results of the present investigation it is concluded that our findings on morphology of this species confirm the records of the previous studies. This study also revealed that the population of this lizard has decreased in the study area compared to 2009 and before. To sum up, this preliminary study on the biology of *Teratoscincus bedriagai* in Iran will pave the way for further studies on this species for herpetologists all around the world.

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