

Toxicological and epidemiological studies of scorpion sting cases and morphological characterization of scorpions (*Leiurusquin questriatus* and *Androctonus crassicauda*) in Luxor, Egypt



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ABSTRACT

Background and aim: Scorpion envenomation is a common acute life threatening health problem in developing countries as Egypt. Scorpion venom is a complex structure composed of neurotoxic proteins, salts, acidic proteins, and organic compounds, thereby having of neurologic, cardiovascular, hematologic, and renal side effects, in addition to local effects such as redness, pain, burning, and swelling.

Aims: The study consisted of two parts to describe demographic characteristics, toxicological manifestations of scorpion sting cases in Luxor, Egypt and morphological characterization of the commonest scorpion species in the studied community for easy rapid identification of scorpion species by doctors from the patient history to provide better choices of management

Materials & methods: First part of the study include all cases of scorpion envenomation attending General Hospital of Esna, Luxor, Egypt during the period of scorpion activity 2017, demographic data was collected then cases were assessed for clinical manifestations, ECG, complications and deaths related to scorpion species. Second part: scorpions were collected from areas around patient housing for morphological description of their sense organs and venom apparatus by Scanning Electron Microscopy.

Results: A total of 110 cases of scorpion stings were reviewed, males 81 (72.9%) and females 30 (27.1%), with a mean age of 31.9 ± 17.9 years. Localized pain was the most frequent presenting complaint (89.80.2%), vomiting was the commonest clinical symptom (90.9%). All scorpion stings were due to the most endemic species in North Africa, *Leiurusquinquestriatus* & *Androctonuscrassicauda*. Death rate among cases was (5.5%) all were Abrog's Grade III. Cardiac dysrhythmia and subsequent pulmonary edema were the commonest cause of death. Clinical manifestations were more sever in *Leiurus quinquestriatus* stings while death rate was more in *Androctonus crassicauda* stings. The morphological characterization of the sense organs (eyes, pedipalps, pectines & sensory setae) and venom apparatus of the scorpions *L. quinquestriatus* & *A. crassicauda* were described by Scanning Electron Microscopy.

Conclusion: Scorpion sting is an acute health threatening in Southern Egypt, *Leiurus quinquestriatus* & *Androctonus crassicauda* are most endemic scorpion species in Southern Egypt. More attention for scorpion envenomation in such subtropical hyper desert localities is required to eradicate toxic scorpion species and prevent possible causes of deaths.

Abbreviations: ECG, electrocardiography; GCS, Glasgow coma scale; SEM, scanning electron microscopy; TAS, time after sting; BCSS, basitarsal compound slit sensilla

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1. Introduction

Scorpion envenomation is an acute life-threatening medical problem especially in children and older individuals who suffer from respiratory and/or cardiovascular diseases. More than 1.2 million scorpion stings occur annually worldwide, particularly in tropical and subtropical regions [1]. There are 1500 subspecies of scorpions worldwide, with 50 subspecies having venom dangerous for humans with Scorpion (Buthidae) families are the most toxic offender [2]. Scorpion stings are a cause of significant morbidity and mortality [3]. Scorpion venom shows variability by subspecies and has a complex structure composed of neurotoxic proteins, salts, acidic proteins, and organic compounds, thereby having neurologic, cardiovascular, hematologic, and renal side effects, in addition to local effects such as redness, pain, burning, and swelling [4]. It carries a potential risk to induce severe and often fatal clinical complications; as scorpion venoms are complex of several toxins and incorporate a mixture of cardiopotoxins, nephrotoxins, hemolytic toxins, and neurotoxins. Mortality is due to cardiac dysfunction and pulmonary edema [5].

Clinical manifestations of scorpion sting depend on dose of venom, age of affected child, season of sting, and most importantly time lapse between sting and hospitalization. Several other factors such as sex of the child, pre-hospitalization first aid, interval between sting and prazosin administration have also been suspected to play an important role in the development of complications and subsequently adverse outcome [6].

Abrog's classification for grading Signs and Symptoms of scorpion sting cases [7,8]

Grade I: Pain and/or paresthesia at the scorpion sting site, tingling, numbness and minor swelling in the skin area encompassing the sting (local symptoms)

Grade II: Fever, chills, tremor, excessive sweating, nausea, vomiting, diarrhea, hypertension and priapism (systemic symptoms \pm local symptoms)

Grade III: Cardiovascular, respiratory, and/or neurologic distresses (complications)

2. Patients & methods

The study considered the first one conducted in the studied locality, Esna, Luxor, southern Egypt, which is main tertiary care hospital. Esna city situated about 55 kms south of Luxor. Luxor climate is severely arid and classified as hyper-desert and extreme Mediterranean type. Maximum temperature ranges between 11 °C in winter and 44 °C in summer, with wind ranges (14.2 and 4.5 mph) [9].

The study is hospital based observational descriptive study include all cases of scorpion envenomation attending emergency department of General Hospital of Esna, Luxor, Egypt during the period of scorpion activity of 2017 (spring and summer months), General Hospital of Esna is the main tertiary care hospital in Esna; data was collected by structured questionnaire include demographic data (age, sex, marital status, smoking status), time after sting. All scorpion sting cases were examined for clinical manifestations (vital signs, local and systemic). ECG, Glasgow coma-scale score (GCS), use of mechanical ventilation, complications, and evolution of envenomation were assessed. We exclude from the study Unknown bites or stings Data registration was done by the resident doctors at the study site. Treatment of scorpion stings was conducted according to a protocol, with directions for lines of treatment, set by the Ministry of Health. During the study, a polyvalent antivenom produced by (Nile Company, Egypt) recommended dose was changed from one ampoule containing 1 ml antivenom to five ampoules. After sensitivity testing, patients received the antivenom intravenously. The antivenom was diluted with normal saline. Auxiliary drugs for treatment of symptoms and signs of envenomation included: sedation using chlorpromazine and promethazine, and pulmonary oedema was treated by oxygen, Lasix, central venous pressure line and

monitoring fluid intake, and intermittent positive pressure ventilation.

2.1. Scorpion collection

Scorpions were collected from patient's bedclothes and by professional hunters at night, by black and light technique [10] from areas of envenomation around patient housing. Avoiding scorpion cannibalism, captive scorpions were housed in individual plastic boxes at the Department of Zoology, Faculty of Science, Assiut University, Egypt for identified and treated according to [10]

2.2. Scanning Electron microscopy

The venom apparatus and sense organs isolated from scorpions (fixed, coated with gold and examined using Scanning Electron Microscopy (SEM) in the Electron Microscopy unit, Assiut University, Egypt. Samples were fixed in 5% glutaraldehyde in sodium phosphate buffer for 1.5 h, rinsed in distilled water and dehydrated in ethanol. Critical point drying was carried out. Samples were mounted on stubs, coated with carbon or gold then examined by Joel JSM 35 SEM at 20 KV.

2.3. Statistical analysis

Data was analyzed using SPSS version 22 (SPSS, Inc., Chicago, IL). Qualitative data was expressed as frequency and percent, mean \pm SD for quantitative data. Chi-square test was used for comparison of qualitative data, and *t*-test was used in qualitative. *P* values less than 0.05 were considered statistically significant.

2.4. Ethical consideration

Official consent from director of the Esna hospital of Luxor was obtained to examine all scorpion sting cases in scorpion activity months of 2017. The obtained data is confidential and for the purpose of the scientific research only. The study protocol was approved by the ethical committee, faculty of medicine, Assiut University, Egypt.

3. Results

The study included 110 Scorpion sting cases that attended the General Hospital of Esna, Luxor, Egypt during scorpion activity months (spring and summer) of 2017 in the studied locality, the study revealed that; higher occurrence of scorpion stings among children (less than 18 years old) (34.5%) and lesser occurrence among the age category (65–75 years old) about 5% with a mean age of 31.9 ± 17.9 years, more frequently occurring in females than males (54.9%:45.1%). About two thirds (67.3%) of the studied group are non smokers. more than half of sting cases (52.7%) were admitted to hospital within half an hour after stings as shown in Table 1. Table 2 reveals local reactions to scorpion sting; pain at sting site was most frequent (92.7%) then redness (54.5%), swelling (49.1%). concerning systemic manifestations; vomiting (90.9%) was most agonizing complaint, followed by headache (56.4%), and disturbed conscious level (47.3%). About one fifth (21.8%) of the cases showed abnormalities in ECG. There was high recovery rate (94.5%) among scorpion sting patients. Vital Signs measurements among Scorpion Stung Patients reveals ; the mean systolic and diastolic Bp were (116.11 ± 14.33 and 73.89 ± 5.58 , respectively). Mean pulse and respiratory rate were (74.47 ± 4.62 and 18.78 ± 8.90 , respectively) and mean value of body temperature was 38.77 ± 0.90 . More than half (52.70%) of scorpion stings were due to scorpion type *Leiurus quinquestriatus*.

Regarding the occurrence of clinical manifestations and overall mortality among the scorpion sting patients in relation to scorpion type; there was higher occurrence of clinical manifestations among *Leiurus quinquestriatus* sting cases than (*Androctonus crassicauda*) but the

Table 1
Epidemiological criteria of scorpion sting cases.

Epidemiologic characteristic	Number of patients (No = 110)	%
Age (years)		
● Less than 18	38	34.5
● 18-35	30	27.3
● 35-50	26	23.6
● 50-65	12	10.9
● 65-75	4	3.6
Gender		
● Male	44	45.1
● Female	66	54.9
Smoking pattern		
● Smokers	36	32.7
● Nonsmokers	74	67.3
Time after sting (TAS) (minutes)		
● < 30	58	52.7
● 30 < 60	44	40
● 60-120	8	7.3

Table 2
Clinical Manifestations & Evolution of Scorpion Sting Cases.

	Number of patients (No = 110)	Patients %
Local reaction		
● Pain at sting site	102	92.7
● Swelling	54	49.1
● Redness	60	54.5
● Numbness	36	32.7
Systemic		
● Hypertension	6	5.5
● Tachycardia	0	0
● Tachypnea	4	3.6
● Fever	110	100
● Vomiting	100	90.9
● Headache	62	56.4
● Palpitation	4	3.6
● Dyspnea	6	5.5
● Dizziness	28	25.5
● Convulsion	6	5.5
● Disturbed conscious level	52	47.3
● ECG	24	21.8
Evolution		
● Complete Recovery	104	94.5
● Death	6	5.5

difference is statistically significant only for redness ($p = 0.03^*$), overall mortality among cases stung by scorpion (*Androctonus crassicauda*) are higher ($p = 0.0001^*$) **Table 3**.

Table 4 shows the distribution of epidemiological Criteria among the Outcome of Scorpion Sting Cases. **Table 5** show the distribution of clinical manifestations and Time after Sting among the outcome of Scorpion Sting Cases. The study revealed higher occurrence of pain, headache, vomiting and dizziness among those who admitted to hospital after one hour from the sting but the difference is statistically significant only for dizziness ($p = 0.04^*$). On the other hand, there is statistically significant higher occurrence of disturbed conscious level among those who admitted to hospital within half to one hour compared to other groups ($p = 0.04^*$). There was higher occurrence of death (75%) among those who admitted to hospital after one hour and high recovery rate among those who admitted to hospital within half an hour (58%) compared to other groups and this difference was statistically significant (0.002^*). 72.2% of Scorpion sting cases were classified as grade II according to Abroug’s classification for grading Signs and Symptoms of scorpion sting cases and higher death rate occurred among grade III cases **Table 6**.

Table 3
Comparative Analysis of Case Occurrence, Clinical Manifestations & Mortality Rate between *Leiurus quinquestriatus* & *Androctonus crassicauda* Sting Cases.

Clinical manifestation	<i>Leiurusquinquestriatus</i>		<i>Androctonuscrassicauda</i>		P-value
	No.	%	No.	%	
● Case Occurrence	58	52.7	52	47.3	
Local reaction					
● Pain at stung site	54	93.1	48	92.3	0.579
● Swelling	22	37.9	32	61.5	0.011*
● Redness	24	41.4	36	69.2	0.03*
● Numbness	18	31.0	18	34.6	0.422
Systemic manifestation					
● Headache	30	51.7	32	61.5	0.339
● Palpitation	4	6.9	0	0	.073
● Dyspnea	4	6.9	2	3.8	0.682
● Vomiting	52	89.7	48	92.3	0.442
● Dizziness	10	17.2	18	34.6	0.03*
● Convulsion	2	3.4	4	7.7	0.419
● Disturbed conscious level	26	44.8	26	50.0	0.70
● ECG	14	24.1	10	19.2	0.38
Mortality rate					
● Overall mortality	0	0.0	6	11.5	0.01*

Table 4
Distribution of Epidemiological Criteria among the Outcome of Scorpion Sting Cases.

Epidemiologic characteristic	<i>Died</i>		<i>Recovered</i>		P-value
	No.	%	No.	%	
● Case Occurrence	6	5.5	104	94.5	
Age					
Mean ± SD	28 ± 18.6		32.1 ± 17.6		0.617
Gender					
● Male	1	16.7	47	45.2	0.15
● Female	5	83.3	61	58.7	
Smoking					
● Smoker	0	0.0	36	34.6	0.09
● Non smoker	6	5.5	68	59.1	

P value is Non-significant.

3.1. Morphological characterization of (*Leiurus quinquestriatus* and *Androctonus crassicauda*) scorpions

These two species of the present study belong to one family; Buthidae; *L. quinquestriatus*; Body length ranges between 9 and 9.5 cm, coloration is orangish-yellow to yellow. It has elongated chela, fifth segment of metasoma black; legs lighter distally (**Fig. 1,A&B**). *A. crassicauda*; they are over 10 cm in length. Adults can vary in colour from a blackish-brown, to black in the dorsal region and yellowish brown at the opisthosoma ventral surface and legs (**Fig. 1,C**).

3.2. Scanning electron microscopically study

A Sensory organs:

The sense organs of the scorpion are eyes, pedipalps, pectines and sensory setae (sensillae)

i Eyes (Median &Lateral Eyes): There are a pair of median eyes located in the center of the carapace and there are three pairs of lateral eyes located at the front of the carapace, It is similar to a pigmented cup covered by a biconvex lens (**Fig. 2,A–C**).

Table 5
Distribution of clinical manifestations and Time after Sting among the outcome of Scorpion Sting Cases.

Clinical manifestation	Died		Recovered		P-value
	No.	%	No.	%	
● Case Occurrence	6	5.5	104	94.5	
Local reaction					
● Pain at stung site	6	100.0%	96	92.3%	0.629
● Swelling	2	33.3%	52	50.0%	0.357
● Redness	2	33.3%	58	55.8%	0.257
● Numbness	0	0%	36	34.6%	0.086
Systemic manifestation					
● Headache	5	83.3%	57	54.8%	0.174
● Palpitation	0	0%	4	3.8%	0.796
● Dyspnea	0	0%	6	5.8%	0.708
● Vomiting	6	100.0%	94	90.4%	0.557
● Dizziness	5	83.3%	23	22.1%	0.004*
● Convulsion	0	0%	6	5.8%	0.708
● Disturbed conscious level	0	0%	52	50.0%	0.019*
Time after sting (TAS) (minutes)					
● < 30	0	0	58	55.8	0.001*
● 30 < 60	3	50	41	39.4	
● 60-120	3	50	5	4.8	

There is significant difference between died and recovered cases regarding Dizziness, disturbed conscious levels and time after sting.

Table 6
Scorpion sting Cases and Mortality according to Abroug's classification for grading Signs and Symptoms of scorpion sting cases.

Grade	No. (%)	Number of deaths. (%)
● Grade I	6 (5.5%)	0 (0%)
● Grade II	80 (72.2%)	0 (0%)
● Grade III	24 (21.8%)	6 (25%)

- ii **Pedipalps:** Is the second pair of appendages and lateral to the chelicerae (Fig. 2,D–F).
- iii **Pectines:** Is a modified appendage attached of the sternum of the second segment of mesosoma and joined to each other in the middle Each pectin consists of marginal lamella with three pieces which bears a series of teeth arranged like the teeth in a comb. Male with (32: 38) teethes, while female (28: 35) teethes with short hairs (Fig. 2,G&H).

Sensory setae (sensillae): Are scattered all over the scorpion's body especially much longer on tail and legs. There are fine sensory hairs occurred in pedipalps and sting called Trichobrothria. Basitarsal compound slit sensilla (BCSS) groups of cuticular grooves found on the distal basitarsal segment near the tarsal joint of all legs (Fig. 3,A&B).

● **Venom apparatus**

In the last five segments of the abdomen forming the metasoma (tail). At the end is the telson, which is a bulb-shaped structure containing the two venom glands and a sharp, curved stinger with two venom pores to deliver venom (Fig. 3,C,D&E).

4. Discussion

Scorpionism and its consequences constitute a factual problem of public health in several countries all over the world, especially in north-Saharan Africa. Approximately 1500 species of scorpions are described. Only about 25 species worldwide are considered dangerous to humans [11]. Scorpion activity period in Egypt is warm months presented in spring and summer; these small temporal variations may be explained by environmental conditions and the thermophilic nature of scorpions [7]

The total number of scorpion sting cases in the emergency department of general hospital of Esna, was 110 cases in the period of scorpion activity months of 2017 (from 1st march to 30th October) which similar to the result of [11], in which a total of 120 subjects were recruited prospectively emergency department of Batman State Hospital, Turkey over an 8 months period from March 2007 to October 2007. This may attributed to the same period of activity and to some extent the same environmental and socio-demographic factors.

Scorpion Stings in the present study were higher(34.5%) among children (1-18yrs) than other age groups with a mean of 31 ± 89 yrs. Children are more susceptible to scorpion envenomation [12] this due to their inquisitive nature and risk-taking behavior [13]. Scorpion stings were slightly more in female than males(54.9% : 45.1%) which similar to the result of [11] study in which scorpion stings more frequently occurring in females than males (62.5%: 37.5%). Because stings in the study locality usually present inside buildings and females usually don't move outside as males due to customs and traditions in southern Egypt, furthermore males are keener to protect themselves from any danger than females. On the other side [6] reported that male are more affected than females 58% versus 42% with male to female ratio of 1.38:1, and attributed this because males may had more contact

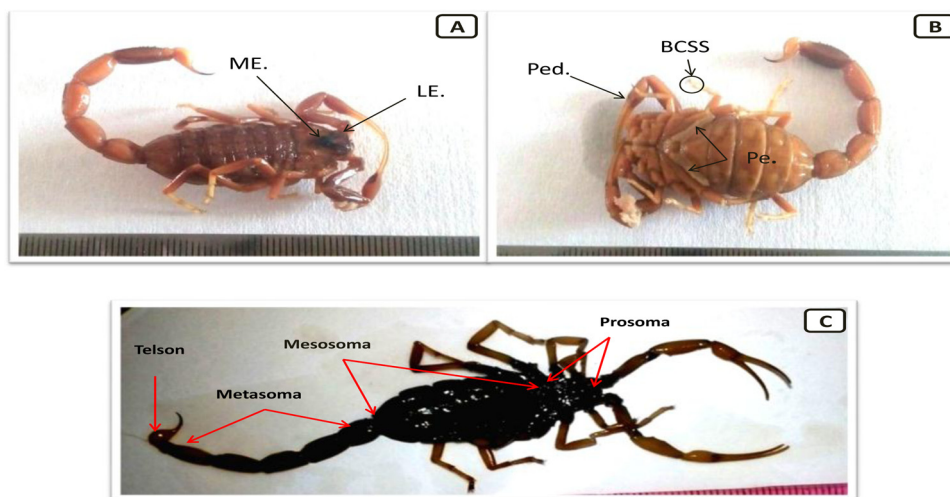


Fig. 1. Photograph showing: (A) Dorsal view of *Leiurus quinquestriatus*,(B) ventral view of *Leiurus quinquestriatus*, median eye (ME.), lateral eye (LE.), pedipalp (Ped.), basitarsal compound slit sensilla(BCSS), pectin (Pe.) and (C) Dorsal view of *Androctonus crassicauda*.

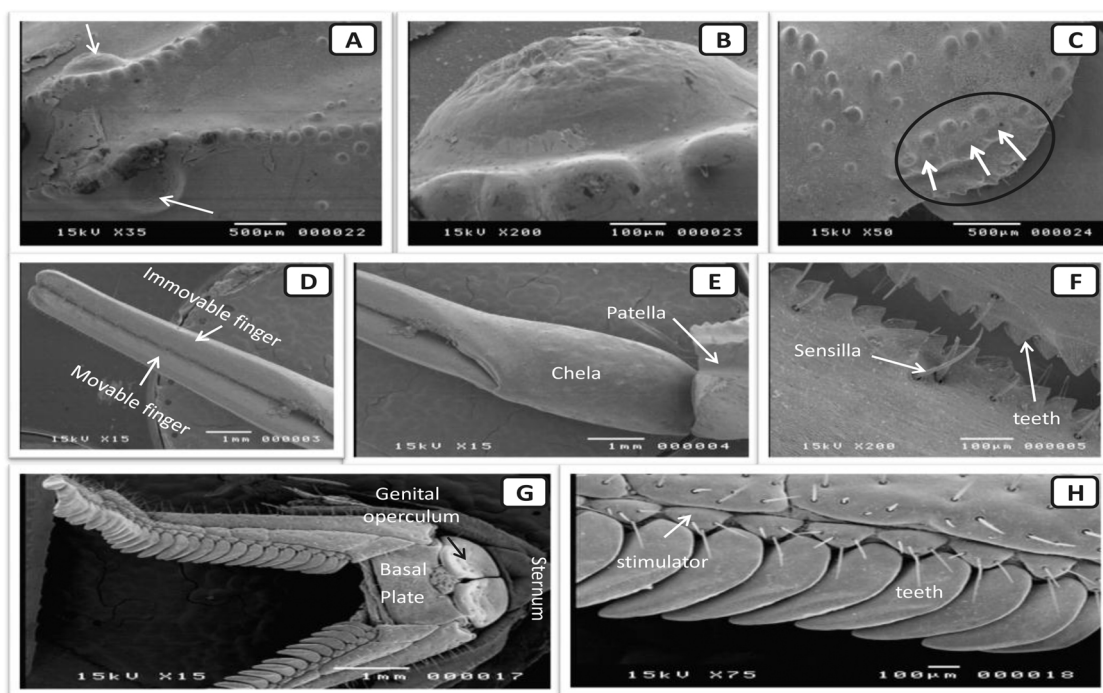


Fig. 2. Scanning electron micrograph showing of *Leirus quinquestriatus*: (A)the median eyes (arrow),(B) magnification median eyes,(C) lateral eyes(arrow),(D) anterior part of chela showing movable and immovable fingers,(E) chela, (F) minute teethes of chela,(G)pectin and(H) magnification teethes of pecten.

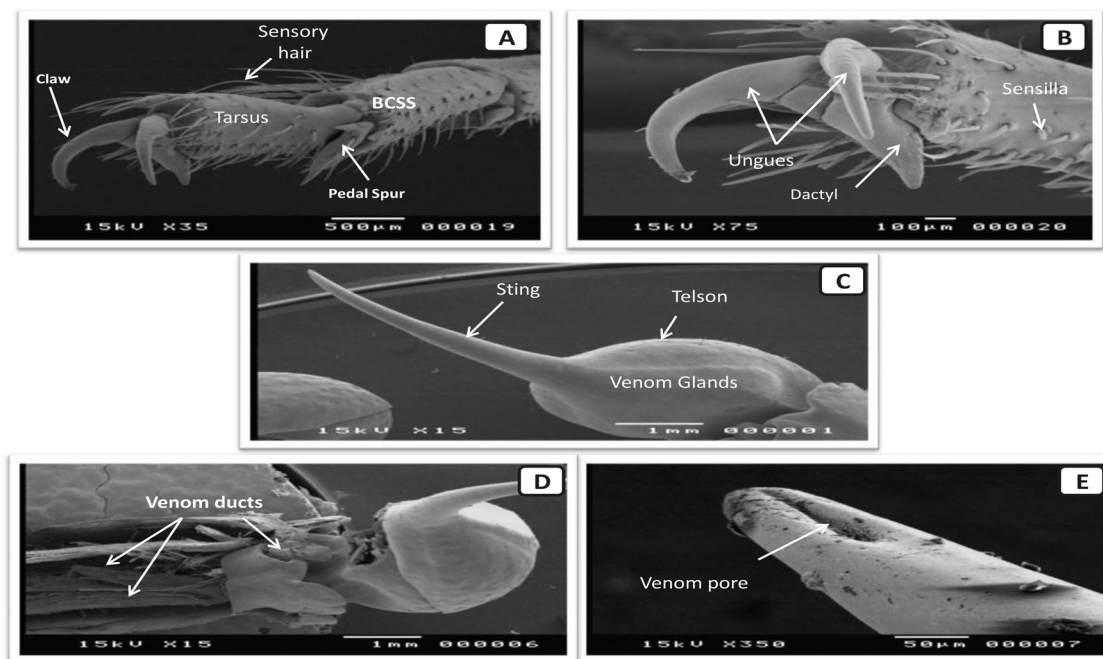


Fig. 3. Scanning electron micrograph showing: (A) lateral view of Tarsus of leg L. *quinquestriatus*,(B) magnification of tarsus claws (C) venom apparatus of *Androctonus crassicauda*, (D)venom ducts *A. crassicauda* and(E) sting with venom pore.

with different types of scorpions than females [14]. Concerning time after sting (TAS) which considered an important risk factor in determine severity and mortality in scorpion envenomation cases; the time elapsed between the sting and hospital admission was between 15 min and 120 min with a mean of 31 ± 75 min. Moreover more than half of the cases attended the emergency unit within half an hour after sting, this can be explained by occurrence of sever agonizing pain in the majority of cases (70.6%)immediately after sting force them to seek medical consultation rapidly and hospital admission [8], while 47.3%

have a delayed access to the medical care, this delay in seeking this medical care may be attributed to barriers in access to health facilities due to difficulty in transportation and scanty of health care facilities in these areas. TAS appears to be critical because scorpion venom propagates very rapidly through the victim's body, as proven in clinical and experimental reports [8]. Death rate was 75% when TAS was more than two hours, this due to delayed medical assistance constituted a negative impact on envenomation prognosis; hence, patients that arrived at the hospital more than two hours after sting have a greater risk

of unfavorable evolution [15].

Scorpion stings are characterized by severe localized, immediate and very intense burning pain that require parenteral analgesia or regional anesthesia. There is usually no associated local tissue injury [16]. Concerning local manifestations among studied group; pain at sting site was the commonest (92.7%) followed by redness (54.5%), then swelling (49.1%) and lastly numbness (32.7%). Pain occurred in (92.7%) of stings that are similar to the result of [11] and [17] localized pain was most common local symptom in of sting cases (97.5%, 88.7% respectively).

About systemic manifestations among studied group; vomiting was the commonest symptom followed by headache, disturbed conscious level then dizziness. vomiting as a commonest systemic manifestations coinciding with the result of [8] in which vomiting presented in 73% of the cases, Vomiting is due to serotonin content of venom [18] and transient para sympathetic stimulation after sting [16] The present study reveals that more than half of scorpion stings (52.70%) were caused by *Leiurus quinquestriatus* scorpion while the remaining cases (47.3%) were due to *Androctonus crassicauda*. These two species belong to family of Buthidae, which is the largest group in scorpion families (more than 800 scorpion species), and is mainly found in North Africa, Middle East, Asia, and India [19]. *Leiurus quinquestriatus* and *Androctonus crassicauda* are endemic in Africa of Middle East than other Buthidae species [20]. Egyptian scorpions *Leiurus quinquestriatus* and *Androctonus crassicauda* were found on patient's bedclothes. Most of the works were studied specific sensory organs [21].

Regarding occurrence of clinical manifestations (local and systemic) among the scorpion sting patients in relation to scorpion type; there is higher incidence of manifestations (local & systemic) among *Leiurus quinquestriatus* than *Androctonus crassicauda* stings, this can be explained by the result of [20].

The clinical presentations of scorpion envenomation in general prospective are different from those observed in cases of Snakebite. Clinical presentations of Snakebite cases as observed in previous studies were; Local pain at the site of bite, edema, coagulopathies, moderate hypotension, malaise, vomiting, abdominal pain and diarrhea [22–24].

Mortality from *A. crassicauda* was more than caused by *L. quinquestriatus*, this may be attributed to that occurrence of severe agonizing pain at the sting site that occurred immediately after sting by *A. crassicauda* and forcing the patients for rapid medical consultation and proper management and recovery. While the sting cases caused by *L. quinquestriatus* had a little pain and other local manifestations giving the time for the venom to progress in the body silently and produce late severe systemic manifestations and complications, in addition to delayed access to the medical care that attributed to barriers in access to health facilities, difficulty in transportation and scanty of health care facilities in these areas.

There was high recovery rate (96.4%) among scorpion sting patients that were belong to severity classes 1 and II, this result is more or less similar to [8] that record 11 deaths among 163 sting cases all of which belonged to severity class III, while [19] registered recovery of all scorpion sting cases that were belong severity grade I. Deaths from scorpion stings are rarely fatal in developed countries, but they are still a significant cause of mortality in developing nations [25].

According to Abroug's classification (connect the manifestation to grading) for grading Signs and Symptoms of scorpion sting cases; only 6 stings were Grade 1, 80 were grade II, 24 cases were grade III; this can be explained by different times of hospital arrival after stings that affect appearance of clinical manifestation, in a study of [19] all stings were grade 1 with 100% recovery rate. All deaths were grade 3 this can be explained by occurrence of cardiac dysrhythmia in grade 3 that attributed to death.

The most of the lethal species varied and extensive extend family; Buthidae includes the majority of medically significant scorpion species [25]. The most important lethal species in the Middle East include

Androctonus crassicauda, *Androctonus australis*, *Buthus mmox*, *Buthus occitanus*, and *Leiurus quinquestriatus* [26]. Buthidae is the largest family of scorpions, its members are known as thick-tailed scorpions and bark scorpions [27,28]. Scorpion (*Androctonus amoreuxi*) is found abundant in Egypt. *Androctonus crassicauda* is one of the most important of the family: Buthidae [29,30]. In the present study, the Egyptian scorpions *Leiurus quinquestriatus* and *Androctonus crassicauda* were found on patient's bedclothes.

Many papers of scorpion venoms, venom chemistry, their medical use, behavior and morphological are available, while in our study, morphological characterization of sensory organs and venom apparatus was studied by scanning electron microscopy for many reasons: Scorpions used sensory organs and venom apparatus for detect their prey place, prey capture, defense, and probably to hold back mates.

Most of the works were studied specific sensory organs [31–34]. In the present study revealed the morphological characterization of sense organs and venom apertures of scorpions *Leiurus quinquestriatus* and *Androctonus crassicauda* by SEM, Great work exists on the circadian activity of scorpion eyes relative to changing intensities of light [35]. Their median eyes have lenses and a daily fluctuation of light intensity sensor and may be capable of image formation, while the lateral eyes suggest that they detect only changes in light intensities [36] the two lateral eyes exist; posterior eye is slightly larger than the median eyes [37]. Previous studies had revealed the important of basitarsal compound slit sensilla (BCSS) and pectin [38,39] in the sensing of vibrations produced by prey. We conducted by SEM survey of pedipalps, used for hunting and defense. Chela has two segments: chela with an immovable finger and movable finger. Specialized mechano-sensory setae (trichobothria) on pedipalps detect air vibrations that correspond with [37]. Sensory setae are widespread in all arachnids. In scorpions, we observed short and curved setae (sensillae) are scattered and covered all over the scorpion's body and sensitive to direct touch that resembles with [40]. As viewed under the scanning electron microscope, the venom apparatus of scorpion is situated in the telson and is composed of a pair of venom glands and a stinger that agrees with [41].

5. Conclusion

Scorpion sting is an acute health threatening in Saharan Africa and Southern Egypt. *Leiurus quinquestriatus* and *Androctonus crassicauda* scorpion species are among endemic scorpion species in Southern Egypt. Cardiac dysrhythmia is main cause of death in scorpion envenomation cases. *Leiurus quinquestriatus* scorpion species are more toxic than *Androctonus crassicauda*, while late presentation of manifestation in *Androctonus crassicauda* sting cases responsible for bad prognosis and high mortality among such cases.

Recommendations

It would be necessary to reinforce the medical staff and to improve intensive care equipment to obtain a better management of this pathology in addition to approved polyvalent antivenom, In scorpion endemic areas people should be educated to check for the presence of scorpions in clothing, beddings, and shoes before blindly putting hands into them and early approach to a medical center, instead of approaching the traditional faith healers and quacks. Pesticides like organophosphates, pyrethrins and chlorinated hydrocarbons are known to kill scorpions should be used to eradicate such scorpions.

Conflict of interests

The authors declare that they have no competing interests.

Transparency document

The [Transparency document](#) associated with this article can be

found in the online version.

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