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Habitat Selection by Spiny-Tailed Lizard (*Uromastyx aegyptia*) in Hengam Island, Iran

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Original Research Article

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Abstract: A population of spiny-tailed lizard (*Uromastyx aegyptia*) exists in Hengam Island in the Persian Gulf. The field work was carried out over a period of 10 days by the use of a four-member group work in May 2015 through 10 random transects in the whole Island by the use of motorcycle. Once the animal's cavity was found, some plots with dimensions of 10 by 10 meters were established over the center hole of the spiny-tailed lizard and habitat variables such as the region slope, geographical direction, type of the soil texture, percentage and number of plant cover according to species, distance to the nearest water source, road, and vegetation patches were measured. The habitat factors measured in the control points where there were no signs of the animal's holes were also measured and compared with the present points. Ultimately, 28 holes of the spiny-tailed lizard in 7colony that had far from each other, were considered in the region. The results showed that the spiny-tailed lizard of the regions with a mean slope of 10% facing towards the north preferred rather semi hard soils (contain gravel and silt) ($p<0.05$). To protect the population of this species in the region, paying attention to some effective parameters such as the percentage cover of *plant species*, region slope and Acacia tree are of the most important factors for the use of the habitat of this species.

Keywords: Habitat selection, *Uromastyx aegyptia*, Hengam Island.

INTRODUCTION

The spiny-tailed lizard exists in a vast area from the north and east-north of Africa and to the Middle East [1]; it is seen in Hengam and Siri Islands in Iran [2].

The spiny-tailed lizards are named Saara and Uromastyx genus of Agama family. The spiny-tailed lizard is a terrestrial species spotted in open and wide areas covered with gravel as well as in rocky and stony areas; they often prefer gravel and wady habitats; they are also found in areas with low plant cover near the holes (figure1, 2) [3]. They like to establish their nests in hilly and rocky areas with good shelter and accessible plant cover [4*]. They set up holes in nature that can be 3 meters long [5]. Other references name these holes as structures with more than 10 meters long and 1.8 meters deep [6]. These species are grouped as vulnerable conservation category (Vulnerable A2abcd+4abcd) due to their habitat degradation through overgrazing, human development, landfill, military activities, vehicles, their illegal trafficking for food and medicine, and as a pet [3]. The study performed on this species in Saudi Arabia showed that the hide of this animal had been used as a source of leather and its meat consumed as a source of protein in the past [7]. Marketing for this species in Morocoo [8]. Global warming is also effective in reducing the population of this species due to active thermoregulatory [9]. The study done on the wastes of spiny-tailed lizard in Qatar showed that 84% of this animal's diet has been plants of *Hordeum vulgare* species consumed as the main dish. Grazing is effective in the food existence of this species [10]. The research performed in America showed that the destruction of their habitat by mechanical devices had a negative effect on rock lizards (living in the rock crevices) [11]. The aim of this study is to specify the variables effective in the selection of this species habitat in Hengam Island near Siri Island as one of the two known habitats for this species in Iran with regard to the fact that less than 100 spiny-tailed lizards survive in Hengam Island in the south of Iran [12]. The results of this study will be of great help in protecting the population of this species.

MATERIALS AND METHODS

Study area

Hengam Island with a geographical coordinates of north latitude of 26^{o}, 36' to 26^{o}, 41' and east longitude of 55°, 51' to 55°, 55' with an area of about 6.33 square kilometers is situated in the south of Iran. Figure-3 shows the location of the study area. The mean daily sunshine hours is about 9.1 enjoying more sunshine hours compared with other locations in Iran. The mean temperature is estimated to be 27°C [12]. List of plant species in Hengam Island was shown in Table-2 [13].

Data collection

Finding the burrows of the spiny-tailed lizard started in May 2015 by erecting random transects in the study field and the use of a working group of four that lasted 10 days; ultimately, 28 burrows in 7 colony that far from each other were considered. With regard to the short and sparse plant cover in Hengam Island, some plots with a dimension of 10 by 10 square meters were conducted and habitat variables like percentage of plant cover and density of plant cover segregated according to species, distance to the nearest plant patch, water source, road, and region slope were measured. The percentage of plant cover was obtained by visual estimation; the density of plant cover was measured by visual counting method segregated according to species; and distance to closes water source, plant patch, and road were obtained by the use of GIS. To establish the random plots, we distanced ourselves from the burrows and walked in different directions to the habitat and selected the random or the absence points. The points where within a radius of them there was no trace of the spiny-tailed lizard, above habitat variables were also measured.

Data analysis

First, the normality of the data was examined by Kolmogorov-Smirnov test and Leven test was used to examine the homogeneity of the variances. These two cases are the initial conditions for the use of parametric tests. Since our data were not normal, they were transformed by the use of the square root and logarithm to the base 10. To compare the mean of habitat variables between the presence and absence points, independent t-test was employed. To obtain the effective variables and to specify the most important habitat variables, the principal components analysis test was used. Furthermore, the mean of the width and height of the burrow's opening was computed. The data were first entered into Excel Software and then transferred to SPSS Software (version 23).

RESULTS

Macro habitat

Our results showed that all the colonies of this animal were located in the south of Hengam Island (figure 4); therefore, this species prefers the southern regions of its habitat to the central and northern parts on a macro-scale. With regard to the Hengam Island topographic map, it is clear that the major part of the central and to some extent the northern region is mountainous and only the southern part of this island is suitable for nests. Furthermore, with regard to the windrose of the region (Fig-5), it is clear that the dominating wind direction in this region is from the east-north to the west-south with high speed leading to cooling the temperature of the species and the holes at the high temperature of this Island so that 89% of the hole's entrance is constructed towards the north.

Micro habitat

Measurement of the width and height of 28 burrows of spiny-tailed lizards in Hengam Island showed that the mean of the opening width of spiny-tailed lizard's burrow was 28.75 and its height was 14.68 centimeters. Most of the burrowing points of spiny-tailed lizard were situated in regions with a mean slope of (0.10± 0.09); mean plant cover percentage (0.1± 0.03); mean distance to plant patches (16.85± 3.61) meters; and its distance to the closest water source was (965 ± 131) meters. Table-1 shows the results of the independent t-test. The burrows were in regions with mean slope 10% and close to the plant patch of *Acacia tree* with more percentage of vegetation. The dominant habitat variables in burrowing regions selected by spiny-tailed lizard including three main factors of Eigen value 1< with a sum of about 72.58% of variance in habitat micro-scale are presented in Table 3. The first factor is based on percentage of vegetation, the second is based on slope, and the third one is texture of soil and distance to the closest patch.

Table-1: Mean ± standard error of habitat variables in presence and random plots in 10x10 square meters

Variables	Presence (n=28) Mean (SE)	Random (n=28) Mean (SE)	t	P
Soil percent(nearly soft)	0.81(0.04)	0.64(0.04)	-0.11	0.9
Slope	0.10(0.09)	00.00(0.00)	4.47	<0.001**
Percentage of Vegetation	0.1(0.03)	0.03(0.01)	-1.04	0.04*
Densityof plant species	19.78(2.99)	11.75(1.87)	0.16	1.40
Distance to the nearest water	965(131)	789(91.57)	-0.57	0.57
Distance to the cloesest patch (Acacia tree) (m)	16.85(3.61)	44.96(8.43)	-1.60	0.03*

Table-2: Plant species in Hengam Island [13]

Number	Scientific name of Hengam plants
1-	*Abutilon fruticosum*
2-	*Abutilon hirtum*
3-	*Abutilon muticum*
4-	*Acacia nilotica*
5-	*Acacia oerfota*
6-	*Aerva persica*
7-	*Aizoon canariense*
8-	*Anagallis arvensis*
9-	*Aristida adscensionis*
10-	*Astragalus crenatus*
11-	*Capparis elliptica*
12-	*Capparis mucronifolia*
13-	*Cassia italica*
14-	*Cenchrus ciliaris*
15-	*Chenopodium murale*
16-	*Convolvulus pilosellifolius*
17-	*Cordia myxa*
18-	*Coriandrum sativum*
19-	*Cynodon transvaalensis*
20-	*Cyperus arenarius*
21-	*Cyperus rotundus*
22-	*Emex spinosus*
23-	*Ephedra foliate*
24-	*Eragrostis cilianensis*
25-	*Erodium neuradifolium*
26-	*Erucaria hispamica*
27-	*Fagonia bruguieri*
28-	*Fagonia indica*
29-	*Geranium mascatense*
30-	*Granium trilophum*
31-	*Gymnocarpos decander*
32-	*Hammada salicornica*
33-	*Helianthemum lippii*
34-	*Heliotropium bacciferum*
35-	*Heliotropium sp*
36-	*Hippocrepis bisiliqua*
37-	*Launnaea intybacea*
38-	*Lepidium sativum*
39-	*Lycium shawii*
40-	*Malva parviflora*
41-	*Malva pusilla*
42-	*Malva sylvestris*
43-	*Mangifera indica*
44-	*Medicago polymorpha*
45-	*Parietaria alsinifolia*
46-	*Peripoloca aphylla*
47-	*Phalaris minor*
48-	*Phalaris paradoxa*
49-	*Platychaete glaucescens*
50-	*Prosopis cineraria*
51-	*Punica granatum*
52-	*Raphanus sativus*
53-	*Reichardia orientalis*
54-	*Reseda aucheri*
55-	*Saliva aegyptiaca*
56-	*Senecio glanucus*
57-	*Solanum incanum*
60-	*Stipa capensis*
61-	*Taverniera spartea*

62-	*Urospermum picroides*
63-	*Zygophullum qatarense*

Table-3: The principal components analysis test with 3 major axes based on 9 measured habitat variables in burrowing regions of spiny-tailed lizard. Hengam Island, 2015

Variables	Principal component		
	1	2	3
Semi hard Soil	0.55	0.46	**-0.62**
Slope	0.48	**-0.64**	-0.18
Distance to closest patch(m)	0.30	-0.20	**0.57**
Distance to closest water(m)	-0.62	0.60	0.08
Number of plant species	0.35	-0.05	0.03
Percentage of vegetation	**0.78**	0.74	0.57
Eigen value	3.93	1.87	1.44
Percent of total variance (%)	39.34	18.79	14.45
Percent of cumulative Variance (%)	39.34	58.13	72.58

Fig-1, 2: Species and hole of spiny-tailed lizard in Hengam Island, 2015 (picture by Shirin Aghanajafizadeh)

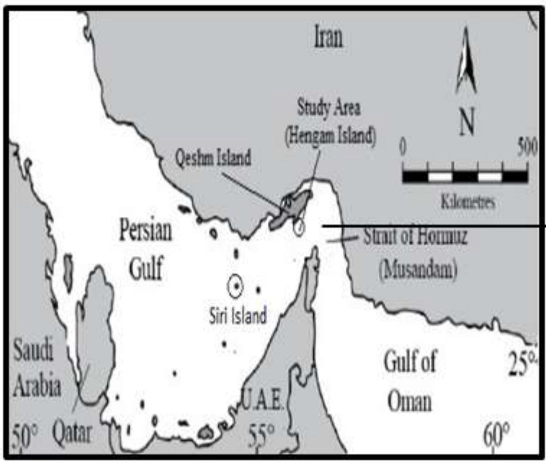

Fig-3: Geographical location of Hengam Island, Iran

Fig-4: Location of Spiny tail lizard colony in Hengam Island, 2015.

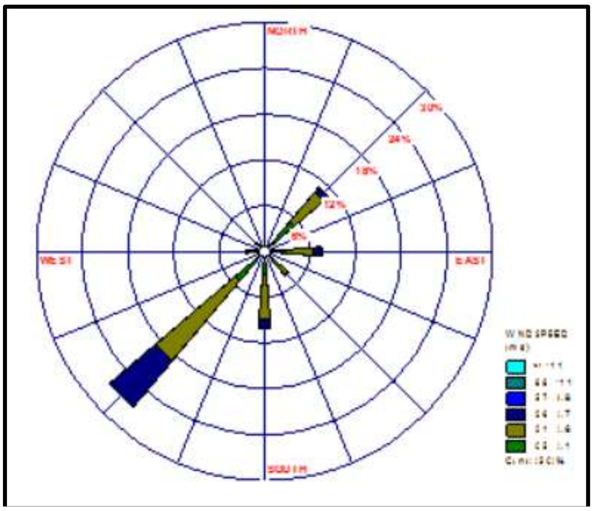

Fig-5: Wind flower of Hengam Island [12]

DISCUSSION

Our results showed that spiny-tailed lizard digs its holes in regions with an average slope of 10% and close to the plant patch of *Acacia tree* with high percentage of vegetation and semi hard soil. The mean slope in the established location of the holes was 10% which can be due to the heavy rain and islanded region under study in winter until spring and prevention of the entrance of run-off water into the holes. Therefore, this slope percentage contributes to the stability of the holes. It seems that the establishment of the holes at higher slopes is difficult and energy-consuming for the entrance and exit of the animal. The higher percentage of relatively semi hard soil (contain silt and gravel) at the site of the holes is due to the fact that the spiny-tailed lizard is a species with strong claws. The establishment of holes is such soil is easier. The establishment of holes in full soft soil which is unstable and loose is not effective, since it collapses with water and wind erosion. Therefore, the spiny-tailed lizard makes its holes in relative semi hard soil with a percentage of silt and gravel to contribute to the stability of its burrow. The high percent of vegetation is an important and effective variable for the use in the habitat of this vulnerable species. The adults of this animal are all herbivorous [5] and it can be said that with regard to the poor vegetation of the region. Fortunately, the density of livestock in the region is low. With an increase in livestock grazing on these plant bushes, of course the food source of this decreases and its population is threatened. Of the 28 holes considered in the region, 25 were towards the north, 3 towards the west. The prevailing winds of the region are heading towards the south. It contributes to cooler holes and this animal. The results of our research correlate with the research work performed by Rubio and Carrascal in 1994 in Iberian Peninsula [14]. Their research showed that the tropical lizard holes faced towards the north and were covered with small stones and plants. The holes in Hengam Island also face towards the north and in gravel- silty soils with a higher percentage of vegetation. The spiny-tailed lizard is a herbivorous species in Hengam Island; therefore, the density of insects plays no role in the selection of its habitat and it is not in the same direction with the results obtained by Castilla in 2011performed on spiny-tailed lizard in Qatar. The decomposition of the pellet collected showed that this species was herbivorous since the grains of plant (*Hordeum vulgare*) were clearly seen in its pellet. In Hengam Island is not *Hordeum vulgare* species. The results of our research performed on lizards and those obtained by Stelltelli *et al*., in 2013 showed that lizards preferred their habitat with *Acacia tree* [15]. It is interesting that the spiny-tiled lizard is also seen in a habitat with *Acacia tree* in Hengam Island and high percentage vegetation around holes of this animal. Furthermore, the results of the experiments performed on *Ameiva exsul* lizard by Gifford *et al*., in 2012 showed that the lizards actively chose locations facing the sun to take sunbath, while at the same time they used plant patches for cooling. Our observations also confirm their behavior of taking sunbath and use of *Acacia sp* plant patches for providing shade for cooling. With regard to the important and effective variables in the use of habitat by this species, it can be said that at present, Hengam Island is a relatively favorable habitat for spiny-tailed lizard. To support the remaining population of this species in the study area .It is important to maintain the soil structure and vegetation cover alongside the trees of Acacia And it is hoped that by increasing the population for the evaporation and grazing of livestock, the above-mentioned habitat variables do not go through the downward trend.

CONCLUSION

Our results showed that all the colonies of this animal were located in the south of Hengam Island; therefore, this species prefers the southern regions of its habitat to the central and northern parts on a macro-scale. With regard to the Hengam Island topographic map, it is clear that the major part of the central and to some extent the northern region is mountainous and only the southern part of this island is suitable for nests. Furthermore, with regard to the wind rose of the region (Figure-5), it is clear that the dominating wind direction in this region is from the east-north to the west-south leading to cooling the temperature of the species and the holes at the high temperature of this Island so that 89% of the hole's entrance is constructed towards the north. In micro habitat, the burrows were in regions with mean slope 10% and close to the plant patch of *Acacia tree* with high percentage of bush vegetation.

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