

Research Paper: Epidemiology of Scorpion Envenoming in the Prefecture of Figuig, Morocco



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ABSTRACT

Background: Scorpion stings are a public health problem in Morocco. Many studies have been conducted in various geographic locations to explore this problem. In this context, this is the first study aims to provide an epidemiological analysis of scorpion stings in the prefecture of Figuig, Morocco between 2009 and 2017.

Methods: This is a retrospective study providing an epidemiological analysis of scorpion stings over 9 years. The data comprised the number of cases collected each month, their origin, and clinical outcomes. The data were transferred to Microsoft Office Excel and the statistical analysis describing means, standard deviations and frequencies, was performed using the program Epi info 6.

Results: Over 9 years, there have been 1485 accidents recorded with sex ratio (M:F) as 1:1. The average incidence recorded is 127.62 per 100000 inhabitants per year. The stings were more frequent in summer months, particularly July and August, and 21.14% of the cases were children under 15 years. Of all cases, 73.4% did not need any medication, 3.03% needed hospitalization to treat specific symptoms and medical conditions, and 2.89% needed treatment for systemic effects of the envenomation. About 94.81% of all patients presented local symptoms and only 1.41% have their condition evolved into advanced symptoms and general manifestations.

Conclusion: Scorpion stings are a public health problem in the prefecture of Figuig. The present study provided analysis in order to integrate the national strategy to fight the scorpion stings in Morocco.

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1. Introduction

Scorpions with more than 1500 species and their venom as toxic as and even more than that of the snakes [1] are regarded dangerous creatures with their deadly stings which require medical emergency, especially with regard to the speed of the venom distribution inside the body of children. Worldwide, the frequency of scorpion stings was estimated 1.2 million with a mortality rate of 3250 deaths per year [2]. The geographic areas involved with scorpionism are concentrated in subtropical regions; Mexico, South-America, North-Sahara Africa, South Africa, Middle-East, and India [3]. (Figure 1)

According to the National Anti-Poison and Pharmacovigilance Centre (CAPM), scorpion stings are the leading cause of intoxication in Morocco by an incidence ranging from 0-2.9% and an average mortality rate of 0.34% [4]. Considering the geographical and climate diversity of Morocco, more than 50 scorpion species have been described from 11 genera and two families (The Buthidae and Scorpionidae). The most recognized species in the country are the black scorpion (*Androctonus mauritanicus*) and yellow scorpion (*Buthus occitanus*) (Figure 2) [5].

This study aimed to describe the epidemiological characteristics of the scorpion stings in the prefecture of Figuig considering their climate and geography. By its location in the extreme southeast of Morocco, it is bordered in the north by the prefecture of Jerrada, to the northwest by the prefecture of Bouleman, to the west by the prefecture of Errachidia, and in the south and east by the Morocco-Algerian border. It covers an area of 55.990 km² [6].



The estimated population of the prefecture was 138.325 inhabitants according to the national census of the population in 2014 [7]. The distribution of the population between rural and urban areas is equal; 69203 inhabitants in rural areas and 69123 inhabitants in urban areas. The prefecture has six principle cities with various distances (affecting the transfer of patients) from the Intensive Care Unit (ICU) in the prefectural hospital: Bouarfa (the capital), Tendrara (66 km far from the prefectural Hospital), Figuig (108 km), Bouanane (125 km), Bni-Tadjite (190 km), and Talsint (220 km).

The geography of the prefecture is characterized by two major elements: The highlands represent 50% of the areas of the prefecture, with an attitude between 1300 and 1500 m above the mean sea level. The vast majority of this land is covered by semi-arid desert plant: *Stipa tenacissima*; and Mountains ranges are extensions of the high Atlas Mountains in Morocco, making the soil abundant of stones and increasing the soil hardness. The climate is semi-arid characterized by the cold in the winter and the extreme heat in the summer with frequent winds along the year. The annual pluviometry is as low as 150 mm/y [6].

2. Material and Methods

This is a retrospective study of data recorded monthly by the epidemiological-cell animator over 9 years from 2009 to 2017. The data comprised the number of cases reported each month, their origin, and clinical outcomes. The data were transferred to Microsoft Office Excel and the statistical analyses such as describing means, standard deviations, and frequencies were performed in Epi info 6.

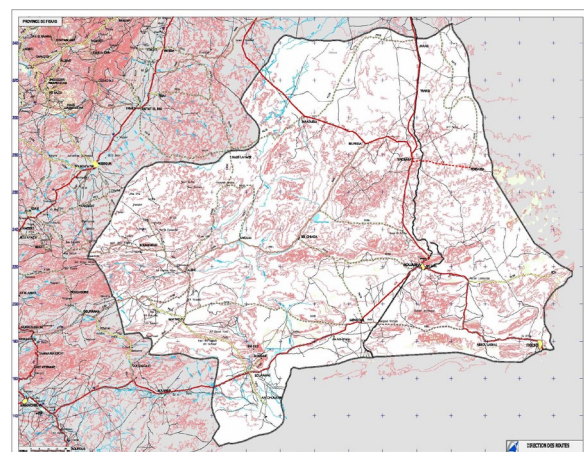


Figure 1. Geographic locations of the six towns in the prefecture of Figuig

The map on the left shows the community division of the prefecture (Abbou-Lakhal refers to Figuig town and Beni-Guil refers to Bouarfa) [8]. The map on the right shows the roads of the prefecture.

This study data were collected from the local health authorities that followed and registered all scorpion stings cases in the prefecture of Figuig in the Southeastern of Morocco from 2009 to 2017. The survey was held over the whole prefecture in their different geographical areas, urban areas, and rural areas. Each scorpion sting (in urban or rural areas) was registered in one of the local hospitals in the six cities depending on the geographical position of the accident: Bouarfa, Figuig, Tandrara, Bouanane, Talsint, and Benitdjit.

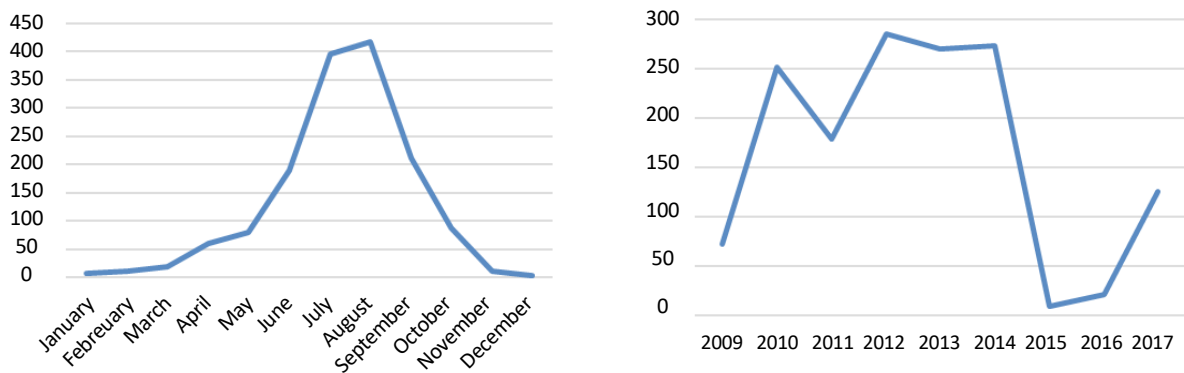
If a sting accident occurred in Figuig City or any rural areas near to it and considered as part of that city, then the accident would be registered in the local hospital of Figuig. Those divisions are covered by the Moroccan Ministry of Health. The data provide no indication of the residence origin of the victims (rural vs. urban), so we made our calculations according to the cities where the accidents happened and registered.

The findings of this study are based on all declared cases happened in the prefecture. In our analysis, we included all cases in the data as they are. Therefore,

our calculations were reported to the general population (legal population of the prefecture of Figuig from the official web site of high commission for planning in Morocco available at https://www.hcp.ma/Etudes-demographiques_r165.html). The geographic areas considered in our study is all administrative areas of the prefecture of Figuig and the considered population is the total population of the prefecture.

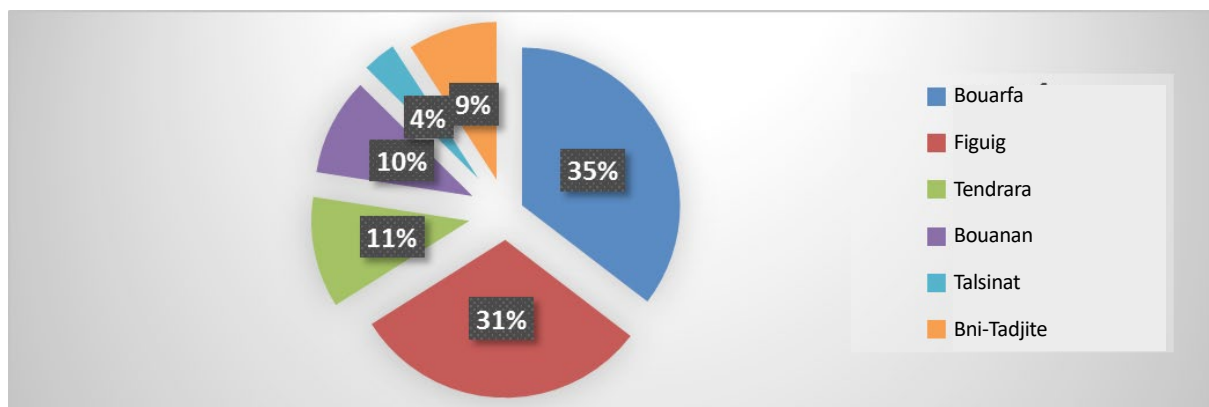
3. Results

Over 9 years, there have been 1485 sting accidents recorded in the prefecture with an annual average of 165 cases per year. The highest yearly recorded cases was in 2012 with 285 cases. The sex ratio (M:F) was 1:1 (52.72% males versus 47.27% females). The percentage of children being stung under 15 years old was 21.14% of the total cases. Five deaths were recorded over 1485 cases which represent 3.36 deaths per 1000 individual stung over 9 years. The lethality rate for the prefecture of Figuig was calculated as 0.33% [Minimum 0.0-Maximum 1.39].



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Figure 2. The distribution of the scorpion stings in the prefecture of Figuig over the study years and months



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Figure 3. The distribution of the scorpion stings frequencies in the six major cities of the prefecture



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Figure 4. Example of Scorpion present in the prefecture of Figuig in dorsal and ventral views in their habitat (*Buthus occitanus*) (original picture)

The incidence of scorpion stings in the prefecture of Figuig was calculated as 1.27%, and 94.81% of stung patients have had only local signs such as pain, redness, and tingling, and so classified as Class I patients. About 3.77% of patients presented general symptoms such as vomiting, nausea, sweating, so classified as Class II patients. Only 1.41% of stung patients have their symptoms evolved to cardiac manifestations and or respiratory and neurological distress as Class III (life threatening) patients.

Of total 1485 cases, 45 (3.03%) patients were admitted to the hospital for intensive care unit and fellowship. Almost, 98.72% of the patients were not referred to the

prefectural hospital and their conditions were considered as stable. In terms of treatment and medication, 23.56% of stung patients were treated for their local symptoms, while 2.89% needed appropriate care and special treatment. The rest, i.e. 73.40% was considered stable with no need for treatment or medication (Table 1).

The scorpion stings occurred during all year's months, starting from January (0.40% of all stings occurred in the prefecture) to December (0.13%), with an average of 13.75 stings per month [Maximum 86-Minimum 0]. The highest months recorded for the stings were August (28.14%) and July (26.59%) defining the summer time which accounts for 67.54% of the total cases.

Table 1. The distribution of the epidemiological characteristics of the stung patients in the prefecture of Figuig

Epidemiological Characteristics of Stung Patients		No.	%
Gender	Female	702	47.27
	Male	783	52.72
Age	≤15 years	314	21.14
	>15 years	1171	78.85
Local signs (Class I)	Pain, redness, tingling, Oedema	1408	94.82
General signs (Class II)	Vomiting, nausea, sweating	56	3.77
Deficiency signs (Class III)	Cardiology distress, respiratory distress, neurological deficiency	21	1.41
Hospitalisation	-	45	3.03
Referring the patients	Not referred	1466	98.72
	Referred	19	1.27
Treatment of the patients	No treatment	1090	73.4
	Symptomatic treatment of local signs	350	23.56
	Symptomatic treatment of general signs	43	2.89

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Over 9 years, we can see a clear upward trend in the number of cases from 72 cases in 2009 to 251 cases in 2010 after a slight decrease, and then to increase and remain steady with an average of 273 cases, until 2015 when the number of stung patients drops a few (9 cases), and then it rose again in the last two years of study (Figure 2). Analyzing the frequencies of the scorpion stings according to residence origin indicates that the vast majority of the stings were recorded in Bouarfa (35.42%) and Figuig (30.63%), while the lowest frequencies were recorded in Bni Tadjite (9.15%) and Talsint (3.43%). (Figure 3).

In this study, we calculated the incidence rate by considering the population's projections for the whole prefecture [8]. The average incidence for the prefecture of Figuig is 127.62 per 100000 inhabitants per year (127.62±86.53) [Minimum 6.92-Maximum 22.93]. The average of the fatality rate is 0.43 per 100000 inhabitants per year [Minimum 0.00-Maximum 1.55]. We found no deaths were recorded from 2013 to 2017.

4. Discussion

Scorpions are venomous arthropod that belongs to the class of the Arachnid (eight legs); sometimes seen as mysterious creators and agents of the devil. Those "living-fossils" show a few morphological changes over hundreds of millions of years indicating a powerful adaptation and evolution [9] (Figure 4). Many factors are involved in the envenomation and the clinical outcomes of the stung patients as follows:

Factors related to the scorpion: species, size of the scorpion, number of stings, the quantity of the venom injected, depth of the sting, and composition of the venom. Factors related to the subject: age, physiological condition, body weight, the presence of co-morbidities and site of envenomation, closer proximity of the sting to the head and torso results in quicker venom absorption into the blood circulation and quicker onset of symptoms [1, 10]. Other factors that play an important role are public health system, medications available, on time transfer and the health professionals training. The venom of the Buthidae family is composed of many proteins acting on ion channels ($\text{N}^+ \text{-K}^+$) which activates the release of various mediators: acetylcholine, adrenaline, and noradrenaline, leading to their clinical manifestation in the body [11].

The findings of the present study indicate an incidence rate of scorpion stings of 1.27% per year which is in the range of the national incidence [0-2.9%] [10] but lower than other regions in Morocco; i.e. the prefecture of Beni Mellal with 1.36% per year [5], Marrakesh-Tensift-El

Houz and Sous-Massa-Draa with 2.44% per year [12], and prefecture of Khouribga 2.74% per year [13]. This rate is close to the national incidence found in Algeria 1.34% [14]. Other different incidence rates of various countries were recorded in the literature; 0.50% per year in Iran [15] and 0.19 % per year in Brazil [16].

Gender difference exposure to scorpion stings was a controversial subject between areas, as no sex-difference [13, 17] or areas were reported where men were more exposed [11, 12, 16, 18, 19], especially for subjects under 15 years [5]. Our findings confirm that men are more exposed in these areas than women (52.72% versus 47.27%) probably because of their daily life working in the field where they are directly in contact with these animals.

Considering the population of the prefecture as 138325 inhabitants (2014) [20] with a density of 2.5 inhabitant per km^2 and over 9 years, 5 deaths have been recorded indicating a frequency of lethality of 0.34% similar to the national value published by the National Centre of Anti-Poison (NCAP): 0.34% higher than the r Marrakesh-Tensift-El Houz and Souss-Massa-Draa region of 0.28% and lower than other Moroccan regions: region of Khouribga with 0.7% [13] and region of Beni-Mellal with 3.2% [21]. The mean mortality rate is 0.43 per 100000 persons, higher than the rate found in Algeria 0.23 per 100000 [22], while in Tunisia it is about 100 deaths per year, Mexico 50 deaths per year [11]. In Brazil, the rate of mortality and lethality were 0.03 per 100000 persons, i.e. 0.16% [16] and in Argentina 0.59% (2003) [12].

The endemic pattern of our finding was confirmed in the literature [4, 18, 19, 23], indicating high activity of these arthropods in the summer season and high risk of their contact with humans. Public health policymakers have to reinforce their plans and organize more preventive medical campaigns in various parts of the prefecture, especially the remote areas from the prefectural hospitals where appropriate safety stock of symptomatic medication has to be available. In our study, the low frequencies recorded in the two cities (Bni Tadjite and Talsint) which both of them accounting for 13% of the total cases, could be explained by their geographical locations which are more close to the High Atlas ranges and the ability of their populations to use the traditional medicine instead of being redirected to the local hospital and use modern medication. Some studies suggest that 40% of Moroccan stung patients prefer to use traditional medicine [24].

The envenomation by *Androctonus mauritanicus* and *Buthus occitanus* are accompanied by diverse symptoms due to: Parasympathetic autonomic nervous system involve-

ment: sweating, agitation, vomiting, and abdominal pain; Sympathetic autonomic nervous system involvement: tachycardia, hypertension, and mydriasis; and Central nervous system involvement: convulsion and coma [5].

The scorpion sting is not always accompanied by venom inoculation. A large part of stung patients present local symptoms (94.82%), so was classified as Class I patients. About 3.77% of stung patients were classified as Class II and only 1.41% of total patients have their conditions evolved to advanced stages (Class III). Similar results were found in different Moroccan regions: region of Marrakech-Tensift-El Houz and Souss-Massa-Draa [12] and prefecture of Khouribga [13]. The opposite results were reported from the prefecture of Beni-Mellal where Class II patients were more dominant (70.9%) [25].

Other countries such as West Bank (Palestine) [2], Tunisia [18], Iran [3], and North of Mali [26] reported identical results. In Morocco, antivenom therapy is not customary, the main stone of the national strategy to deal with the scorpionism is symptomatic treatment with fellowship and monitoring the clinical condition of the patient. In the prefecture of Figuig, only 1.27% of total stung patients should have been transferred to the prefectural hospital for fellowship and further assistance, while 98.72% (1466 subjects) cases were not transferred. Out of 1485 cases, 73.4% did not need any treatment and were considered under observation, a figure different from the national result where 58.70% did not need any medication [4]. About 23.56% of stung patients were followed for symptomatic treatment of local signs, while 2.89% have been treated for general signs and symptoms. Similar results were described in other regions of Morocco [25].

5. Conclusion

Scorpion stings are still a serious problem in the prefecture of Figuig as well as the whole country. Our work provides an epidemiological analysis for this issue in order to show regional differences and variations and to participate in the development of interventional strategies and preventive programs to reduce the lethality of this public health problem.

Ethical Considerations

Compliance with ethical guidelines

This project was approved as a partnership between the university Ibn-Tofail and authorities of Minister of health, to study and investigate the envenoming in the prefecture.

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Authors contributions

Statistical analysis, Writing and Pictures: Rida Elyamani; Conceptualization and review: Zineb Serhie; and Supervision and Methodology: Abdelmajid Soulaymani.

Conflict of interest

The authors declared no conflict of interest.

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References

- [1] Lakhkar BB, Patil MM, Patil SV. Scorpion sting envenomation. *Journal of Nepal Paediatric Society*. 2016; 36(3):284-7. [DOI:10.3126/jnps.v36i3.14875]
- [2] Adawi SH, Adawi SH, Adawi DH. The Scorpion sting: Epidemiology, clinical symptoms, treatment, surveillance and reporting obstacles in the Salfit district (West Bank) (2014-2015). *International Journal of Tropical Disease & Health*. 2016; 14(3):1-10. [DOI:10.9734/IJTDH/2016/23351]
- [3] Kassiri H, Kassiri E, Veys-Behbahani R, Kassiri A. Epidemiological survey on scorpionism in Gotvand County, Southwestern Iran: An analysis of 1 067 patients. *Journal of Acute Disease*. 2014; 3(4):314-9. [DOI:10.1016/S2221-6189(14)60067-6]
- [4] El Ougir R, Semlali I, Benlarabi S, Souleymani-Bencheikh R. [Scorpion stings and envenomations in Morocco from 2001 to 2008 (French)]. *Journal of Epidemiology and Public Health*. 2009; 57(1):S24. [DOI:10.1016/j.respe.2009.02.083]
- [5] Aboumaâd B, Lahssaini M, Tiger A, Benhassain SM. Clinical comparison of scorpion envenomation by *Androctonus mauritanicus* and *Buthus occitanus* in children. *Toxicon*. 2014; 90:337-43. [DOI:10.1016/j.toxicon.2014.09.001] [PMID]
- [6] Kingdom of Morocco. Ministry of the Interior Province of Figuig. [Monograph of the Province of Figuig (French)] [Internet]. 2005 [Updated 2005 May 1]. Available from: http://www.oriental.ma/upload/MoDUle_1/File_1_99.pdf
- [7] Office of the High Commissioner for the Plan of Morocco. [Note on the first results of the General Census of Population and Housing 2014 (French)] [Internet]. 2014 [Access :19 October 2018]. Available at: https://www.rgph2014.hcp.ma/Note-sur-lespremiers-resultats-du-Recensement-General-de-la-Population-et-de-l-Habitat-2014_a369.html

- [8] Kingdom of Morocco. High Commission for Planning, Center for Studies and Demographic Research [Projections of the population of Morocco by place of residence 2005-20304 (French)]. [Internet]. 2007 [Updated 2007 December 7]. Available at: http://www.rofoof.cnd.hcp.ma/index.php?lvl=notice_display&id=1077
- [9] Lourenço WR. The evolution and distribution of noxious species of scorpions (Arachnida: Scorpiones). *Journal of Venomous Animals and Toxins Including Tropical Diseases*. 2018; 24(1):1-12. [DOI:10.1186/s40409-017-0138-3] [PMID]
- [10] El Hidan MA, Touloun O, Boumezzough A. Spatial relationship between environmental factors and scorpion distribution in Morocco. *Journal of Entomology and Zoology Studies*. 2017; 5(3):674-8.
- [11] Cupo P. Clinical update on scorpion envenoming. *Revista da Sociedade Brasileira de Medicina Tropical*. 2015; 48(6):642-9. [DOI:10.1590/0037-8682-0237-2015] [PMID]
- [12] El Hidan MA, Touloun O, El Oufir R, Boumezzough A. Epidemiological and spatial analysis of scorpion stings in two regions of Morocco: Marrakesh-tensift-Al haouz and soss-massa-draa. *Journal of Coastal Life Medicine*. 2016; 4:299-304. [DOI:10.12980/jclm.4.2016j6-22]
- [13] Soulaymani Bencheikh R, Idrissi M, Tamim O, Semlali I, Mokhtari A, Tayebi M, et al. Scorpion stings in one province of Morocco: Epidemiological, clinical and prognosis aspects. *Journal of Venomous Animals and Toxins including Tropical Diseases*. 2007; 13(2):462-71. [DOI:10.1590/S1678-91992007000200005]
- [14] Selmane S, Benferhat L, L'Hadj M, Zhu H. Scorpionism in Sidi Okba, Algeria: A cross-sectional study of 2016 stung patients between 2014 and 2015. *Tropical Biomedicine*. 2017; 34(2):425-32.
- [15] Isazadehfar KH, Eslami L, Entezariasl M. [Epidemiology of Scorpionism in southwest, Iran, 2008 (Persian)]. *Iranian Journal of Epidemiology*. 2013; 8(4):54-60.
- [16] Reckziegel GC, Pinto VL. Scorpionism in Brazil in the years 2000 to 2012. *Journal of Venomous Animals and Toxins including Tropical Diseases*. 2014; 20(1):46-8. [DOI:10.1186/1678-9199-20-46]
- [17] El Hidan MA, Touloun O, Boumezzough A. An epidemiological study on scorpion envenomation in the Zagora oases (Morocco). *Journal of Coastal Life Medicine*. 2015; 3(9):704-7. [DOI: 10.12980/jclm.3.2015j5-86]
- [18] Chakroun-Walha O, Karray R, Jerbi M, Nasri A, Issaoui F, Amine BR, et al. Update on the epidemiology of scorpion envenomation in the South of Tunisia. *Wilderness & Environmental Medicine*. 2018; 29(1):29-35. [DOI: 10.1016/j.wem.2017.09.011] [PMID]
- [19] Amr ZS, Al Zou'bi R, Abdo N, Hani RB. Scorpion stings in Jordan: An update. *Wilderness & Environmental Medicine*. 2017; 28(3):207-12. [DOI:10.1016/j.wem.2017.05.003] [PMID]
- [20] National Institute of Statistics (Madagascar). General census of population and housing 2014. Madagascar: National Institute of Statistics; 1996.
- [21] Charrab N, Bencheikh RS, Mokhtari A, Semlali I, El Oufir R, Soulaymani A. The epidemiological situation of scorpion stings in Beni Mellal Province (Morocco). *Santé Publique*. 2009; 21(4):393-401. [DOI:10.3917/spub.094.0393]
- [22] Selmane S, Benferhat L, L'Hadj M, Zhu H. Modelling the scorpion stings using surveillance data in El Bayadh Province, Algeria. *Asian Pacific Journal of Tropical Disease*. 2016; 6(12):961-8. [DOI:10.1016/S2222-1808(16)61165-9]
- [23] Nejati J, Saghafipour A, Mozaffari E, Keyhani A, Jesri N. Scorpions and scorpionism in Iran's central desert. *Acta tropica*. 2017; 166:293-8. [DOI:10.1016/j.actatropica.2016.12.003] [PMID]
- [24] Laïd Y, Boutekdjiret L, Oudjehane R, Laraba-Djebari F, Hellal H, Guerinik M, et al. Incidence and severity of scorpion stings in Algeria. *Journal of Venomous Animals and Toxins including Tropical Diseases*. 2012; 18(4):399-410. [DOI: 10.1590/S1678-91992012000400008]
- [25] Charrab N, Soulaymani A, Semlali I, Mokhtari A, El Oufir R, Bencheikh RS. [The epidemiological and clinical characteristics of scorpion envenomations in the province of Beni Mellal (Morocco) (French)]. *Annals of Analytical Toxicology*. 2009; 21(3):143-6.
- [26] Dabo A, Golou G, Traoré MS, Diarra N, Goyffon M, Doumbo O. Scorpion envenoming in the north of Mali (West Africa): Epidemiological, clinical and therapeutic aspects. *Toxicon*. 2011; 58(2):154-8. [DOI:10.1016/j.toxicon.2011.05.004] [PMID]

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