Original Article

Fauna and Geographical Distribution of Scorpions in Ilam Province, South Western Iran

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Abstract

Background: Scorpions' stings and their own mortalities place them among the most important health and medical problems. The dreadful features and especially their poisonous stings are considered a major cause of human stress and abhorrence/phobia. The current study aimed to study the scorpion fauna of Ilam Province, south western Iran in order to manage scorpionism related problems.

Methods: In this field-laboratory investigation during March 2014 to February 2015, different parts of Ilam Province were surveyed. Nine sampling parts were selected based on geographical situation, scorpionism reports, weather, flora, and local data. Capturing scorpion was done employing a black light, and a long forceps from dusk to midnight. The collected scorpions were placed to 70% ethyl alcohol. All specimens were determined based on the valid taxonomic keys, furthermore their sexes were studied.

Results: Out of the 391 collected scorpions, 11 species were identified as follows: *Hottentotta saulcyi*, *Mesobuthus eupeus*, *Compsobuthus matthiesseni*, *Razianus zarudnyi*, *Hemiscorpius lepturus*, *Androctonus crassicauda*, *Orthochirus iranus*, *Odontobuthus bidentatus*, *Buthacus macrocentrus*, *Scorpio maurus*, and *Polisius persicus*.

Conclusion: Eleven species of Buthidae, Scorpionidae and Hemiscorpiidae families from high risk areas were identified. Despite the low surface of the province, such different species reveals a diverse scorpion fauna that, in turn, shows good and suitable habits of scorpions, as considered by health staff.

Keywords: Habitat, Scorpion, Fauna, Ecology, Iran

Introduction

The fearful feature and painful poisonous stings of scorpions have caused human phobia for a long time. Most people think of scorpions as pests and killers of man (Polis 1990). Scorpions having diverse distribution are mostly living in semi-temperate regions at latitude of 23–38 °C, while their abundance and diversity toward Equator and also poles decrease (Polis 1990). Out of about 1,500 scorpion species in the world, few cause severe toxicity, including more than 1.23 million stings annually, of which approximately 3,250 (0.27%) cause death (Khatony et al. 2015). Mexico, Colombia, and Iran are the most affected countries.

Out of about 100,000 scorpionism cases including children (75%) in Iran, only 36,000–50,000 ones are reported officially, with a 7–60 mortality rate per year (Ghaderi 2004, Zarei et al. 2009, Mirshamsi et al. 2011), especially in Khuzestan, Bushehr and Ilam Provinces (south-western Iran) (Rafizadeh et al. 2013).

The Iranian scorpion fauna ranges from 51–66 species in 17–23 genera and 3–4 families, according to different references (Mirshamsi et al. 2011, Navidpour 2012), of which about 10 species have been incriminated in human envenomation, that, in turn, is more than any other country in Middle East (Dehghani and Fathi 2012). Except *Hemiscorpius lepturus* (Hemiscorpiidae), the most important, medically, scorpion in Iran (Kovařík 1997), all the

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venomous scorpion species belong to the Buthidae family (Zarei et al. 2009).

Ilam Province (Latitude: 33° 63' 74" N, Longitude: 46° 42' 27" E) located at west of Iran with around 20,150km^2 and 1.2% surface of the country area, rich and diverse plant coverage, and also various climates, is of the most suitable living-places for scorpions. The current study aimed at determining fauna and bio-geographical distribution of scorpions in Ilam in 2014–15.

Materials and Methods

In this cross-sectional study of employing field and laboratory techniques, the fauna was investigated during March 2014 to February 2015. The sampling sites (nine places) were selected based on geographical situation, scorpionism reports, weather, and plant coverage in all the three climates of the province. The detailed data of sampling sites have been shown in Table 1 and Fig. 1.

The sampling was done at night (from dusk to midnight) using a black light -ultra violet (UV) light- and a long forceps. All the captured scorpions were placed in 70% ethyl alcohol. No specimens were caught by above-mentioned method during November to February months, due to cold weather of sampling areas. The geographical data were recorded by a GPS apparatus (GARMIN 78 S). All the specimens were identified according to taxonomic keys (Navidpour et al. 2008a). The gender of specimens was also determined based on Farzanpey method (Farzanpay and Vachon 1979).

Results

Out of all the 391 specimens collected from nine sites in different parts of the province, 11 species were identified as follows: *Hottentotta saulcyi*, *Mesobuthus eupeus*, *Compsobuthus matthiesseni*, *Razianus zarudnyi*, *Hemiscorpius lepturus*, *Androctonus crassicauda*, *Orthochirus iranus*, *Odontobuthus bidentatus*, *Buthacus macrocentrus*, *Scorpio maurus*, and *Polisius persicus.*

The most abundant species were *H. saulcyi* 25.09% (relative frequency), *M. eupeus* 23.29%, and *C. matthiesseni* 16.18% which showed the highest frequency in all the three climates studied. The lowest abundance stood for *P. persicus* 1.79% and *S. maurus* 1.29%, respectively. *H. lepturus* which is the most poisonous scorpion of Iran had a 7.16% relative frequency. Further, *R. zarudnyi* was found just in mild mountainous climate, however, *O. bidentatus* 3.58% and *B. macrocentrus* 2.84% were found in low abundance at dry-hot climate. Totally, 138 males and 253 females were identified showing F/M sex ratio of about 2:1 (Table 2).

Table 1. Sampling sites of scorpions in Ilam Province, 2014

Climate type	County	Sampling site	Longitude	Altitude	Height (sea level m)
Cold mountainous	Aivan	Babagir	46 ◌̊ 11◌́	33◌̊ 56◌́	1,070
Cold mountainous	Ilam	Gholandar	46◌̊ 27◌́	33◌̊ 39 ◌́	1,045
Cold mountainous	Sirvan	Karezan	46◌̊ 32◌́	33◌̊ 44◌́	1,280
Moderate mountainous	Badre	Badre	47◌̊ 1◌́	33◌̊ 19◌́	1,090
Moderate mountainous	Dare-shahr	Dare-shahr	47◌̊ 21◌́	33◌̊ 10◌́	670
Moderate mountainous	Zarin-abad	Sayed-naseredin village	46◌̊ 50◌́	33◌̊ 10◌́	810
Dry and hot	Abdanan	Murmuri	47◌̊ 41◌́	32◌̊ 44◌́	520
Dry and hot	Mehran	Golan	46◌̊ 16◌́	33◌̊ 25◌́	550
Dry and hot	Dehloran	Bishe-deraz	47◌̊ 01◌́	32◌̊ 46 ◌́	390

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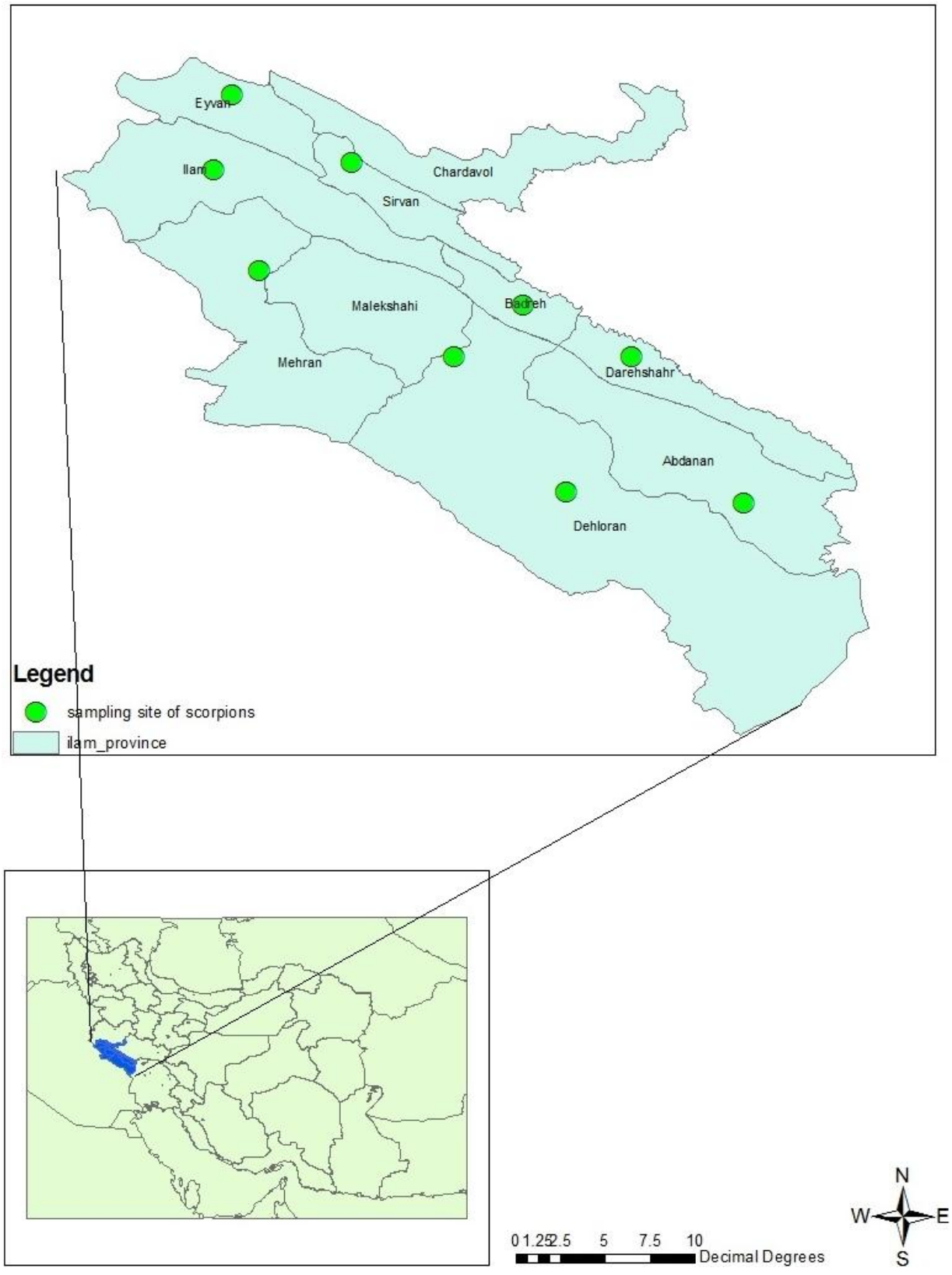

Fig. 1. Sampling sites of scorpions in Ilam Province, 2014

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Table 2. Scorpions collected in different parts of Ilam Province, 2014

Family	species	Sampling sites	Frequency of each species			Relative frequency at the province (%)
			Male N (%)	Female N (%)	Total	
Buthidae	*Hottentotta saulcyi*	All areas	30 (31)	68 (69)	98	25.09
Buthidae	*Mesobuthus eupeus*	All areas	40 (43)	52 (57)	92	23.29
Buthidae	*Compsobuthus matthiesseni*	Ilam, Sirvan, Dareh-shahr, Zarin-abad	22 (35)	41 (65)	63	16.18
Buthidae	*Razianus zarudnyi*	Mehran, Badre, Zarin-abad	16 (47)	18 (53)	34	8.69
Hemiscorpiidae	*Hemiscorpius lepturus*	Mehran, Badre, Abdanan	10 (36)	18 (64)	28	7.19
Buthidae	*Androctonus crassicauda*	Sirvan, Mehran, Dehloran, Ilam, Aivan	5 (24)	16 (76)	21	5.39
Buthidae	*Orthochirus iranus*	Sirvan, Mehran, Dehloran, Ilam, Aivan	6 (33)	12 (67)	18	4.67
Buthidae	*Odontobuthus bidentatus*	Dehloran, Abdanan	2 (14)	12 (86)	14	3.58
Buthidae	*Buthacus macrocentrus*	Dehloran, Abdanan	3 (27)	8 (73)	11	2.84
Buthidae	*Polisius persicus*	Abdanan	3 (43)	4 (57)	7	1.79
Scorpionidae	*Scorpio maurus*	Dehloran, Abdanan	1 (20)	4 (80)	5	1.29
All Scorpion species			138 (35.30)	253 (64.70)	391	100

Discussion

In the current study, totally 11 scorpion species from Buthidae, Scorpionidae, and Hemiscorpiidae families were identified, which shows a diverse fauna due to the good habitat and favorite climate of the studied area. In other studies accomplished in Iran, 8 species from Fars and Kohgilouyeh and Boyer-Ahmad provinces (Azizi et al. 2001), 10 species from Hormozgan Province (Shahi et al. 2009), 3 species from Gonabad County (Ramezani-Avval-Riabi et al. 2010), 8 species from Kerman Province (Dehghani 2008), 7 species from Kish Island (Khaghani et al. 2005), 7 species from Qeshm Island (Zarei et al. 2009), 8 species from Sistan and Baluchestan Province (Nejati et al. 2014), 2 species from Sari County (Motavali-Haghi et al. 2004), 5 species from Chaharmahal and Bakhtiari Province (Pirali-Kheirabadi et al. 2014), and finally 5 species from Zanjan Province (Moradi et al. 2015) have been reported. Comparing the current findings to other studies, the species richness and diversity of scorpions can be concluded, based on the quantity of species found. However, in neighboring provinces of Lorestan, and Khuzestan with almost similar climates, 5 and 19 species have been reported respectively, showing much more diversity in Khuzestan Province (Taherian 2003, Navidpour et al. 2008b).

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In the current study, 11 species including *H. saulcyi*, *M. eupeus*, *C. matthiesseni*, *R. zarudnyi*, *H. lepturus*, *A. crassicauda*, *O. iranus*, *O. bidentatus*, *B. macrocentrus*, *S. maurus*, and *P. persicus* were collected and identified in Ilam Province. Mozafari had reported 7 species in one county of the province (Mozaffari et al. 2013), Gowhari had identified 10 species in different climates of the province (Gowhari et al. 2012), however, Navidpour reported 14 species in three families, while *Vachoniolus iranus*, *Compsobuthus jakesi*, *Apistobuthus susanae* species were not found in our study. The recent species had been found in Ein-e-Kosh village (Navidpour et al. 2008a), located in far south of the province, having a similar climate and ecosystem to that of Khuzestan Province. Therefore, no sampling has been done in that area, a fact that justifies the difference.

The most abundant species of the province was *H. saulcyi* which collected in all the three climatic areas of the province, as well reported by Gowhari in all studied places (Gowhari et al. 2012). Sedaghat (Sedaghat et al. 2012), in respect to biogeographical distribution of Iran's scorpions has reported the *H. saulcyi* in Khuzestan, Kohgiloyeh-Boirahmad, and Kermanshah Provinces with dry-hot, cold-mountainous, and mild-mountainous climates, respectively, showing high adaptation of the species.

The second abundant species was *M. eupeus* found in mountainous areas and beneath the rocks, that were in accordance with the findings of Khairabadi in Chaharmahal and Bakhtiari mountainous areas, and also those of Motavali-Haghi from mountains of Sari County, northern Iran (Motavali-Haghi et al. 2004, Pirali-Kheirabadi et al. 2014).

Out of the most dangerous and venomous scorpions, *H. lepturus* and *A. crassicauda* (black scorpion) with frequencies of 7% and 5%, respectively, were also found in the studied area. The *H. lepturus* has been reported as the most dangerous and main cause of death in Khuzestan Provinces' scorpionism (Radmanesh 1990, Dehghani and Fathi 2012, Nejati et al. 2014). The thin and small sting has been reported as the feature of such species, along with a painless sting which leads to acute complications such as tissue necrosis, hemolysis, and even death during the first 48 hours. *Hemiscorpius lepturus* was identified in Golan, Badre, and Murmuri areas of the province.

Androctonus crassicauda was found in five areas of the province (Table 2) reported as the main scorpionism cause in Khuzestan Province. The current species have also been reported in Semnan, Bushehr, and Lorestan provinces (Sedaghat et al. 2012).

From the sex-ratio point of view, the females were the dominant gender during the study, i.e. 2:1 (F/M) sex ratio. Wilson has reported the sex-ratio (F/M) of 3.91 and/or 4:1 (Lourenço 2002). Shahi has also reported much more abundance of females than males in Hormozgan Province which both are in accordance with our findings (Shahi et al. 2009).

Conclusion

Despite the relatively small area (1.2% of the country surface), a diverse fauna was seen, compared to other studies in different provinces of Iran. Such geographical distribution may be affected by climate changes and global warming, their habitat, and even the distribution pattern of each species (Bellard et al. 2012). The health and medical importance of scorpions necessitates comprehensive and periodic research on their ecology including habitat, diet, environment's temperature, humidity, and precipitation in the province.

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