

Species composition and distribution of dangerous scorpions of *Hemiscorpius* genus and clinical symptoms due to envenomation in high-risk regions of southern Iran

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Abstract. *Shahi M, Moosavy SH, Hanafi-Bojd AA, Akbari M, Rafinejad J. 2021. Species composition and distribution of dangerous scorpions of Hemiscorpius genus and clinical symptoms due to envenomation in high-risk regions of southern Iran. Biodiversitas 22: 2945-2951.* The southern regions of Iran, including Hormozgan province, are high risk areas for scorpion stings. This study aimed to determine the distribution and species diversity of dangerous scorpions of *Hemiscorpius* and also to determine the clinical symptoms of their bites in the high-risk areas of Hormozgan province. Scorpion sampling was carried out from Shahid Mohammadi and Koodakan hospitals in Bandar Abbas also filed areas of Bandar Abbas and Khamir counties by searching the scorpion's shelter throughout the day and using ultraviolet light at night. To determine the clinical symptoms, the data recorded in the patient's file were extracted and recorded in the sting checklists. Five species of the *Hemiscorpius* genus were identified. *H. gaillardia* and *H. persicus* are reported for the first time from Hormozgan province. Specific clinical symptoms after several hours of delayed were pain, swelling, itching, warmth, and edema, necrosis of the sting site, nausea, vomiting, dizziness, and fever. Complications such as urine discoloration, hemoglobinuria, severe hemolysis, and acute renal failure were observed. The results showed that envenomation with *Hemiscorpius* Scorpions should be considered as an urgent medical issue.

Keywords: Antivenom, hemoglobinuria, Iran, renal failure, scorpion sting

INTRODUCTION

Scorpions are among the poisonous arthropods and every year in warm seasons in large areas especially western and southern regions of Iran threatens the health of many residents of these areas. Annually about 50,000 cases of scorpion sting are reported in Iran (Mousavi et al. 2015). Most of the deaths due to scorpion stings occur in the western and southern regions of Iran (Dehghani Rouhullah and Fathi 2012, Karami et al. 2013, Shahi Mehran et al. 2015). *H. lepturus* is the most dangerous scorpion species in western and southwestern regions of Iran (Dehghani R et al. 2012, ZARE et al. 2010). This scorpion has cytotoxic venom and causes complications such as hemolysis, renal failure, and sometimes death in patients (Dehghani R et al. 2012). Khuzestan, Hormozgan, Sistan and Baluchestan, and Kerman provinces are the most important scorpion envenomation centers in Iran (Dehghani Rouhullah et al. 2016). Hormozgan province is one of the high-risk scorpion-sting in southern Iran (Rafinejad et al. 2020). Every year significant sting cases of scorpion and death due to scorpion envenomation are reported in this province (Moosavy et al. 2016, Shahi Mehran et al. 2015). In 2018, 4292 scorpion stings and 5 cases of deaths induced by scorpion envenomations were reported in the Hormozgan

province that Bandar Abbas with 1307 cases were the most related (Shahi Mehran et al. 2021). Unfortunately, considering the importance of scorpion envenomation, very few studies have been conducted on fauna, ecology, epidemiology, and clinical symptoms of scorpions in this province.

So far 22 scorpion species have been reported from different regions of Hormozgan province that 5 species belonging to the *Hemiscorpius* genus including *H. persicus*, *H. lepturus*, *H. enischnochela*, *H. acanthocarcus*, and *H. gaillardia* that they are among the most dangerous scorpions in Iran (Navidpour et al. 2013, Rahmani et al. 2015, Shahi Mehran et al. 2016). *Hemiscorpius* sting may cause a wide variety of clinical symptoms in the patients which include fever, allergies, salivation, vomiting, seizure, nervous system failure, hemolysis, acute renal failure, cardiovascular failure, edema, blister, and necrosis that in some cases cause death (Shahi Mehran et al. 2020a).

Considering the importance of scorpion envenomation and lack of information from the main agent of sting and death of patients in some parts of the province, this descriptive study was designed and conducted. The main purpose of this study was to identify dangerous species of scorpions and their distribution in high-risk cities in terms of scorpion sting including Bandar Abbas and Khamir and

determine the clinical symptoms of envenomation to urgent referral, timely care, and treatment, and prevent severe complications.

MATERIALS AND METHODS

Study area

This is a cross-sectional study that conducted in Bandar Abbas and Khamir counties, which are considered among the most high-risk centers in terms of scorpion stings and death due to scorpion envenomation in Hormozgan province and also was performed on scorpion sting victims referred to emergency wards of Shahid Mohammadi and Koodakan hospitals of Bandar Abbas during 2014-2015.

Scorpion sampling was done by determining sampling stations in different parts of the mentioned Counties (Figure 1). To determine the causes of the sting and clinical symptoms in the patients, the samples of scorpions caught by the patients were collected at the time of admission, and clinical information was recorded from the patients' file and registering in the regulated checklists.

Bandar Abbas County has located in geographical coordinates of 54° and 53 minutes to 56° and 30 minutes east length and 26° and 53 min to 27° and 31 min north width on the southern coast of Iran. Bandar Abbas is situated on flat ground with an average altitude of 9 meters above sea level. The mean rainfall in Bandar Abbas County

was reported between 150 and 200 mm per year (16). Khamir County with an area of 3705.9 km² consists of two parts about 5.2% of the total soil area of Hormozgan province. The county is located in geographical coordinates of 53° and 49 minutes to 55° and 23 min east length and 26° and 54° to 27° and 28 minutes north width. The average annual rainfall is about 120 mm, and the annual relative humidity is about 75%.

Sampling size and scorpion identification

Sampling was done by random sampling method during the day (Until noon) from under the rocks and dried tree branches and night time (Night catch with UV light) from 20 villages of Bandar Abbas and Khamir counties during 2014-2015. The collected scorpions were placed in a container containing 75% alcohol with identification labels. Samples were identified by Nikon stereomicroscope XN-Model using diagnostic keys of Iranian scorpions in the medical entomology laboratory of Bandar Abbas School of Public Health (Monod and Lourenco 2005, Navidpour et al. 2013). Data were analyzed by SPSS 16 software using descriptive and inferential statistics including frequency, percentage, and k-square. Tables and charts were plotted by Excel software. ArcGIS 10.2 software was used to determine the spatial distribution of dangerous *Hemiscorpius* species in the studied areas.

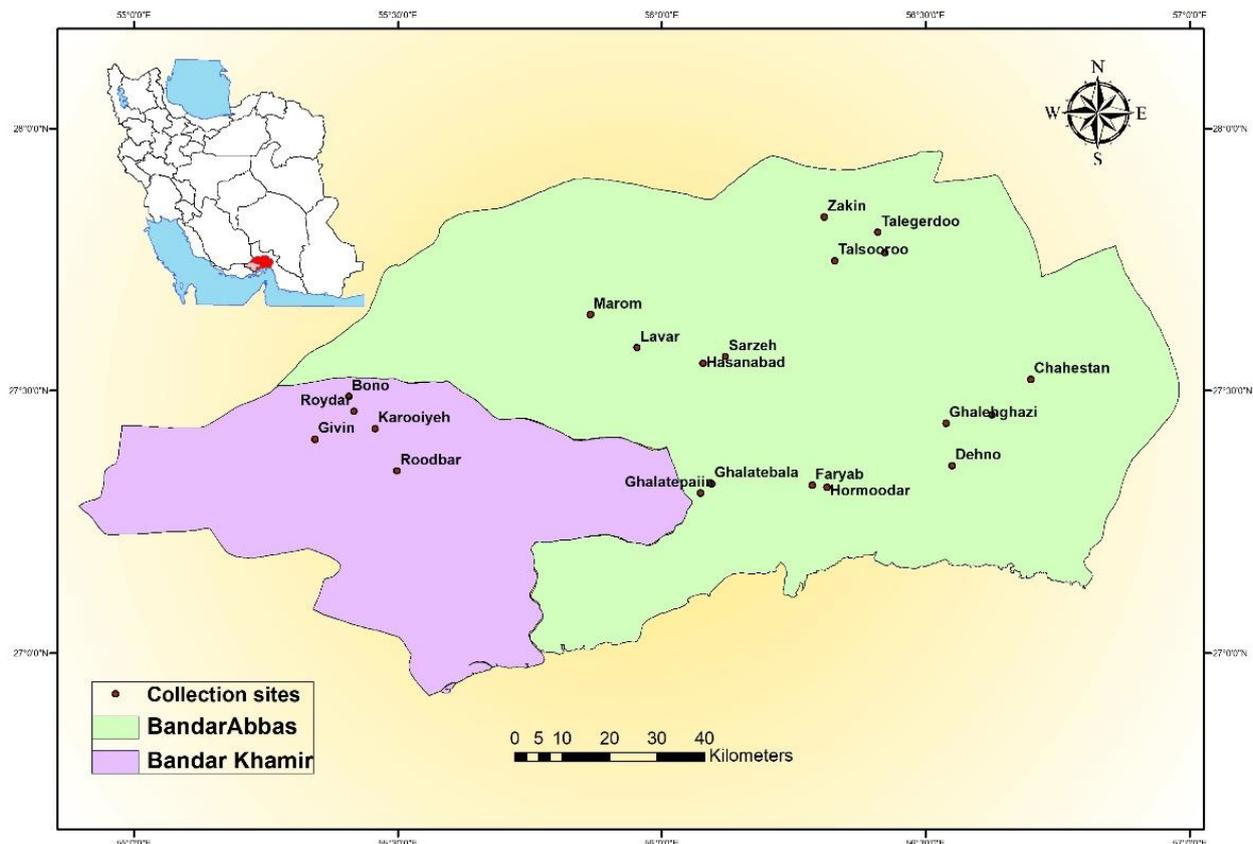


Figure 1. Sampling stations in the studied areas in Bandar Abbas and Khamir Counties, Iran, 2014

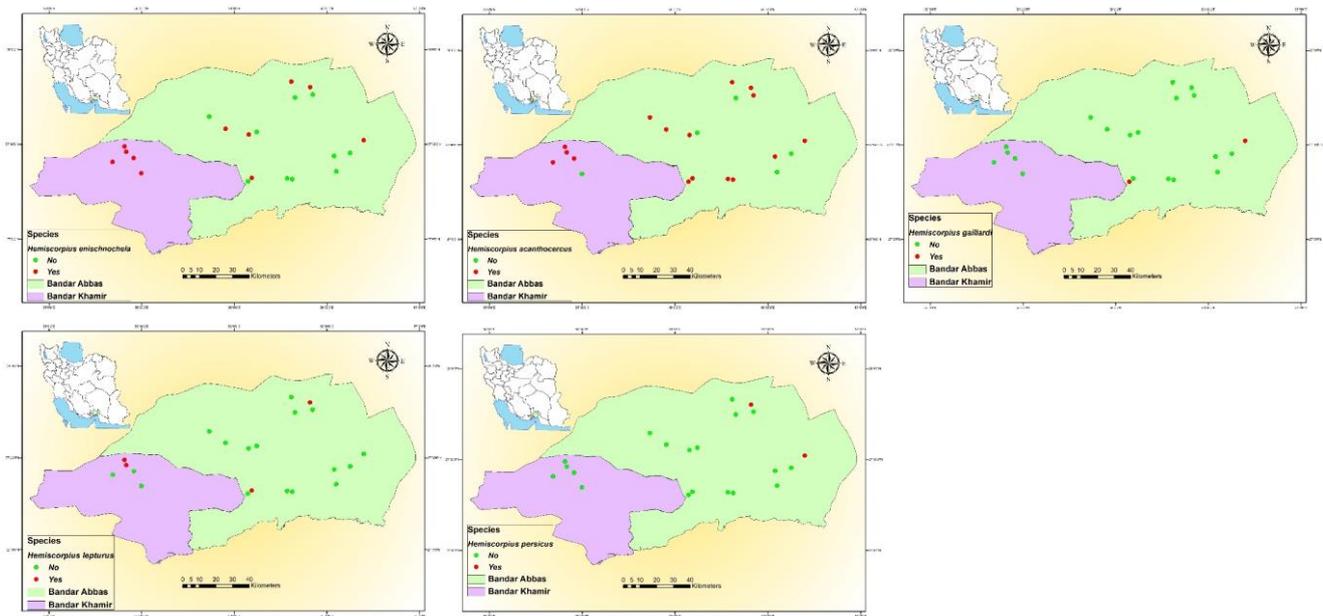


Figure 2. Species distribution of *Hemiscorpius* in Bandar Abbas and Khamir counties, Iran, 2014

Clinical symptom

In this study, a total of 305 patients including 149 men and 156 women were examined. Clinical findings of patients are shown in Figure 3. The most common clinical symptoms of scorpion sting in patients were redness and the least symptoms were related to Rash (Figure 3).

The recorded reports and observations indicated a lack of complaints from pain and burning in the site of sting in the early stages of *Hemiscorpius* scorpion sting. After a few hours, redness, pain, and other clinical symptoms are common.

Other symptoms with lower percentage selected by *Hemiscorpius* scorpions were Sweating (2%), muscle pain (1.6%), hand and foot tingling (1.6%), cellulite (1.3%), Numbness of bite organ (1%), tachycardia (0.7%), shortness of breath (0.7%), Chest pain (0.7%), Blurred vision (0.7%), epigastric burning (0.7%), and generalized rash (0.3%), Confusion (0.3%) and Weakness (0.3%). Among the victims, three (1%) were studied. Among the patients, three (1%) were allergic to scorpion antidote serum. Also, five (1.6%) of the patients were admitted to the intensive care unit (ICU) due to acute symptoms such as hematuria and severe hemolysis.

Discussion

The highest species richness of scorpions was related to mountainous areas. This finding is consistent with the results of other similar studies (Azizi et al. 2001). In Bandar Abbas, the highest species richness in *Hemiscorpius* genus was observed by the identification of five species of *H. acanthocercus*, *H. enischnochela*, *H. gaillardia*, *H. persicus*, and *H. lepturus*. Also, the highest

frequency was related to *H. acanthocercus*. This species is native to Hormozgan province (Monod and Lourenco 2005).

In Khamir County, only three species of *Hemiscorpius* were identified including *H. enischnochela*, *H. acanthocercus*, and *H. lepturus*. The dominant species of *Hemiscorpius* was *H. enischnochela* in this region. The high frequency of patients envenomed by *H. acanthocercus* and *H. enischnochela* referred to the Shahid Mohammadi, and Koodakan hospitals, confirms the accuracy of the results of the field (Shahi Mehran et al. 2020b).

Hemiscorpius enischnochela was abundant in rural areas of Khamir County. This is one of the species that tend to enter human residences, especially in summer (Shahi M et al. 2009). This can be due to the escape from the heat and sheltering into a cool and wet environment of human places. Endophily behavior of this species increases their risk of contact with residents of these places.

The highest geographical distribution in the studied areas is related to *H. acanthocercus*. This scorpion was collected in major locations of collection. The dominant species of scorpions belonging to genus *Hemiscorpius* in mountainous areas in Bandar Abbas and Khamir counties were *H. acanthocercus* and *H. enischnochela* respectively.

Hemiscorpius lepturus were collected from two stations in Bandar Abbas and Khamir counties. *H. gaillardia* and *H. persicus* were observed only in central, fin, and Takht parts of Bandar Abbas County with very low frequency. In Hormozgan province, except for two species of *H. gaillardia* and *H. persicus*, which are first reported from Hormozgan province, the other species of *Hemiscorpius* including *H. acanthocercus*, *H. enischnochela*, and *H. lepturus* has been reported by different researchers (Monod and Lourenco 2005; Navidpour et al. 2012; Navidpour et al. 2013).

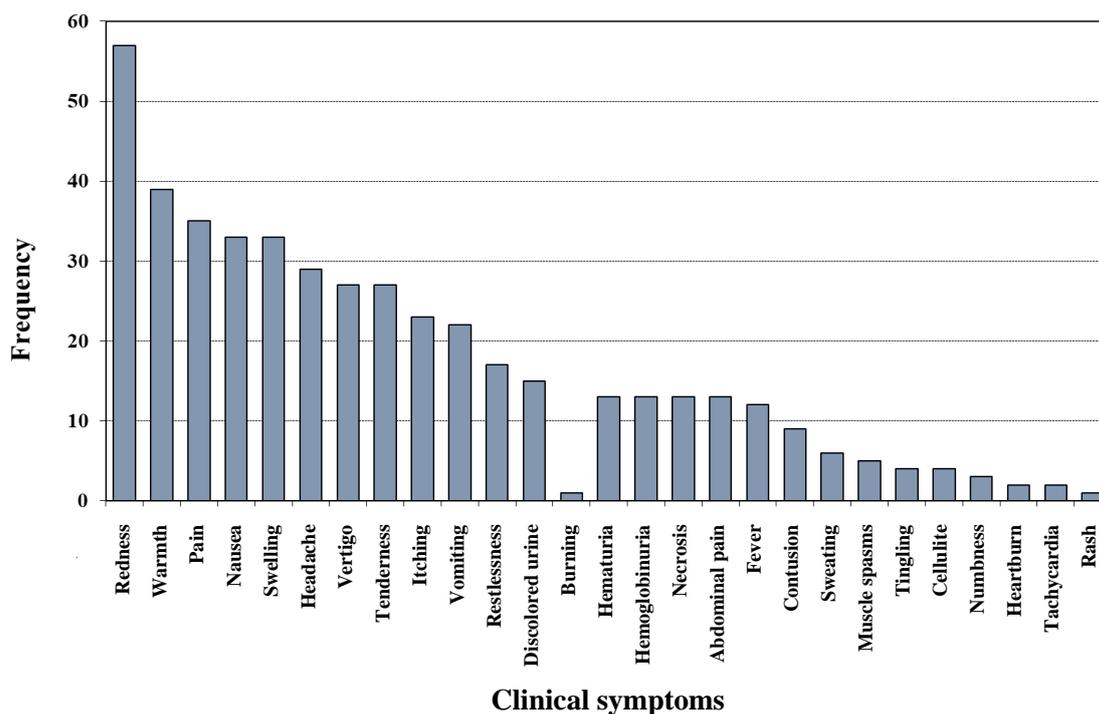


Figure 3. Frequency of specific clinical symptoms observed in patients selected by *Hemiscorpius* scorpions, Shahid Mohammadi, and Koodakan hospitals of Bandar Abbas, Iran, 2014

Compsobuthus persicus is another scorpion identified with high abundance and envenomation cases in the patients. This scorpion was the second cause of scorpion sting in the patients under investigation.

Other species with high frequency were *Mesobuthus eupeus*, *Odontobuthus doriae*, and respectively. In another study in Jask County of Hormozgan province, the dominant species was *Mesobuthus eupeus* (Fekri et al. 2012). The rarest species in this study were *Odontobuthus brevidigitus*, *Razianus zarudnyi*, and *Orthochirus varius*. Two recent species have been reported by Navidpour from Hormozgan province (Navidpour et al. 2013).

In this study, dangerous species of *Hemiscorpius* include *H. acanthocercus*, *H. enischnochela*, *H. persicus*, and *H. gaillardia* are first introduced as scorpion sting agents in the south of Iran. *Hemiscorpius persicus* and *H. gaillardia* have been reported only from the east of Iran (Monod and Lourenco 2005). *Hemiscorpius lepturus* is one of the most dangerous scorpions identified in Khuzestan province (Mohseni et al. 2013, Rahmani and Jalali 2012). In this study, *H. acanthocercus* had the highest rate of scorpion sting in the patient's people. *Hemiscorpius gaillardia* scorpion had the least frequency of scorpion sting in *Hemiscorpius* genus.

A wide range of clinical symptoms in patients was observed including, burning, redness or stinging site, nausea, dizziness, and headache. Other clinical symptoms with less frequency were swelling, itching, vomiting, fever, abdominal pain, restlessness, necrosis, and hematuria. In similar studies in western parts of Iran, these clinical

symptoms have been reported in scorpion envenomation patients (Rahmani and Jalali 2012).

Out of 305 patients, five (1.6%) were admitted to the intensive care unit (ICU) due to acute symptoms including hematuria and severe hemolysis. All of these victims were stung by species belonging to *Hemiscorpius* including *H. enischnochela* and *H. acanthocercus*. So far in western regions of Iran, only one species of scorpion belonging to the genus *Hemiscorpius* has been introduced as the cause of necrosis, hemolysis and severe hematuria, and even death (Vazirianzadeh et al. 2013).

No acute symptoms such as hematuria, hemolysis, and renal failure were observed in the patients who were stung by Buthidae family. The clinical symptoms of scorpion sting are very different and according to scorpion species, the amount of venom injected, season, age and physiological status of the injured may occur from a mild local reaction to severe physiological changes leading to death (Rafizadeh et al. 2013).

According to the statements of the patients, unlike the Buthidae family, stinging of *Hemiscorpius* scorpions was associated with very little pain in the sting site. Some researchers also reported the mild pain of the sting with *Hemiscorpius* (Dehghani R et al. 2012, Vazirianzadeh et al. 2013). Hemiscorpionidae family has a small sting of about 1 mm and their sting have a low pain. This causes a lack of attention and causes delayed referral to hospital and treatment.

Our finding showed, in envenomation with *Hemiscorpius*, the pain was created after at least four hours

which was associated with redness, swelling, and itching of the stinging site. Other symptoms such as nausea, vomiting, dizziness, headache, inflammation, transpiration, and abdominal pain were observed exclusively or with much more frequency than the patients who were stung by other genus scorpions. In addition, in envenomation with *Hemiscorpius* scorpions, necrosis of the sting site, urine discoloration, and hemoglobinuria were observed. The important point is that in the patients with plurality sting or when the place of the sting is in the trunk area, the symptoms had been found faster. The results of another study showed that renal failure was more severe in children who were stung in the trunk and delayed referring to the hospital (Afzali and Pezeshki 1998).

According to reports in scorpion patients in western Iran, the most severe complications observed due to *H. lepturus* (Kassiri et al. 2012a, Vazirianzadeh et al. 2013). The results of different researchers' studies have shown that *H. lepturus* venom has neurotoxic, cytotoxic, and hemolytic effects and causes severe skin wounds and inflammations with hidden and severe hemolysis (Dehghani R et al. 2012, ZARE et al. 2010). It also affects the central nervous system, the cardiovascular, skin, and kidneys (Emam et al. 2011). In the present study, severe complications such as severe hemolysis, hematuria, necrosis, acute renal failure, and death with mentioned acute symptoms were observed.

The main strategy for scorpion sting treatment in Iran is using specific antidotes of any species (Kassiri et al. 2012a, Kassiri et al. 2012b). The polyvalent serum has been prepared specifically for the treatment of envenomation of six dangerous scorpion species in Iran. The important point is that currently the polyvalent serum in Iran containing only the antidote of one of the *Hemiscorpius* species (*H. lepturus*). Due to the necessity of specificity of the antidote for each species, according to the available evidence, this antidote is not specific for the treatment of patients people bitten by other species of the *Hemiscorpius* and does not have the effectiveness.

Our finding in this study showed that *Hemiscorpius* sting should be considered as a medical emergency. This requires immediate attention based on clinical symptoms in the injured. It is also recommended that physicians in this region become familiar with the scorpions of the region and their treatment protocol.

Due to the importance of the subject, it is very important and necessary to conduct more extensive clinical studies and also to investigate the distribution of dangerous species belonging to the *Hemiscorpius* genus in other parts of the province.

In conclusion, the results showed that envenomation with *Hemiscorpius* scorpions should be considered as an urgent medical issue. In view of the importance of the subject, it is suggested that studies on *Hemiscorpius* venom and the evaluation of the effect of scorpion anti-venom should be taken.

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