

A Five Year Epidemiologic Study on Scorpion Stings in Ramhormoz, South-West of Iran

Khodabakhsh Karami,¹ Babak Vazirianzadeh², Eman Mashhadi,¹ Muhsen Hossienzadeh³ and Seyed Abbas Moravvej^{4*}

¹Department of Public Health, School of Public Health and Social Determinant of Health Research Centre, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

²Department of Medical Entomology, School of Health, and Infectious and Tropical Diseases Research Centre, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

³Department of Pediatrics, College of Medicine, Jundishapur University of Medical Sciences, Ahvaz, Iran

⁴Department of Plant Protection, College of Agriculture, Chamran University, Ahvaz, Iran

Abstract.- Scorpionism is a major health problem in Khuzestan, included Ramhormoz, south-west of Iran. This descriptive retrospective survey was conducted to give us basic information about scorpionism in this city during 2006-2010. During 2006-2010, a total of 20902 scorpion-stung patients referred to the Rmhormoz health centers. The frequencies of entomo-epidemiological and medical parameters were recorded converted to the percentage rank. The results of this study showed that the preventing ways of scorpion stings should be educated among the residents and antivenin of scorpions provided in the health centers of Ramhormoz.

Keywords: Scorpion sting, epidemiology, Ramhormoz, Iran

INTRODUCTION

Scorpionism or being stung by scorpions is a major health problem in the tropics and sub-tropics including southern half of Iran (Khuzestan, Sistan-and-Baluchestan, Hormozgan and Kerman) with 75% annual mortalities of scorpion sting in Iran; however, the most of mortalities and cases of scorpion stings have occurred in Khuzestan (Azhang and Moghisi, 2006; Pipelzadeh *et al.*, 2007; Jalali *et al.*, 2010; Pourrezai *et al.*, 2010; Zare Mirakabadi *et al.*, 2011; Zayerzadeh *et al.*, 2011).

Iranian scorpion fauna consists of 44 named species from 23 genera in 3 families, Buthidae, Scorpionidae and Hemiscorpiidae. Khuzestan has 19 of these species (Farzanpay, 1987; Lourenço, 2001; Navidpour *et al.*, 2008; Lowe, 2010) (Table I).

Khuzestan province is well-known for its scorpions and scorpionism among the Iranian provinces but there is little knowledge about the subject in some areas such as Ramhormoz (Radmanesh, 1990, 1998; Vazirianzadeh *et al.*, 2008).

Table I.- List of scorpion species occurring in Khuzestan Province of Iran (Navidpour *et al.*, 2008).

Buthidae

1. *Androctonus crassicauda* (Olivier, 1807)
2. *Apistobuthus susanae* (Lourenço, 1998)
3. *Buthacus macrocentrus* (Ehrenberg, 1828)
4. *Compsobuthus garyi* (Lourenço & Vachon, 2001)
5. *Compsobuthus jakesi* (Kovařík, 2003)
6. *C. matthiesseni* (Birula, 1905)
7. *Hottentotta sauleyi* (Simon, 1880)
8. *H. schach* (Birula, 1905)
9. *H. zagrosensis* (Kovařík, 1997)
10. *H.khoozestanus* sp. n.
11. *Mesobuthus eupeus phillipsii* (Pocock, 1889)
12. *Odontobuthus bidentatus* (Lourenço et Pézier, 2002)
13. *Orthochirus farzanpayi* (Vachon & Farzanpay, 1987)
14. *O. iranum* (Kovařík, 2004)
15. *O. stockwelli* (Lourenço & Vachon, 1995)
16. *Razianus zarudnyi* (Birula, 1903)
17. *Vachoniolus iranum* sp. n

Scorpionidae

18. *Scorpio maurus townsendi* (Pocock, 1900)

Hemiscorpiidae

19. *Hemiscorpius lepturus* (Peters, 1862)

* Corresponding author: samoravvej@yahoo.com , a-

moravvej@phdstu.scu.ac.ir

0030-9923/2013/0002-0469 \$ 8.00/0

Copyright 2013 Zoological Society of Pakistan

Ramhormoz area is one of the most important foci of scorpion sting problem in the east of Khuzestan from point of medical, epidemiology and

geographic local scorpion distribution according to the reports of local health authority of Khuzestan (Radmanesh, 1990, 1998; Vazirianzadeh and Samie, 2006).

Thus, public health education helps people and authorities to prevent from being stung and remedy scorpionism in these regions. To achieve this objective, information regarding scorpionism is essential and a key factor. Therefore, this survey was conducted to give us basic information about scorpionism in this city.

MATERIALS AND METHODS

Ramhormoz (31° 17' 0" N, 49° 36' 0" E) is an ancient city with the rural and tribe social structure in Khuzestan province in southwestern Iran.

This research was a descriptive retrospective study. The data of the present research has come from files of outpatient or hospitalized persons referring to the health centre and hospital of city of Ramhormoz during 2006-2010.

Scorpion-stung patients who referred to the health centre and hospital of city of Ramhormoz during 2006-2010 filled out a questioner requesting age, gender and residence of victim, stung part of body, color of stinging scorpion, treatment with or without antivenin injection, the way how antivenin applied and death due to the sting. The frequencies of entomo-epidemiological and medical parameters were converted to the percentage rank. The scorpion species were identified using Farzanpay's (1987) key to the Iranian scorpions.

RESULTS

During 2006-2010, a total of 20902 scorpion-stung patients referred to the above-mentioned centers. Statistics of each year is presented in Table II which shows that the incidence of scorpion stings were similar rate during 2006-2010; however, the largest of scorpion stings data were happened in 2006 (22.62% of scorpion stings), and the least were happened in 2010.

Data collected in this study revealed that the highest incidence of scorpion sting cases were taken place in summer (43.63%) followed by spring (39.46%), fall (12.57%) and in the winter as the

lowest incidence (4.34%) in Ramhormoz region. The most frequent of scorpion sting cases belonged to the month of June (17.94% of scorpion stings) and the lowest to the January with 0.69% (Table III).

Table II.- Percentage and number of scorpion-stung and fatality in Ramhormoz during 2006-2010.

Year	Number	Percent
2006	4730	22.62
2007	3867	18.5
2008	4246	20.3
2009	4055	19.4
2010	4004	19.1

Generally, most victims of scorpion stung people were in rural area (11762: 56.3%) than in urban area (9140: 43.7%).

Table IV shows that the greatest rate of scorpion stings victims belonged to the 15-24 year old persons (20.60%) followed by 25-34 year old persons (19.22%) and the lowest rate of scorpion stings were reported among the older than 65 year old patients (6.22%).

Totally, the number and percent of stung women and men of scorpion-stung patients were 10912 (52.2%) and 9990 (47.8%), respectively.

Legs, as the lower parts of the body were targeted by scorpion stings more than the other parts (39%) followed by hands with 36% and head and trunk with 25%.

Out of 20,902 scorpion sting cases, 20,895 cases (99.97%) recovered, however deaths (0.03%) were recorded during the present study. Totally, 3.8% of victims recovered using convenience treatments without scorpion antivenin serum. However, the rest treated by scorpion antivenin serum including intra-venin (7.70%) and intra-muscular (92.30%) injections and convenience treatments. The interval hours after stings and injections were recorded as: survival was 70.3 % after 0-6 h, 14.8% after 6-12 h and 10.9% after more than 12 h. All deaths (seven cases; six were children with 1.5-14 year old and one was a 75 year old person) occurred when scorpion antivenin serum was injected 0-6 h after stung. In other cases all

Table III.- Number of scorpion stings in Ramhormoz during 2006-2010.

Year	Months											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2006	22	37	106	324	690	870	772	812	539	315	203	40
2007	20	34	71	246	610	734	604	644	445	267	131	61
2008	29	47	102	392	559	649	608	588	753	313	155	51
2009	37	66	179	209	515	695	644	634	489	291	217	79
2010	37	38	82	357	596	801	585	555	448	293	168	44
Total (No. / %)	145 (0.69)	222 (1.06)	540 (2.58)	1528 (7.31)	2970 (14.21)	3749 (17.94)	3213 (15.37)	3233 (15.47)	2674 (12.79)	1479 (7.08)	874 (4.05)	275 (1.32)

Table IV.- Frequency and percentage of scorpion stings according to age groups in Ramhormoz during 2006-2010.

Age	2006		2007		2008		2009		2010	
	No.	%	No.	%	No.	%	No.	%	No.	%
0-4	396	8.3	260	6.7	296	7	260	6.4	267	6.6
5-9	520	10.9	266	6.8	266	6.2	229	5.6	228	5.6
10-14	602	12.7	332	8.5	369	8.7	368	9.07	274	6.8
15-24	701	14.8	896	23.1	918	21.6	896	22.09	894	22.3
25-34	641	13.5	794	20.5	802	18.9	923	22.7	858	21.4
35-44	605	12.7	507	13.1	569	13.4	628	15.4	567	14.1
45-54	566	11.9	384	9.8	370	8.7	338	8.3	368	9.2
55-64	416	7.7	223	5.7	255	6	209	5.	313	7.8
Upper 65	283	5.9	205	5.3	374	8.8	204	5.03	235	5.8
Total	4730	100	3867	100	4246	100	4055	100	4004	100

victims recovered No case of anaphylaxis shock was reported after injection of scorpion antivenin serum. During the study, a total of 20,100 vials of scorpion antivenin serum were applied.

Scorpion-stung patients reported 11,031 (52.7%) yellow scorpions and 4,117 (19.7%) black scorpions. The rest did not recognize the color of the scorpions.

The scorpions brought to the medical centers by the patients or their relatives were identified as *Androctonus crassicauda* (Scorpionida: Buthidae), *Hemiscorpius lepturus* (Scorpionida: Hemiscorpioiidae), and *Mesobuthus eupeus* (Scorpionida: Buthidae), *Compsobuthus* sp. (Scorpionida: Buthidae) and *Scorpio maurus* (Scorpionida: Scorpionidae).

DISCUSSION

The results of our study showed that there was a difference between frequency of males (47.8%) and females (52.2%) among the patients who were referred to the health centers of Ramhormoz with scorpion stings. It means the females were at greater risk of scorpion stings than males in this area. This rate is accordance with the results of Vazirianzadeh *et al.* (2008) for Khuzestan. Our results are not in accordance with the results in Saudi Arabia (Al-Sadoon and Jarrar, 2003; Jarrar and Al-Rowaily, 2008) who reported that scorpion stings were greater in the males than in the females. The epidemiology of scorpion sting is related to the sex of the victim. It varies according to the year and

location of different studies. However, it may take cultural factors like different activities among females and males.

In this study 56.3% of scorpion sting cases occurred in the rural area of Ramhormoz. Pourrezai *et al.* (2010) and Vazirianzadeh *et al.* (2008) have likewise reported that scorpion stings occur most frequently in rural areas of Ramshir County of Khuzestan province and Lordegan County of Chahar-Mahal-and-Bakhtiari Province in southwestern of Iran. Our results, however, do not agree with the results of Vazirianzadeh *et al.* (2008) and Pipelzadeh *et al.* (2007) of entire Khuzestan Province, southwest of Iran, who reported 60% of scorpion stings in the urban area.

The greatest rate of scorpion stings occurred among the 15-24 year old people. This agrees with the findings in Kashan, central of Iran (Dehghani *et al.*, 2010), Ahvaz, south west of Iran (Emam *et al.*, 2008) and north-west of Khuzestzn (Ghaderi *et al.*, 2006).

Data collected in the current study revealed that the highest incidence of scorpion sting cases during 2006-2010 occurred in summer (43.63%) in the Ramhormoz region. This is in accordance with the studies in south-west of Iran (Chitnis *et al.*, 1993; Vazirianzadeh and Samie, 2006), Saudi Arabia (Al-Sadoon and Jarrar, 2003; Jarrar and Al-Rowaily, 2008) and in Turkey (Ozkan and Kat, 2005; Ozkan *et al.*, 2006). They have reported that 49.7% - 93.4% of scorpion sting cases occurred in summer. However, it is not consistent with the results of a similar study in Lordegan in the south west of Iran with different climate. The surveys in the Ramhormoz area during 2006-2010 explained that there was a consistency regarding the dominance of scorpion stings in the summers. Data collected in the Lordegan study revealed that the highest incidence of scorpion sting cases in 2006 took place in spring (49.72%) however, the surveys in Lordegan area during 2002-2006 explained that there was not a consistency regarding the dominance of scorpion stings in the summer or spring. This consistency was due to the summer during years of 2002 and 2005 and due to the spring during 2003, 2004 and 2006 (Vazirianzadeh *et al.*, 2008). These differences were presumably due to the variation of geographical, climatologic and

species distributions. The important point is that the scorpions stung every year with a similar rate (18.5-22.62%) during entire period of 2006-2010 (Table II).

The species of scorpions collected at the health centre of Ramhormoz were similar to the one reported in other parts of Khuzestan, southwest of Iran (Radmanesh, 1990, 1998; Vazirianzadeh and Samie, 2006; Navidpour, 2008; Vazirianzadeh *et al.*, 2008). However, the *H. lepturus* reported from Ramhormoz is as one of the most dangerous species of scorpion in the world. *H. lepturus* is well known for having a potent cytotoxic venom that causes cutaneous necrosis, deep and necrotic ulcers, psychological problems, ankylosis of the joints, and severe systemic pathology leading to death, severe and fatal haemolysis, secondary renal failure and fatal failure of the kidney (Radmanesh, 1998; Pipelzadeh *et al.*, 2007; Lowe, 2010; Jalali *et al.*, 2010). *H. lepturus* is only scorpion with related cutaneous findings in Iran (Radmanesh, 1990). Presence of *Compsobuthus* sp. in Ramhormoz is another important scorpion in this area, because this species cause similar medical problems in human (Farzanpay, 1987; Dehghani *et al.*, 2009).

A total of 96.2% scorpion stung persons received antivenin of scorpions. This antivenin made in Razi Research Vaccine and Serum Institute, Iran is a 5 ml polyvalent ampoule against 6 species including *H. lepturus*, *A. crassicauda*, *Mesobuthus eupeus*, *Odonthobothus doriae*, *Hottentotta saulcyi* and *Hottentotta zagrozensis*.

In this study seven cases terminated to death that had received the antivenin between 0-6 hours after injecting and no death was recorded in the current study regarding the rest of patients including non-receiver and receiver of antivenin. However, species and ages of scorpions and age, weight and health situation of the patients are essential factors regarding fatality, but it is presumed the reason of seven deaths antivenin was due to *H. lepturus*. Age of victims is another factor in mortality of victims after scorpion sting during this study. Except one of the victims who was 75 years old, the rest were children with the range of 1.5-14 year old. It means that envenomation of scorpion sting is more dangerous among the younger and elder victims (Mahaba, 1997; Radmanesh, 1998; Pipelzadeh *et*

al., 2007; Bosnak *et al.*, 2009).

Our results are in accordance with the results of Gajre and Dammas (1999) who concluded that in the effectiveness of using the earliest species-specific antivenin reduces mortality and morbidity due to scorpion stings. In spite of worldwide debates on serotherapy of the scorpion envenoming syndrome serotherapy is considered as the only specific treatment of scorpion stings in Saudi Arabia. Hamed (2003) has suggested intravascular administration of antivenin instead of intramuscular injection of antivenin because scorpion venom are absorbed and distributed more rapid than the immunoglobulins. It is in contrast to our results which show that antivenom administered in 96.2% of scorpion stung people including 92.30% intramuscular application and 7.70% intra-venin application, with 0.030% mortality and no anaphylaxis shock in Ramhormoz hospitalized people. Vazirianzadeh *et al.* (2013) (**in press what is the year ?**) has reported that 91.53% of stung people were treated using same anti venom in Lordegan area in Iran with no death or shock after serotherapy intra-muscular application. Vazirianzadeh *et al.* (2012) has recorded one death among 57 hospitalized children due to scorpion sting, 73.68% of which received antiserum injection in a hospital in Ahvaz, capital of Khuzestan.

All the above mentioned cases of Iran are in agreement with the study of El-Amin *et al.* (1994) who reported that the reduction in mortality was attributed to the use of antivenom and improved the management of children in Saudi Arabia. Belghith *et al.* (1999) have, however, shown that systematic administration of scorpion antivenin irrespective of clinical severity did not alter the clinical course of scorpion sting.

CONCLUSIONS

According to the results of the current study it is concluded that the scorpion stings in Ramhormoz county is epidemiologically similar to the other parts of Khuzestan, south-west of Iran with reference to age, sex, site of stings, scorpion species and season frequency. It is concluded that residents of Ramhormoz County should be educated since the scorpion stings ranged between 18.5 and 22.62%

during 2006-2010.

Epidemiologically, it is suggested injecting antivenin in the victims will reduce mortality after scorpion stings. All hospitals and other health centers must be well educated and equipped with antivenin vials to be able to extend proper services to scorpion-stung people.

Conflict of interest statement

We declare that we have no conflict of interest.

REFERENCES

- AL-SADOON, M.K. AND JARRAR, B.M., 2003. Epidemiological study of scorpion stings in Saudi Arabia between 1993 and 1997. *J. Venom. Anim. Toxins include. trop. Dis.*, **9**: 54-64.
- AZHANG, N. AND MOGHISI A.R., 2006. *Surveying of scorpion sting and snake site during 2001-2005*. Ministry of Health of Iran, Tehran.
- BELGHITH, M., BOUSSARSAR, M., HAGUIGA, H., BESBES, L., ELATROUS, S., TOUZI, N., BOUJDARIA, R., BCHIR, A., NOUIRA, S., BOUCHOUCHA, S. AND ABROUG, F., 1999. Efficacy of serotherapy in scorpion sting: a matched-pair study. *J. clin. Toxicol.*, **37**: 51-57.
- BOSNAK, M., LEVENT YILMAZ, H., ECE, A., YILDIZDAS, D., YOLBAS, I., KOCAMAZ, H., KAPLAN, M. AND BOSNAK, V., 2009. Severe scorpion envenomation in children: Management in pediatric intensive care unit. *Hum. exp. Toxicol.*, **28**: 721-728.
- CHITNIS, P. A., MARAGHI, S. AND VAZIRIANZADEH, B., 1993. Epidemiological and laboratory study on scorpion stings in Khuzestan province. *J. Guilan Univ. med. Sci.*, **2**: 5-12.
- DEHGHANI, R., DINPARAST DJADID, N., SHAHBAZZADEH, D. AND BIGDELLI, S., 2009. Introducing *Compsobuthus matthiesseni* (Birula, 1905) scorpion as one of the major stinging scorpions in Khuzestan, Iran. *Toxicon*, **54**: 272-275.
- DEHGHANI, R., VAZIRIANZADEH, B., RAHIMI NASRABADI, M. AND MORAVVEJ, S. A., 2010. Study of scorpionism in Kashan in central of Iran. *Pakistan J. med. Sci.*, **26**: 955-958.
- EL-AMIN, E. O., SULTAN, O.M., AL-MAGAMCI, M. S. AND ELIDRISSY, A., 1994. Serotherapy in the management of scorpion sting in children in Saudi Arabia. *Annls. Trop. Pediatr.*, **14**: 21-24.
- EMAM, S. J., KHOSRAVI, A. D. AND ALEMOHAMMAD, A., 2008. Evaluation of hematological and urine parameters in *Hemiscorpius lepturus* (Gadim) victims referred to Razi Hospital, Ahwaz, Iran. *J. med. Sci.*, **8**:

- 306-309.
- FARZANPAY, R., 1987. *Scorpion knowledge*. Iran Academic Press, Tehran.
- GAJRE, G. AND DAMMAS, A. S., 1999. Scorpion envenomation in children: should all stings be given antivenom. *Annl. Saudi Med.*, **19**: 444-446.
- GHADERI, H., SHARIAT, Z., GHODOOSI, A. AND ZIYAEI, M., 2006. Scorpion bites in the north-western of Khuzestan province from May 2002 to December 2003. *Hayat*, **12**: 73-78.
- HAMED, M. I., 2003. Treatment of the scorpion envenoming syndrome: 12-years experience with serotherapy. *Int. J. Antimicrob. Agents*, **21**: 170-174.
- JALALI, A., PIPELZADEH, M. H., SAYEDIAN, R. AND ROWAN, E. G., 2010. A review of epidemiological, clinical and in vitro physiological studies of envenomation by the scorpion *Hemiscorpius lepturus* (Hemiscorpiidae) in Iran. *Toxicon*, **55**: 173-179.
- JARRAR, B.M. AND AL-ROWAILY, M.A., 2008. Epidemiological aspects of scorpion stings in Al-Jouf Province, Saudi Arabia. *Annls Saudi Med.*, **28**: 183-187.
- LOURENÇO, W. R., 2001. The scorpion's families and their geographical distribution. *J. Venom. Anim. Toxins include trop. Dis.*, **7**: 3-23.
- LOWE, G., 2010. Two new *Hemiscorpius* Peters, 1861 (Scorpiones: Hemiscorpiidae) from Northern Oman. *Euscorpius*, **91**: 1-24.
- MAHABA, H. M. A., 1997. Scorpion sting syndrome: epidemiology, clinical presentation and management of 2240 cases. *East Mediterr. Hlth. J.*, **3**: 82-89.
- NAVIDPOUR, S., KOVAŘÍK, F., SOLEGLAD, M. E. AND FET, V., 2008. Scorpions of Iran (Arachnida, Scorpiones). Part I. Khoozestan Province. *Euscorpius*, **65**: 1-41.
- NAVIDPOUR, S., 2008. Description study of *Compsobuthus* (Vachon, 1949) species in South and Southwestern Iran (Scorpiones: Buthidae). *Arch. Razi Inst.*, **63**: 29-37.
- OZKAN, O., ADIGÜZEL, S., CESARETLİY, Y., ORMAN, M. AND KARAER, Z. K., 2006. *Androctonus crassicauda* (Olivier 1807) scorpionism in the Sanliurfa Province of Turkey. *Türkiye Parazitol. Dergisi*, **30**: 239-245.
- OZKAN, O. AND KAT, I., 2005. *Mesobuthus eupeus* scorpionism in Sanliurfa region of Turkey. *J. Venom. Anim. Toxins include trop. Dis.*, **11**: 479-484.
- PIPELZADEH, M. H., JALALI, A., TARAZ, M., POURABBAS, R. AND ZAREMIRAKABADI, A., 2007. An epidemiological and a clinical study on scorpionism by the Iranian scorpion *Hemiscorpius lepturus*. *Toxicon*, **50**: 984-992.
- POURREZAI, S., HOSSIENI, A., VAZIRIANZADEH, B. AND GARDANI, H. A., 2010. Study on some epidemiologic parameters among scorpion stung people who referred to Ramshir Health Centre, SW Iran, 2007-2009. *7th National and 2nd Regional Congress of Parasitology and Parasitic Diseases in Iran, Tehran*, p. 481.
- RADMANESH, M., 1990. Clinical study of *Hemiscorpius lepturus* in Iran. *Am. J. trop. Med. Hyg.*, **93**: 327-332.
- RADMANESH, M., 1998. Cutaneous manifestations of *Hemiscorpius lepturus* sting: a clinical study. *Int. J. Dermatol.*, **37**: 500-507.
- VAZIRIANZADEH, B., FARHADPOUR, F., HOSSEINZADEH, M., ZAREAN, M. AND MORAVVEJ, S. A., 2012. An epidemiological and clinical study on scorpionism in hospitalized children in Khuzestan, Iran. *J. Arthrop-Borne Dis.*, **6**: 62-69.
- VAZIRIANZADEH, B., HAJIHOSEINI, R., AMIRI, B. AND BAGHERI, S., 2008. Epidemiological study of scorpionism in the hospitals of Ahvaz, SW Iran. *J. Hlth. Sci., Ahvaz Joundi Shapour University of Medical Sciences*, **2**: 17-25.
- VAZIRIANZADEH, B., HOSSIENZADEH, M., MORAVVEJ, S. A., VAZIRIANZADEH, M. AND MOSAVI, S., (in press) 2013. An epidemiological study on scorpion stings in Lordegan County, south-west of Iran. *Arch. Razi Inst.*, **68**: code of article A-10-107-1 in the press, IT WILL BE PUBLISHED IN THE SPRING VOLUME)
- VAZIRIANZADEH, B. AND SAMIE, M., 2006. *Epidemiological study of scorpionism in the Khozestan*. 2nd Congress of Medical Entomology, Tehran, pp. 24-26.
- ZARE-MIRAKABADI, A., KHATOONABADI, S.M. AND TEIMOOZADEH, S., 2011. Antivenom injection time related effects of *Hemiscorpius lepturus* scorpion envenomation in rabbits. *Arch. Razi Inst.*, **66**: 139-145.
- ZAYERZADEH, E., ZARE MIRAKABADI, A. AND KOOHI, M. K., 2011. Biochemical and histopathological study of *Mesobuthus eupeus* scorpion venom in the experimental rabbits. *Arch. Razi Inst.*, **66**: 133-138.

(Received 10 May 2012, revised 17 December 2012)