
TAXONOMICAL AND GEOGRAPHICAL OCCURRENCE OF LIBYANS SCORPIONS

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RESUME

A partir de 5000 scorpions récoltés dans différentes régions de la Libye, neuf différentes espèces ont été identifiées: *Leiurus quinquestriatus*, *Androctonus bicolor*, *Androctonus australis*, *Androctonus amoreuxi*, *Buthacus leptochelys*, *Buthus occitanus*, *Buthacus arenicola*, *Orthochirus innesi* et *Scorpio maurus*. L'étude de la distribution géographique montre que l'espèce *Leiurus quinquestriatus* est localisée spécifiquement dans la région du Sud; par contre, *Buthus occitanus* ne se trouve que sur les côtes Libyennes. Les autres espèces, comme *Androctonus*, se trouvent répandues dans toutes les régions alors que *Buthacus Leptochelys*, *Orthochirus innesi* et *Scorpio maurus* sont fréquentes, respectivement, dans l'Est (Aujlab, Jalu), le Sud (Wadi-Atbah) et l'Ouest des côtes libyennes.

Mots clés: Scorpions, taxonomie, distribution géographique, Libye.

SUMMARY

Nine different species of scorpions can be recognized from more than 5000 samples collected from different areas in Libya: *Leiurus quinquestriatus*, *Androctonus bicolor*, *Androctonus australis*, *Androctonus amoreuxi*, *Buthacus leptochelys*, *Buthus occitanus*, *Buthacus arenicola*, *Orthochirus innesi* and *Scorpio maurus*. The geographical occurrence showed that *Leiurus quinquestriatus* seems to be restricted to the Southern areas. On the contrary, *Buthus occitanus* was found in the coastal regions. Other species such as *Androctonus* were widely spread in all regions. *Buthacus Leptochelys*, *Orthochirus innesi* and *Scorpio maurus* were found, in the East (Aujlab, Jalu), the South (Wadi-Atbah) and the Western cost of Libya respectively.

Key words: Scorpions, taxonomy, distribution, Libya.

INTRODUCTION

Scorpion envenomation is a major threat to thousand of lives in Libya and many other parts of third countries. Upon extensive review of literature about scorpions as a public health problem in Libya, the authors encountered very scant information about taxonomic identification of different scorpion species endogenous to Libyan environment.

Furthermore, no studies have been conducted so far to evaluate biochemical characterization of venoms from scorpion species nor to compare their corresponding toxicity. This study is designed to provide background information about the taxonomy and the geographical distribution of scorpions in Libya.

MATERIELS ET METHODS

FIELD STUDY AND SAMPLE COLLECTIONS

Thousands of scorpions were collected from more than sixty five cities and villages in Libya. The sites of the collection were grouped into eight zones. At different intervals, various collecting trips were made to several regions. The sites which were sampled at the same period were indicated in figure1, surrounded by a solid line and considered as a single zone. These areas were chosen as sites of collection for convenience, habitat similarity and high incidence of scorpion sting cases. Field collection lasted from June 1989 to November 1991.

The scorpions were collected from different micro-habitats, such as garbage yards, under the stones, rotten animal hides, rotten woods, trunks of fallen palm trees. Collections were made at day and night times. Zones one and two were sampled first.

The Second part of the collecting program in sites three to eight started in June 1990 when the collecting facilities and the field study conditions became much improved. Every collected scorpion was kept in individual plastic can. Scorpions needed for identification were preserved in 70% alcohol. Location, date of collection and serial numbers were labeled on each sample.

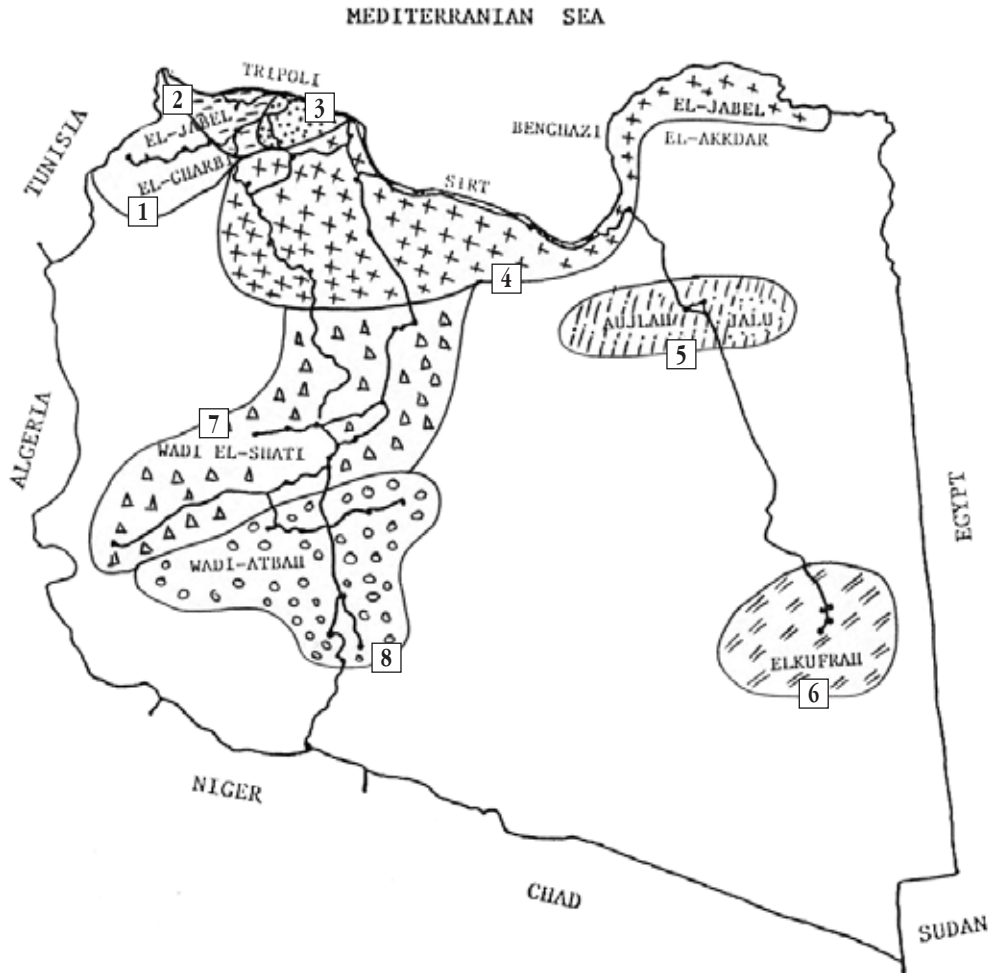


Figure 1. A map showing the various zones (1to 8) of scorpion collection in Libya.

Procedure and time collection

• Diurnal collection

The collection begins early morning by searching the scorpions in their hiding places, mostly near garbage, hides wooden planks, shoes, old mattresses, cut palm tree branches and any other shelters which protect scorpions from direct sun rays. These materials give protection to scorpions since they are ventilated by leaving a sufficient gap between the ground and the so called roof for the scorpion. The natural shelters are usually seen around the farms, the companies and the camp areas, the garbage dumping regions and the Rocky Mountains.

• Nocturnal collection

This method is based on attracting scorpions by their favorite preys such as crickets, moths and many other invertebrates that are active at night. However, the scorpions could be attracted by light as well.

The method is simple and uses a source of light coming a petromax, a plastic container 500cm in diameter and 20cm deep. The container is buried in a whole so that the top is on the level of the ground. The attracted scorpions that rush to catch their prey fall in the container and fail to get out. There should be periodical visits to the trap to confirm that it is working and to collect the different trapped species and instars of scorpions. Emptying the trap should be continuous to ensure getting live scorpions and minimize mortality.

Laboratory studies

The collected scorpions (average length of 65cm), were taken to the laboratory and dead specimens were identified and labeled. The living scorpions were reared under the laboratory conditions. Thus, they were individually placed in plastic containers, each measuring 13cm in diameter and 10cm in height. Each jar contained sand to a depth of 5 to 6 cm and pieces of board or bark serving as hiding places for the scorpions. The top of the jar was closed with a special cover containing small holes for ventilation. It has been noticed that as long as food and water are provided for the scorpions, they survive and it is possible to maintain scorpions alive for several years under these laboratory conditions, especially if they are collected in old instars¹. There are no stringent guidelines for housing scorpions. Any type of container is adequate as long as the container is escape-proof, glistening and smooth². It is desirable, however, to

place scorpions individually in square-bottomed plastic containers having 13cm in diameter and 10cm in depth with hinged punctured lids to allow ventilation and easy access for feeding and watering.

Before introducing the scorpion into to the container, a substrate can be added depending upon their habits. The selected substrate may be sand for psammophiles or rocks for lithophils and soil for most of the others species.

Under more elaborate conditions (i.e., with larger containers with deep layers of soil), scorpions have been induced to burrow and reproduce under laboratory inhabitation^{3,1}.

Preservation of collected scorpions

In this study, a modified method of scorpions preservation described by Williams⁴ and Newlands⁵ has been used. The steps involved are summarized below:

- Scorpions were killed by heat shock by immersing them for less than five seconds in water at 90°C.
- The specimens were then fixed in the following suspension:

a- 10% Formaline.....	12 ml.
b- 95% Ethyl Alcohol.....	30 ml.
c- Glacial Acetic Acid.....	02 ml.
d- Glycerol.....	05 ml.
e- Distilled Water.....	51 ml.

Fixation was accomplished by having the specimen completely submerged in the fixative for 24 hours. Large specimens were injected with the fixative to aid fixative penetration. Since our specimens are also for taxonomic purposes, the chelicerae are pulled interiorly until they become visible, with the opening of one of the fingers of the chelicerae and pedipalp chea. The time needed for fixation depended on the size of the specimens. They should not be kept in the fixative for long period to avoid hardening, which was also avoided by adding glycerol.

- Scorpions were then rinsed in 80% ethanol for one hour, and stored in 70% ethanol in a dark place.
- Due to the vital need for these specimens for taxonomical studies, special care was given to not lose any part of their bodies.

TAXONOMY

Two methods, morphological and anatomical, have been used for classification of the collected scorpions.

Morphology

Morphological classification is based on distinguishing characters using binocular and light microscope allowing determination of ultra-morphological features, starting with the characters that could differentiate between families such as:

1. Number of trichobothria in the pedipalp femur.
2. Mode of expansion of coxapophysis.
3. Presence or absence of retro lateral pedal spurs.
4. Subaculear tubercle.
5. Sternum shape or its reduction.
6. Basal tooth on the internal margin of the cheliceral movable finger.

These characters have been applied using the keys of Vachon ⁶ and Francke and Soleglad ⁷.

To classify these samples up to the species level, a more distinguishing characters have been also used such as:

1. The color of the scorpion.
2. The position of the metasoma at rest for the live samples.
3. The form of the somites of the metasoma especially the 5th segment.
4. The length and the curvature of the stringer.
5. The texture of the carapace i.e. the orientation of the keels (crania) relative to the compound eyes.
6. The distinct morphology of the cheliceral dentation.

Anatomy

In cases where external morphological characters were not enough for identification, the internal structures (anatomical characters) served this purpose. These anatomical distinguishing characters were:

1. The shape and the structure of paraxial organs.
2. The reproductive organs.
3. The hemispermaphores of the male.
4. The ovariterus of the female which help confirming different families and differentiating some species.

RESULTS AND DISCUSSION

Taxonomy

Based on the morphological and the anatomical criteria specified in the methodology chapter, the identification of more than 5000 scorpions, collected from different zones in Libya, were carried out (Table I).

The results showed that only nine different species can be recognized. Most of these species were found to belong to the Buthidae family whereas the rest belonged to the Scorpionidae.

Tableau I. Number of scorpions collected of each zone.

Zone	Number of scorpions collected
1	240
2	190
3	210
4	580
5	630
6	940
7	1250
8	1000

The nine different species recognized were:

1. *Leiurus quinquestriatus*
2. *Androctonus bicolor*
3. *Androctonus australis*
4. *Androctonus amoreuxi*
5. *Buthacus leptochelys*
6. *Buthus occitanus*
7. *Buthacus arenicola*
8. *Orthochirus immesi*
9. *Scorpio maurus*

The identifying pictures of each of these nine different species are presented in plates 1 though 9.

Geographical occurrence

When we correlated our taxonomical findings with the zones of collection, the following observations were documented. Species such as *Leiurus quinquestriatus* seemed to be restricted to the Southern areas and were not seen in the costal area. On the contrary, *Buthus occitanus* was found in the costal regions and did not show up in the Southern part of the country, whereas other species such as *Androctonus australis*, *Androctonus amoreuxi* and *Androctonus bicolor* were widely spread in all regions. These finding confirmed that the occurrence of these scorpions have some kind of trend that may be resulted from the ecological differences within scorpions habitats. In fact, the habitats and climatic factors of the coastal areas differ from that of the Southern part of the country. Brief accounts on the occurrence of the nine different species are as follows:

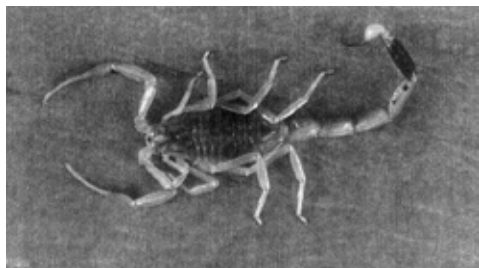


Plate 1: Leiurus quinquestriatus

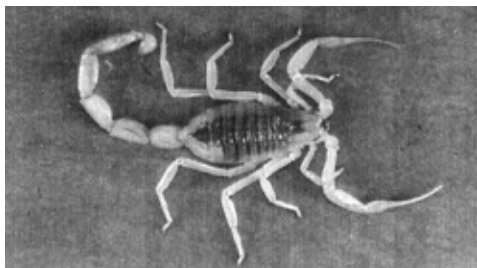


Plate 2: Androctonus bicolor



Plate 3: Androctonus australis

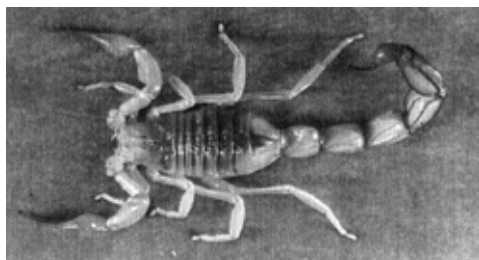


Plate 4: Androctonus amoreuxi

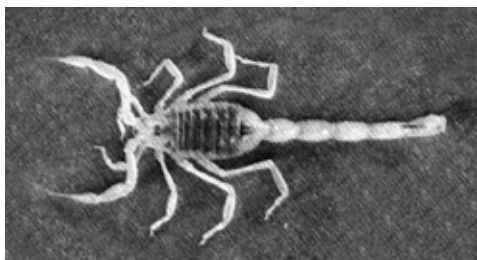


Plate 5: Butbacus leptocbelys

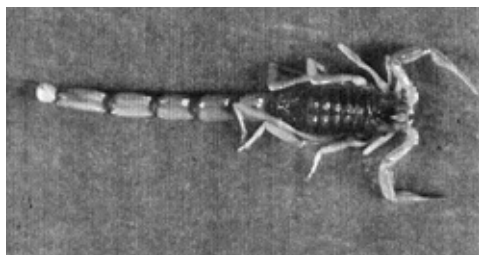


Plate 6: Butbus occitanus

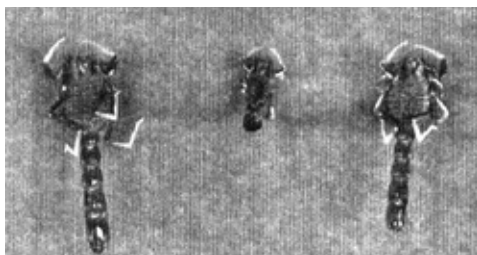


Plate 7: Butbacus arenicola



Plate 8: Ortochirus innesi

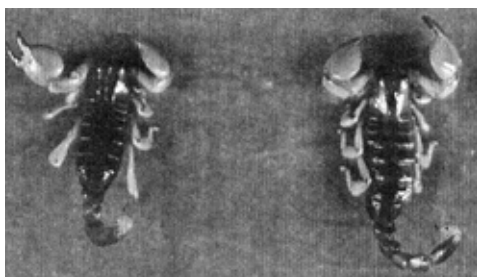


Plate 9: Scorpio maurus

1- *Leiurus quinquestriatus*

This scorpion species (Plate1) is mainly restricted to the southern part of the country namely to Jalow, Aujla and Jkharra (Zone 5), Elkufra (Zone 6), wadi El-shati (Zone 7) and Wadi Atbah (Zone 8);

they were not found in the costal areas (Figure 2).

2- *Androctonus bicolor*

This black coloured scorpion (Plate 2) is widely distributed in all the collecting sites, but at low numbers (Figure 3).

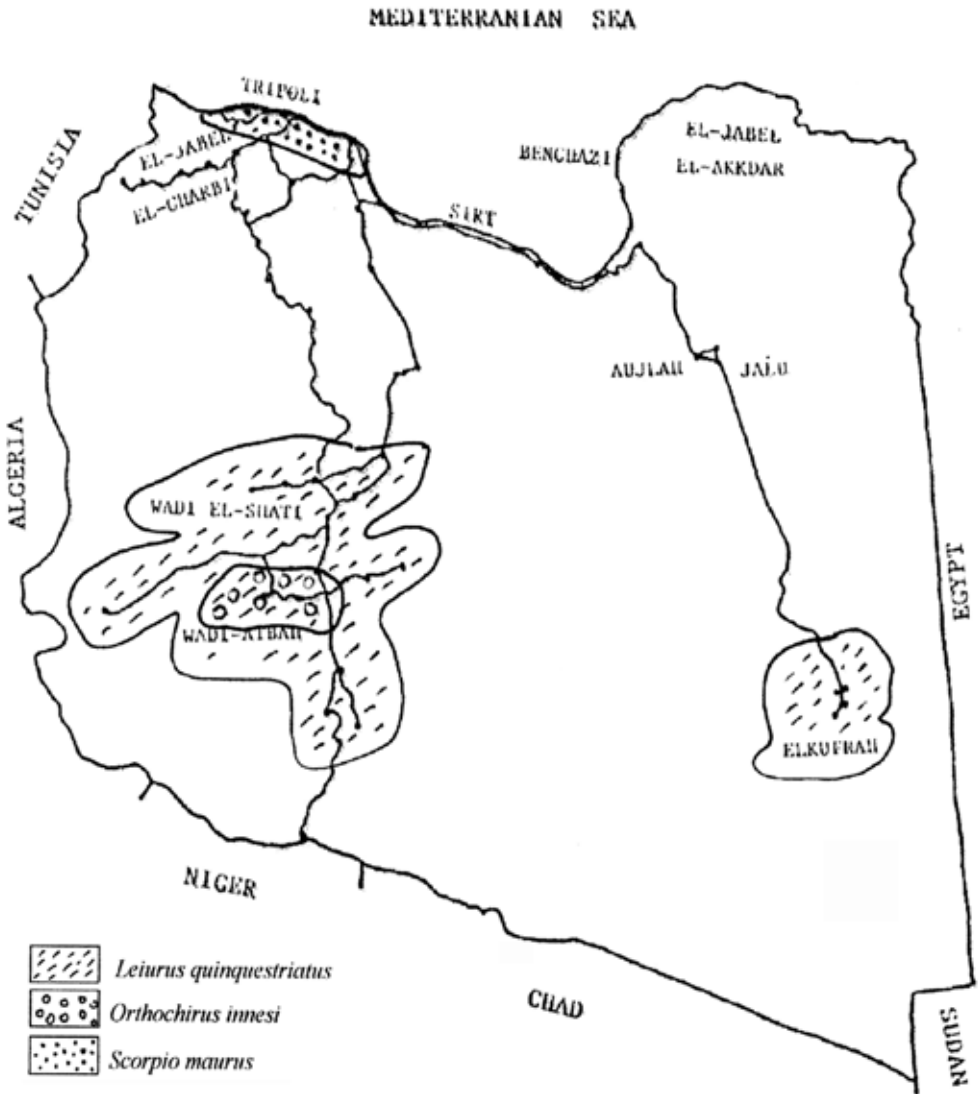


Figure 2. Geographical occurrence of *Leiurus quinquestriatus*, *Orthochirus innesi* and *Scorpio maurus*.

3- *Androctonus australis*

A species (Plate 3) that is found in both coastal and Southern parts of the country; but it is more abundant in the rocky areas such as Buhadi of Sirt, Ashwirff and algariat (Zone 4). It is also found in El-jabal El-gharbi area (Zone 2) in addition to areas along the coast

including El-Jabal El-Akdar area (Figure 3).

4- *Androctonus amoreuxi*

This species (Plate 4) represents the second most abundant species in the collecting zones along with species *Leiurus quinquestriatus* (Figure 3).

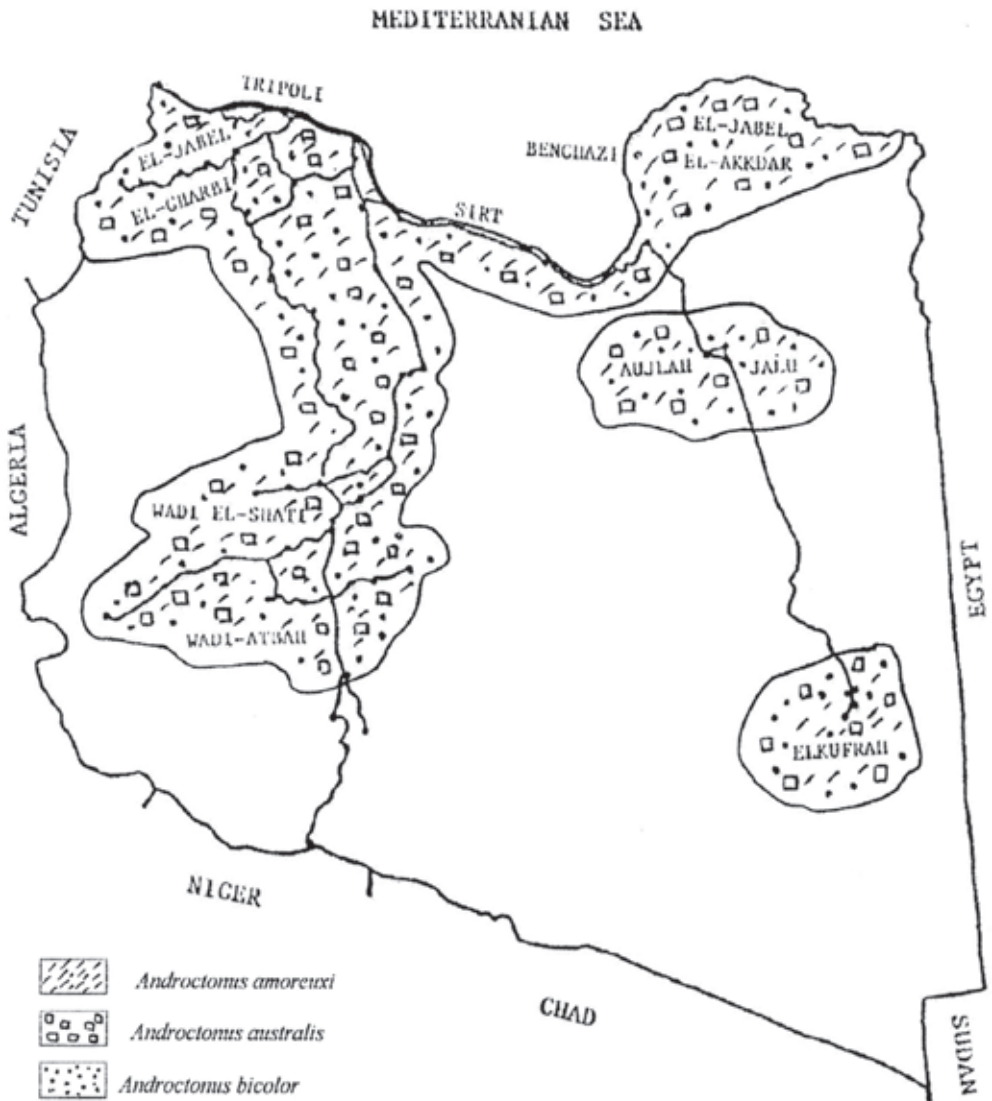


Figure 3. Geographical occurrence of *Androctonus amoreuxi*, *Androctonus australis* and *Androctonus bicolor*.

5- *Buthacus leptochelys*

This species (Plate 5) mainly inhabits Jalow, Aujla and Jekirrah (Zone 5), but it is also found in small numbers in zones 6, 7 and 8 (Figure 4).

6- *Buthus occitanus* (Plate 6)

It is found in large numbers in Tajoura city and its vicinities (Costal region of zone 2), but it also exist in small numbers in costal region (Zones 3 and 4). This species not found in the Southern part of the country (Figure 4).

7- *Buthacus arenicola* (Plate 7)

It is seems that it does not have any problem in sharing habitats with *Buthacus leptochelys*; it also occurs in zones 6, 7 and 8 but with small numbers (Figure 4).

8- *Orthobchirus innesi*

This small black body colored scorpion with a pale distal parts of the appendages (Plate 8) is restricted to zone 8, mainly in Morzug, Marhaba and Tsawah of Wadi Atbah (Figure 2).

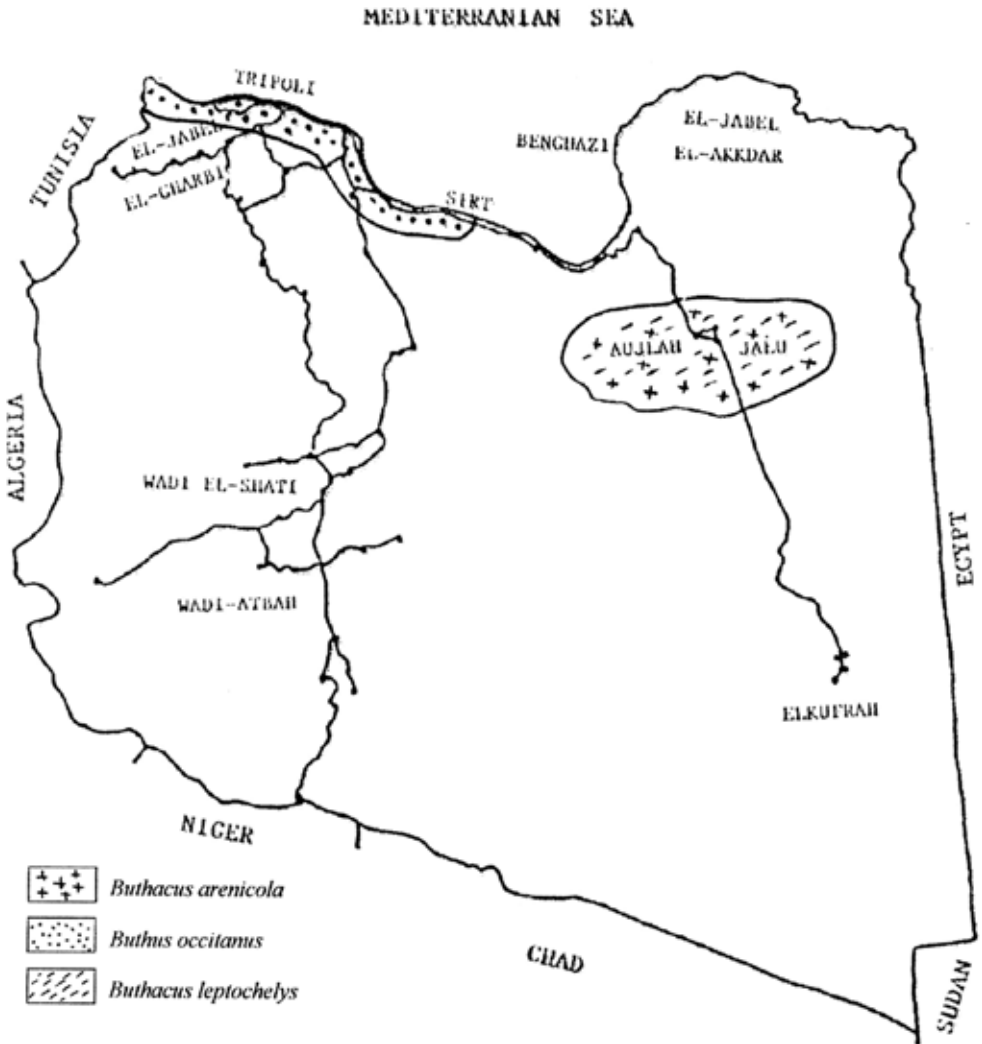


Figure 4. Geographical occurrence of *Buthacus arenicola*, *Buthus occitanus* and *Buthacus leptochelys*.

9- *Scorpio maurus*

This species is restricted to zone 3 which comprises Khums city and Misillata (Figure 2). It has a distinguishing form with large chela (Plate 9), and its unique season of activity i.e. September

to December with an optimum activity during October.

The geographical distribution of each scorpion species in the all collected zones is summarizing in table II.

Table II: Percentage of geographical distribution of scorpion species collected in each zone.

Name of scorpion	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8
<i>Leiurus quinquestriatus</i>	0	0	0	0	13	12	40	35
<i>Androctonus bicolor</i>	12	12	12	10	14	12	14	14
<i>Androctonus australis</i>	3	25	2	55	3	7	2	3
<i>Androctonus amoreuxi</i>	4	15	6	45	11	7	8	4
<i>Buthacus leptochelys</i>	0	0	0	0	73	12	8	7
<i>Buthus occitanus</i>	3	85	5	7	0	0	0	0
<i>Buthacus arenicola</i>	0	0	0	0	80	8	5	7
<i>Orthochirus innesi</i>	0	0	0	0	0	0	0	100
<i>Scorpio maurus</i>	1	3	95	2	0	0	0	0

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