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A review of the scorpion fauna of Saudi Arabia

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ABSTRACT

The scorpions of Saudi Arabia were surveyed in the major regions of Jazan, Al-Medina, Al-Baha, Hail, and Riyadh, in addition to nine provinces surveyed more superficially. Jazan (1,440 specimens) had 10 buthids and two scorpionid species and subspecies; Al-Medina (867) had seven buthid and two scorpionid species and subspecies, one of which, the scorpionid *Scorpio maurus* (*palmatus*?), needs further confirmation of identity. The Al-Baha region (2421 specimens) contained five buthids and two scorpionid species and subspecies; Hail (1,921) had eight buthid and two scorpionid species and subspecies - the most common subspecies here was *Scorpio maurus kruglovi*. *Androctonus crassicauda* and *Leiurus quinquestriatus* were only found in Hail and Al-Baha; *Androctonus bicolor* was newly recorded in Hail and Riyadh. Riyadh (4,164 specimens) had nine buthid, one scorpionid and at least two hemiscorpiid species and subspecies. The Saudi fauna was found to comprise at least 28 species and subspecies of the families Buthidae, Scorpionidae and Hemiscorpiidae.

Keywords: Buthidae, Scorpionidae, Diplocentridae

INTRODUCTION

Arachnologists have been puzzling over the relationships of arachnids for over a century and for an appreciable time the problem seemed no closer to a satisfactory resolution (Shultz 1990). Some have speculated that arachnids are a polyphyletic grade of terrestrial chelicerate (Savory 1971, Krauss 1976, Manton 1977, Van der Hammen 1977a). Weygoldt & Paulus (1979a), whose works were based on information derived from an extensive review of chelicerate biology, were the first to apply cladistic reasoning to the arachnid problem and they discovered the evidence that arachnids are monophyletic. Van der Hammen (1977a), who was the most prolific of the workers in this field (Weygoldt & Paulus 1979b, Van der Hammen 1977b, 1979, 1969, 1982, 1985a, 1985b) has rejected cladistics as too rigid and atomistic to offer a solution for the problems of arachnid evolution, and (l986a) suggested that "discovery of unexpressed potentialities" holds the key to understanding macroevolutionary change. The conclusions of Van der Hammen went unchallenged apart from Lindquist (1986b), but Shultz (1990) admitted that arachnids are probably monophyletic.

The phylogenetic position of scorpions was in dispute but the order limits were clear (Shultz 1990). Weygoldt & Paula (1979a) thought that fossil scorpions were more closely related to Eurypterida than to recent scorpions, but the more recent works of Kjellesvig-Waering (1989) have proved this inappropriate, based on the pectinal presence in fossil scorpions, in addition to the stomotheca, transverse carapacial furrow and biocondylar femoro-patellar joints. Recent scorpions have major differences from other arachnids, such as the flagellar spermatozoa, opisthosomal venom glands, etc. (Van der Hammen 1985c, Shultz 1990).

Detailed recent information about scorpions is available in scorpiological websites (Arachnodata 2009a, 2009b; Euscorpius 2009, ITG Library 2009, WRBU 2009, The scorpion fauna 2009). A lot of controversy has accumulated recently on scorpion taxonomy, especially in higher level systematics and in relation to other arthropods (Fet &

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Bechly 2000, Fet & Braunwalder 2000). Nine families were established by the end of the 20th century (Stockwell 1989, 1992; Sissom 1990, Gromov 1998, Prendini 2000), and at least sixteen were recognised a decade later (Prendini 2000, Fet *et al.* 2000, 2005; Prendini 2001, 2003a, 2003b; Soleglad & Sissom 2001), partly by abolishing some (e.g. Diplocentridae) and re-instating others (Prendini & Wheeler 2005), based on particular morphological features (Polis 1990, ITG Library 2009, Rosin 1965, 1969a, 1969b, 1973; Lourenco 1985). The family Hemiscorpiidae was established, abolished and finally reinstated (The Scorpion Files 2009, following Fet & Soleglad 2005).

As regards the scorpions of Saudi Arabia, earlier reports by several investigators (including Vachon 1979, and more recently Al-Hajjaj 2005, Al-Sadoon & Al-Farraj 2008) indicate the presence of only two medically important species (*Androctonus crassicauda* and *Leiurus quinquestriatus*: both Buthidae) in the Riyadh region. Other buthid species such as *Buthacus leptochelys* and *Vachoniolus* (*Buthacus*) *minipectinibus* were not reported from this region, but were reported to be extant in other regions (Vachon 1979). Buthidae is the largest of the scorpion families (Fet and Lowe 2000, Polis 1990) spreading over many regions, and widespread in the Old World, especially in Asia and Tropical Africa. The recent and continuing studies of Hendrixson (2002, 2006, 2008) and El-Hennawy **(**2009**)** on scorpions of the Arabian Peninsula were helpful and useful guides in our work.

Medically important species have been reported in the older literature (Al-Asmari *et al.* 2007, 2009a, 2009b), but species that are allegedly unimportant medically turn out to produce medically serious outcomes in Saudi Arabia, such as intracranial bleeding and other complications (Annobil 1993, Annobil *et al.* 1991) and other works and information from personal contacts report the same for other species (e.g. *Compsobuthus werneri*, *Apistobuthus pterygocercus*, *Scorpio maurus kruglovi*, *Scorpio maurus* (*palmatus*?) and *Hemiscorpius* spp.).

MATERIALS & METHODS

The bases of scorpion classification have changed in recent years. The important methods and keys of Vachon (1979) and Sissom (1990) were based on three trichobothrial patterns and other morphological features referring to their distribution and dimensions on the body (Figs. 1 & 2). Preliminary work done in the Arabian Peninsula and Saudi Arabia in particular were based on these keys (Al-Asmari *et al.* 2007, 2009a). Recent changes to higher classification were adopted by The Scorpion Files (2009), following Fet & Soleglad (2005), but recent work in the Arabian Peninsula used the work of Hendrixson (2002, 2006, 2008). Here we adopt the higher classification of The Scorpion Files (2009):

Infraorder: Orthosterni Pocock, 1911 (extant scorpions)
- Parvorder: Buthida Soleglad et Fet, 2003
  - Superfamily: Buthoidea C. L. Koch, 1837
    - Family: **Buthidae** C. L. Koch, 1837 (thick-tailed scorpions)
- Parvorder: Iurida Soleglad et Fet, 2003
  - Superfamily: Scorpionoidea Latreille, 1802
    - Family: **Scorpionidae** Latreille, 1802 (burrowing scorpions or pale-legged scorpions)
      - Subfamily: Diplocentrinae Karsch, 1880
        - Tribe: Nebini Kraepelin, 1905
      - Subfamily: Scorpioninae Latreille, 1802
    - Family: **Hemiscorpiidae** Pocock, 1893 (= Ischnuridae, =Liochelidae)
      (Rock scorpions, creeping scorpions, or tree scorpions)
      - Subfamily: Hemiscorpiinae Pocock, 1893

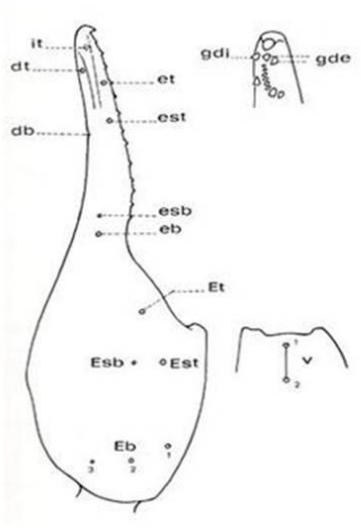


Figure 1: Distinctive distribution and nomenclature of the trichobothria on the pedipalp chela of *Parabuthus liosoma*, from Vachon (1979).
d: dorsal; *i:* internal; *e:* external; *b:* basal; *iag:* inner accessory granule; *oag:* outer accessory granule; *sb:* sub basal; m: medial; *v*: ventral; *st:* subterminal; *t:* terminal; *td:* terminal denticle.

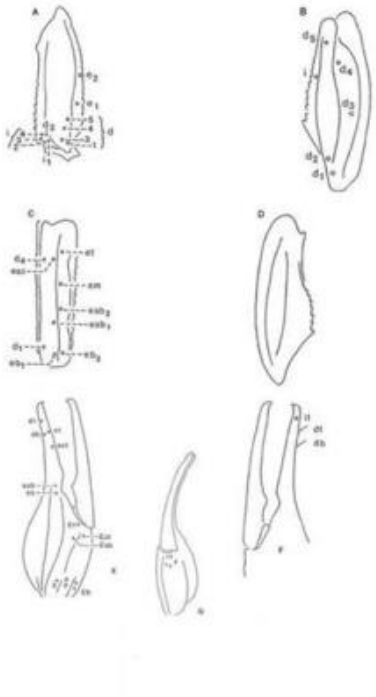


Figure 2: Dissected parts of the pedipalp showing type A basic trichobothrial pattern (from Sissom 1990). A: dorsal view of femur; B: dorsal view of patella; C: external view of patella; D: ventral view of patella; E: external view of chela; F: internal view of chela; G: ventral view of chela.
d: dorsal; *i*: internal; *e*: external; b: basal; sb: sub basal; m: medial; v: ventral; st: subterminal; t: terminal.

RESULTS & DISCUSSION

It was not our intention to keep scorpions in captivity, but this happened almost accidentally during the processes of unloading field batches, classifying and milking them (Al-Asmari *et al.* 2007, 2009a, 2009b). Some species were successfully reared to maturity, mated and their offspring reared (Al-Asmari *et al.* 2007, 2009a, 2009b), feeding them on the mealworms of previous methodologies (Lyon 1991, 1997). We have not confirmed scorpion parthenogenesis in Saudi Arabian populations, although this had been observed by some workers elsewhere (Lourenço 1994, 2008; Lourenço *et al.* 1996, 2000).

The total number of scorpions studied (Al-Asmari *et al.*, 2007, 2009a, 2009b) in the five regions of Jazan, Al-Medina, Al-Baha, Hail and Riyadh (Figs. 3-5) was 10,813 specimens, in addition to other specimens reviewed from an extra nine localities. There were at least 28 species and subspecies recognized from these 14 locations, summarized in Table 1: they belong to three families - Buthidae, Hemiscorpiidae and Scorpionidae.

Figure 3: Map of Jazan and Al-Medina Al-Munawwara regions, showing Jazan [Baish, Samtah, Abu Ariesh, Feifa, Bani Malik, Jazan City (Plantations), Sabia, Al-Khoba, Uhud Al-Masarha and Forasan Isles] and Al-Medina Al-Munawwara [Mahd Addahab, Tabouk Road, Yanbou Road, City (Medina) Road, City Center (Plantations), Uhud and Jedda Road].

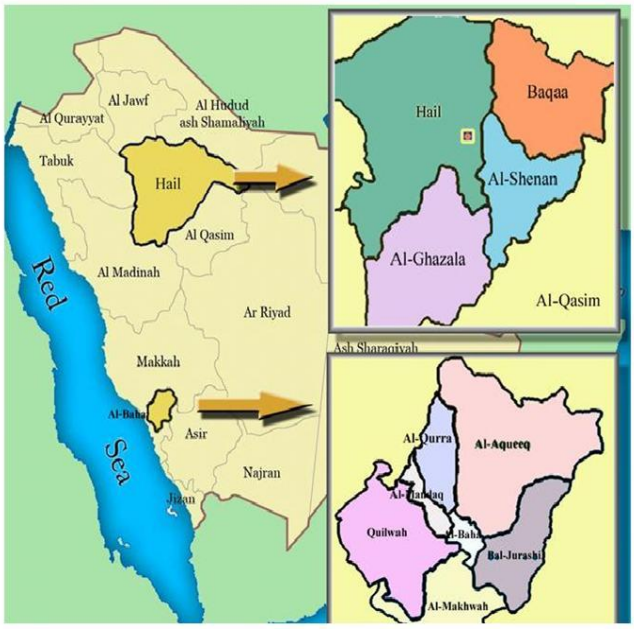


Figure 4: Map of Hail and Al-Baha regions, showing Al-Baha [Al-Quied, Al-Qura, Al-Mandag, Al-Makhwaa, Galwaa, Al-Baha and Baljurashy cities]and Hail [Hail city, Baqaa, Al-Shenan and Al-Ghazala].

Figure 5: Map of Riyadh (Central) region, showing the **s**ectors of Riyadh and locations of collections [Quasiem Road, Ramah road, Nazeem Road, Airport Road, Ben Ban, Dirab, Al-Ha'er, Al-Thumama, Janadria Road, Muzahimiya Road, Al-Kharj and Khashm Al-Aan].

Table 1. List of scorpion species and subspecies collected and identified in Saudi Arabia.

	Species	Family	Region/Province
1	*Androctonus amoureuxi*	Buthidae	Al-Gunfuda
2	*Androctonus australis*	Buthidae	Al-Gunfuda, Aseer, Al-Medina
3	*Androctonus bicolor*	Buthidae	Aseer, Eastern R, Hail, Najran, Quassiem, Riyadh, Tabuk
4	*Androctonus crassicauda*	Buthidae	Al-Gunfuda, Aseer, Eastern R, Hafr Al-Batin, Hail, Jazan, Mecca, Al-Medina, Najran, Quassiem, Riyadh, Tabuk
5	*Apistobuthus pterygocercus*	Buthidae	Hail
6	*Buthacus leptochelys*	Buthidae	Aseer, Attaif, Eastern R, Hail, Jazan, Al-Medina, Quassiem, Riyadh
7	*Buthacus leptochelys nitzani?*	Buthidae	Al-Baha, Al-Gunfuda
8	*Buthacus yotvatensis nigroaculeatus*	Buthidae	Eastern R, Hafr Al-Batin, Riyadh
9	*Butheolus arabicus*	Buthidae	Jazan
10	*Butheolus gallagheri*	Buthidae	Jazan
11	*Butheolus thalassinus*	Buthidae	Jazan
12	*Compsobuthus arabicus*	Buthidae	Hafr Al-Batin, Hail, Al-Medina, Quassiem, Riyadh, Tabuk
13	*Compsobuthus arabicus arabicus?*	Buthidae	Riyadh
14	*Compsobuthus werneri*	Buthidae	Al-Baha, Aseer, Attaif, Hafr Al-Batin, Jazan, Al-Medina, Najran, Riyadh, Tabuk,
15	*Hottentotta jayakari*	Buthidae	Jazan
16	*Leiurus quinquestriatus*	Buthidae	Al-Baha, Al-Gunfuda, Aseer, Eastern R, Hail, Mecca, Al-Medina, Najran, Riyadh, Attaif, Jazan, Tabuk
17	*Orthochirus innesi*	Buthidae	Al-Baha, Aseer, Eastern R, Hail, Jazan, Al-Medina, Quassiem, Riyadh, Tabuk
18	*Orthochirus scrobiculosus*	Buthidae	Hail
19	*Parabuthus liosoma*	Buthidae	Al-Gunfuda, Aseer, Jazan
20	Unidentified	Buthidae	Eastern R
21	*Vachoniolus minipectinibus*	Buthidae	Al-Baha, Eastern R
22	*Vachoniolus spp?*	Buthidae	Eastern R
23	*Hemiscorpius arabicus*	Hemiscorpiidae	Riyadh
24	*Hemiscorpius lepturus?*	Hemiscorpiidae	Riyadh
25	*Nebo hierichonticus*	Scorpionidae	Al-Baha, Aseer, Attaif, Jazan, Al-Medina, Najran, Tabuk
26	*Scorpio maurus fuscus*	Scorpionidae	Al-Baha, Aseer, Attaif, Jazan, Najran,
27	*Scorpio maurus kruglovi*	Scorpionidae	Hafr Al-Batin, Hail, Al-Medina, Quassiem, Riyadh, Tabuk
28	*Scorpio maurus palmatus?*	Scorpionidae	Attaif, Hail, Tabuk

The Jazan region

The scorpions of Jazan (including the Forsan Isles) were identified as 12 species and subspecies (Figure 6). Three species were new records for the region (*Butheolus arabicus*, *Butheolus thalassinus* and *Butheolus gallagheri*). There were six black species (*Androctonus crassicauda*, *Nebo hierichonticus*, *Orthochirus innesi*, *Butheolus arabicus*, *Butheolus thalassinus* and *Butheolus gallagheri*), ranging in length from 2.1 (*Orthochirus*) to 13.5 cms (*Nebo*). *Nebo hierichonticus* (Scorpionidae) is implicated in serious outcomes including death (Annobil, 1993, Annobil *et al.*, 1991) even though its venom toxicity is not very high.

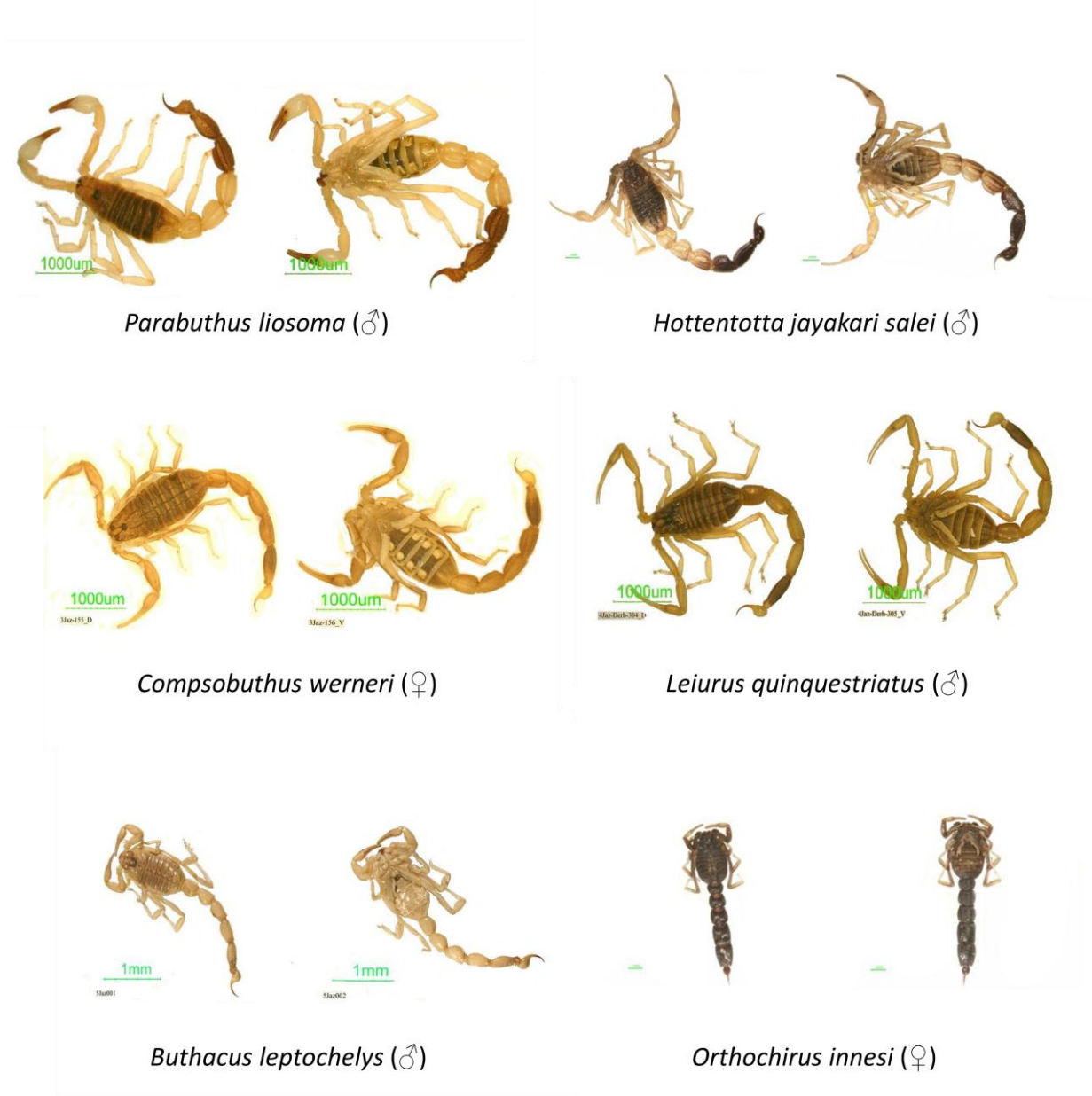
Buthidae Koch, 1837

Parabuthus Pocock, 1890 — *Parabuthus liosoma* H. and E., 1829

Hottentotta Birula, 1908 — *Hottentotta jayakari salei* Pocock, 1895

Compsobuthus Vachon, 1949	*Compsobuthus werneri* Birula, 1908
Leiurus H. and E., 1829	*Leiurus quinquestriatus* H. and E., 1828 and 1829
Buthacus Birula, 1908	*Buthacus leptochelys* Ehrenberg, 1829
Orthochirus Karsch, 1891	*Orthochirus innesi* Simon,1910
Butheolus Simon, 1882	*Butheolus arabicus* Simon, 1882
	Butheolus thalassinus Simon, 1882
	Butheolus gallagheri Vachon, 1980
Androctonus Ehrenberg, 1828	*Androctonus crassicauda* Olivier, 1807
Scorpionidae Pocock, 1893	
Nebo Simon, 1878	*Nebo hierichonticus* Simon, 1878
Scorpio Linnaeus, 1758	*Scorpio maurus fuscus* H. et E., 1829

Figure 6: The scorpion species collected from the Jazan region including the Forasan Isles.



Nebo hierichonticus (♂)

Butheolus arabicus (♂)

Butheolus thalassinus (♂)

Butheolus gallagheri (♂)

Scorpio maurus fuscus (♂)

Androctonus crassicauda (♀)

The Al-Medina Al-Munawara region

The scorpions of this region comprised nine species and subspecies (Figure 7): three of these are black, two large (*Androctonus crassicauda* at 9.9 cms, and *Androctonus bicolor* at 8.3 cms long) and one smaller (*Orthochirus innesi* at 2.5 – 3.3 cms long). All the other species are yellow.

Buthidae Koch, 1837

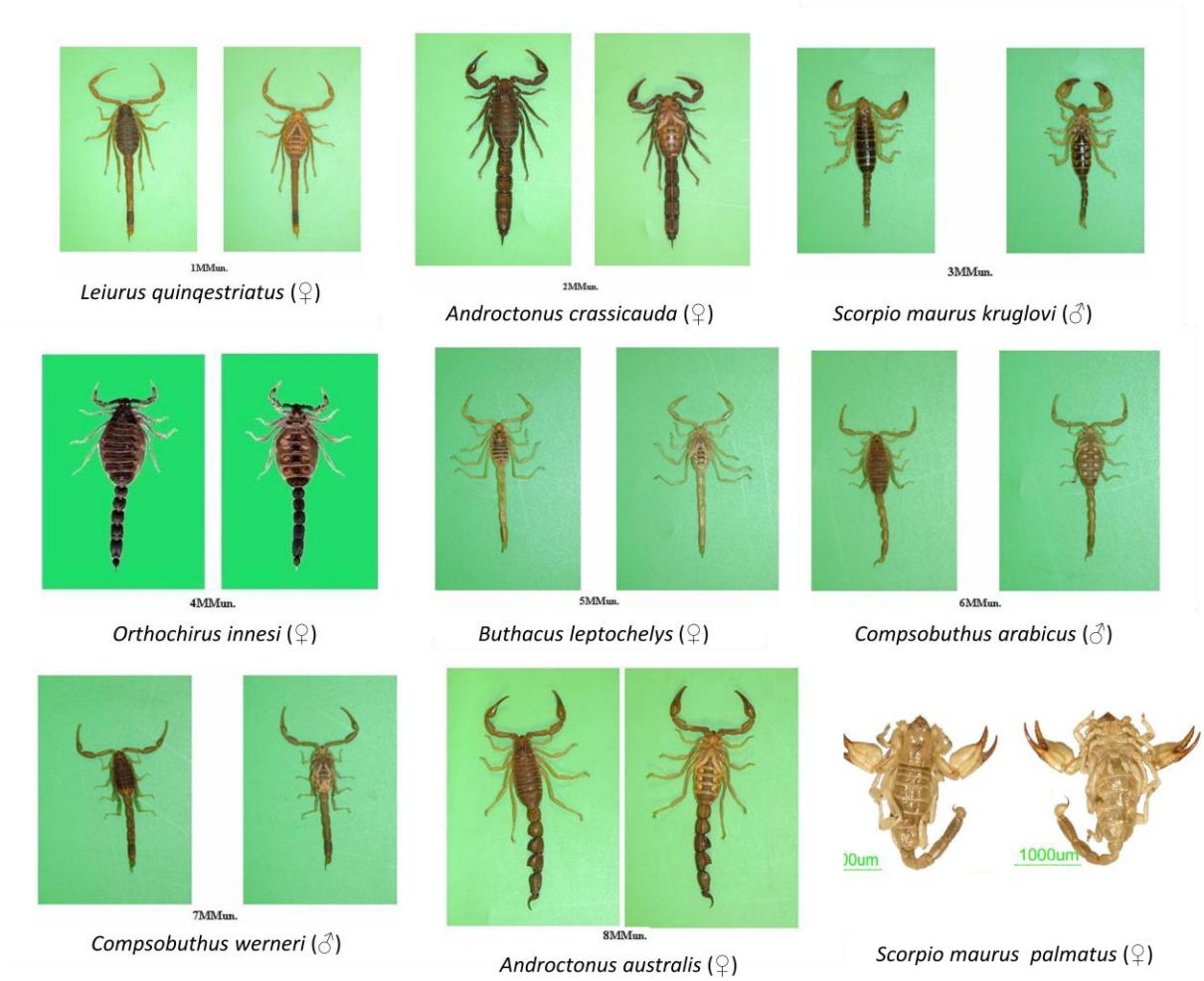
Leiurus H. and E., 1829	*Leiurus quinqestriatus* H. and E., 1828 and 1829
Androctonus Ehrenberg, 1828	*Androctonus crassicauda* Olivier, 1807
Orthochirus Karsch, 1891	*Orthochirus innesi* Simon, 1910
Buthacus Birula, 1908	*Buthacus leptochelys* Ehrenberg, 1829
Compsobuthus Vachon, 1949	*Compsobuthus arabicus* Levy *et al.*, 1973
	Compsobuthus werneri Birula, 1908
Androctonus Ehrenberg, 1828	*Androctonus australis* Linnaeus, 1758

Scorpionidae Pocock, 1893

Scorpio Linnaeus, 1758

Scorpio maurus kruglovi Birula, 1910
Scorpio maurus palmatus Ehrenberg, 1828

Figure 7: The scorpion species collected from the Al-Medina Al-Munawwara region.



Al-Baha Region

In this region there were seven species and subspecies (Figure 8), with only two black species, one large (*Nebo hierichonticus*, mean length 11.3 cm) and one small (*Orthochirus innesi*, 3.2 cm); all other species were yellow. *Nebo hierichonticus* along with hemiscorpiid scorpions lead to complications, intracranial haemorrhage and death (Arachnodata 2009a, 2009b; ITG Library 2009, Annobil 1993, Annobil *et al.* 1991, Navidpour *et al.* 2008). *Buthacus leptochelys nitzani* is reported from cooler places in Palestine, Jordan and Israel, and were found to inhabit similar habitat in Al-Baha and Al-Gunfuda (western Sarawat Ranges) in Saudi Arabia.

Buthidae Koch, 1837

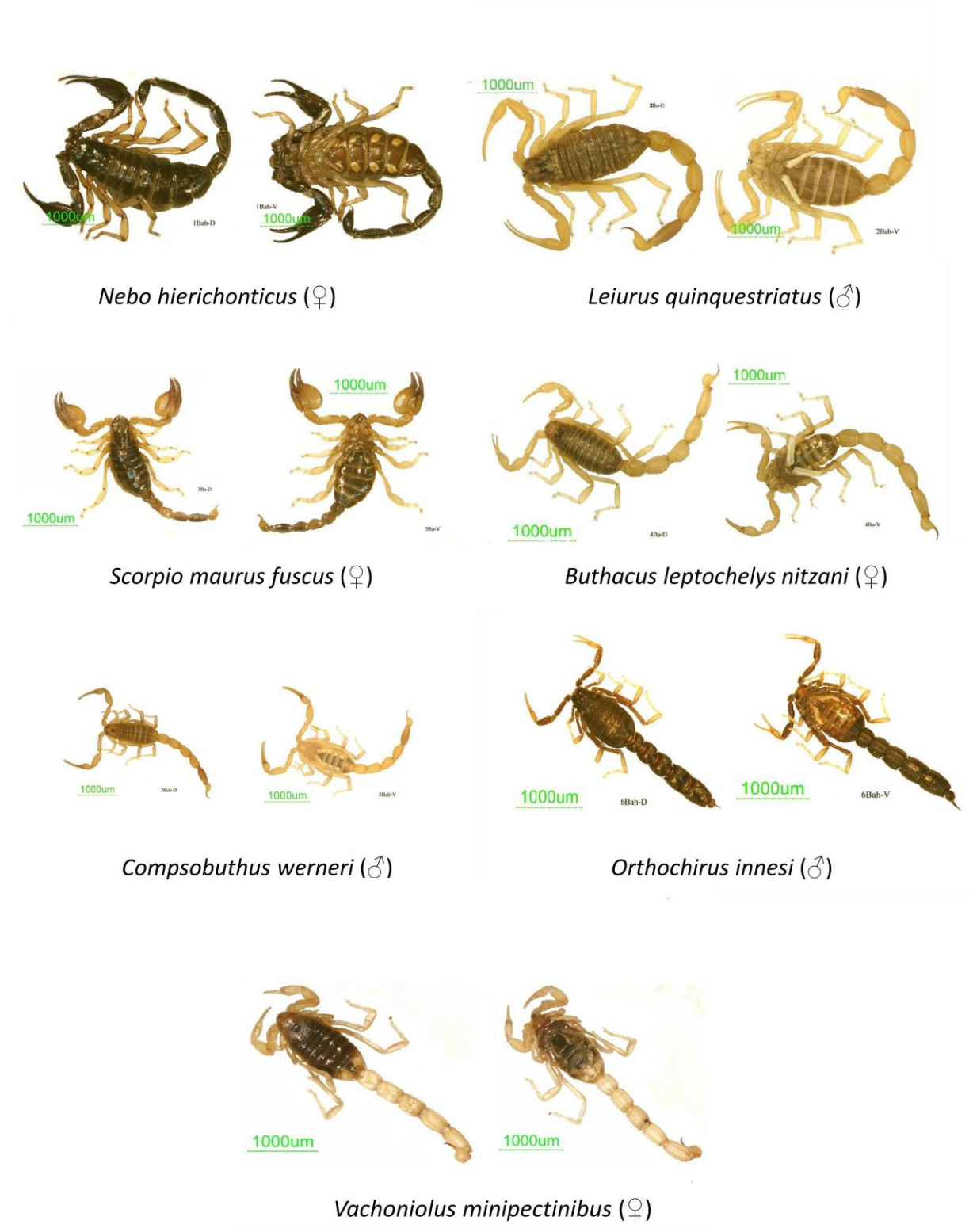
Leiurus H. and E., 1829
Buthacus Birula, 1908
Compsobuthus Vachon, 1949
Orthochirus Karsch, 1891
Vachoniolus Levy *et al.*, 1973

Leiurus quinquestriatus H. and E., 1828 and 1829
Buthacus leptochelys nitzani
Compsobuthus werneri Birula, 1908
Orthochirus innesi Simon,1910
Vachoniolus minipectinibus Levy *et al.*, 1973

Scorpionidae Pocock, 1893

Scorpio Linnaeus, 1758
Nebo Simon, 1878
Scorpio maurus fuscus H. et E., 1829
Nebo hierichonticus Simon, 1878

Figure 8: The scorpion species collected from Al-Baha Region.



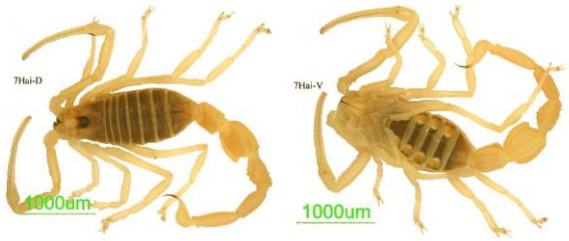
Hail Region

There were 10 species and subspecies in this region (Figure 9), including one new record, *Orthochirus scrobiculosus*. The subspecies *Orthochirus scrobiculosus persa* is found on the eastern side of the gulf (Iran), but we do not know yet whether the Hail specimens belong to this subspecies. Three were black species, two large (*Androctonus crassicauda* 8.5 cms and *Androctonus bicolor* 8.3 cms in length) and two smaller (*Orthochirus innesi* and *Orthochirus scrobiculosus* (both 2.8 – 3.0 cm long). All the other species are yellow.

Buthidae Koch, 1837	
Androctonus Ehrenberg, 1828	*Androctonus crassicauda* Olivier, 1807
	Androctonus bicolor Ehrenberg, 1828
Orthochirus Karsch, 1891	*Orthochirus innesi* Simon, 1910
Compsobuthus Vachon, 1949	*Compsobuthus arabicus* Levy *et al.*, 1973
Buthacus Birula, 1908	*Buthacus leptochelys* Ehrenberg, 1829
Leiurus H. and E., 1829	*Leiurus quinquestriatus* H. and E., 1828 and 1829
Apistobuthus Finnegan, 1932	*Apistobuthus pterygocercus* Finnegan, 1932
Orthochirus Karsch, 1891	*Orthochirus scrobiculosus* Grube, 1873
Scorpionidae Pocock, 1893	
Scorpio Linnaeus, 1758	*Scorpio maurus kruglovi* Birula, 1910
	Scorpio maurus palmatus Ehrenberg, 1828

Figure 9: The scorpion species collected from Hail region.

Leiurus quinquestriatus (♂)



Apistobuthus pterygocercus (♀)

Scorpio maurus palmatus (♂)

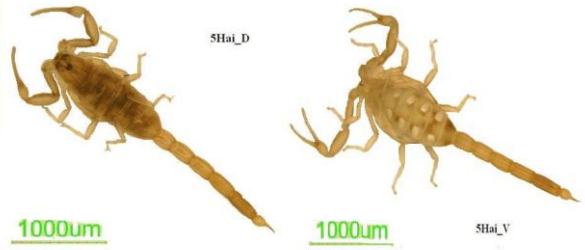
Scorpio maurus kruglovi (♀)

Androctonus crassicauda (♀)

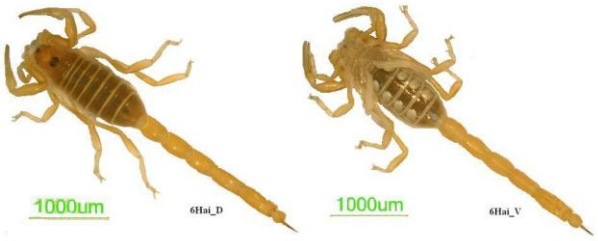
Androctonus bicolor (♂)

Orthochirus scrobiculosus (♀)

Orthochirus innesi (♀)



Compsobuthus arabicus (♂)



Buthacus leptochelys (♂)

Riyadh region

Twelve species and subspecies were recognised from the Riyadh region (Figure 10), including three black buthids (*Androctonus crassicauda* 9.5-11 cms long, *Androctonus bicolor* 7.4-8.6 cms and *Orthochirus innesi* 2.1-3.3 cms), two of which are medically important but the small *Orthochirus innesi* is not. All three families were represented, although the scorpionid *Scorpio maurus kruglovi* and the hemiscorpiid *Hemiscorpius arabicus* only occurred at very low densities; two species are as yet unidentified. The two *Androctonus* species and *Hemiscorpius arabicus* have not been recorded from elsewhere in Saudi Arabia. A third medically important species occurs, albeit at low densities, namely *Leiurus quinquestriatus*, famously dangerous worldwide, known as the "Death Stalker" or the lethal killer. All three species are highly venomous (Beaver, 1981, Dittrich *et al.*, 1995, Simard & Watt, 1990, Karatas & Colak, 2005) and hence their high medical importance.

One of the three hemiscorpiid specimens had stung a patient in the Riyadh region, who was then hospitalized in with a serious medical outcome. This specimen is still unconfirmed to species (*Hemiscorpius lepturus?*). More specimens, in good condition are required to accomplish full identification. Recent reports and personal contacts from the Adduraihmia

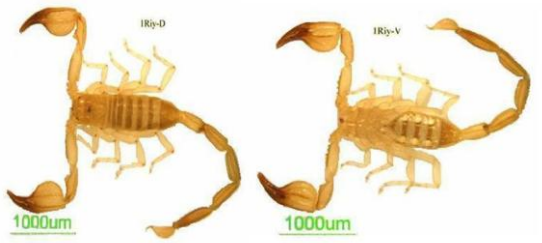
sector on the periphery of Riyadh City provide preliminary information about the existence of a population of this genus.

Hemiscorpius lepturus is only known from nearby on the eastern side of the Gulf, i.e. the southern provinces (especially Khuzestan) of Iran: it is well known for producing medical complications that include haemolysis, renal failure and coma with extensive damage to the skin and subcutaneous tissue (Arachnodata 2009a, 2009b; Navidpour *et al.* 2008, Halse *et al.* 1980). Verification and comparative work on these two species awaits further surveys.

Two buthids (*Compsobuthus werneri* and *Orthochirus innesi*) are rare, whilst three others are rather more frequent (*Compsobuthus arabicus*, *Buthacus yotvatensis nigroaculeatus* and *Buthacus leptochelys*). The toxicity of these less common species demands further clarification, though several investigators (Arachnodata 2009a, Karatas & Colak 2005, Koch 1977, Lamoral 1980, Levy & Amitai 1980, Karatas 2003, Kovarik 2005, Teruel & Tietz 2008) have described their toxicity elsewhere.

Buthidae Koch, 1837	
Leiurus H. and E., 1829	*Leiurus quinquestriatus* H. and E., 1828 and 1829
Compsobuthus Vachon, 1949	*Compsobuthus arabicus* Levy *et al.*, 1973
	Compsobuthus werneri Birula, 1908
	Compsobuthus arabicus arabicus Levy *et al.*, 1973
Androctonus Ehrenberg, 1828	*Androctonus crassicauda* Olivier, 1807
	Androctonus bicolor Ehrenberg, 1828
Buthacus Birula, 1908	*Buthacus yotvatensis nigroaculeatus* Levy *et al.*, 1973
Buthacus Birula, 1908	*Buthacus leptochelys* Ehrenberg, 1829
Orthochirus Karsch, 1891	*Orthochirus innesi* Simon,1910
Scorpionidae Pocock, 1893	
Scorpio Linnaeus, 1758	*Scorpio maurus kruglovi* Birula, 1910
Hemiscorpiidae Pocock, 1893	
Hemiscorpius Peters, 1861	*Hemiscorpius arabicus* Pocock, 1899
	Hemiscorpius lepturus? Peters, 1861

Figure 10: The scorpion species collected from the Riyadh region



Hemiscorpius arabicus (♀)

Leiurus quinquestriatus (♂)

Compsobuthus arabicus (♀)

Compsobuthus werneri (♂)

Androctonus crassicauda (♀)

Androctonus bicolor (♂)

Buthacus yotvatensis nigroaculeatus (♀)

Buthacus leptochelys (♂)

Orthochirus innesi (♀)

Scorpio maurus kruglovi (♂)

Some specimens, such as *Compsobuthus arabicus arabicus?* (Riyadh region), *Hemiscorpius lepturus?* and *Vachoniolus* spp?, could not be identified to species and subspecies due to their damage, and new specimens will be necessary to confirm their identity.

Scorpion venom glands

We studied the venom glad morphology of some of the scorpions that were collected (cf. Al-Asmari *et al.* 2007, 2009a). Venom glands have been studied extensively (Pavlovsky 1912, Lourenco 1985, Polis 1990, Taib & Jarrar 1993, Jarrar & Al-Rowaily 2008, Yigit & Benli 2008) for their histology, histochemistry and characters for higher-level taxonomy (Keegan & Lockwood 1971, Mazurkiewicz & Bertke 1972, Halse *et al.* 1980, Kanwar *et al.* 1981, Cebesoy & Ayvali 2003). Venom profiles have been studied for their physicochemical and biological characteristics, especially in their effects on ion channels (Gantenbein *et al.* 1999, Kovarik 2005), and recent work has involved Saudi Arabian scorpions (Al-Asmari *et al*., in press). Scorpion venom components are known to be active and effective as antimicrobials (Zamudio *et al.* 1997, Possani *et al.* 1999, Torres-Larios *et al.* 2000, Zeng *et al.* 2001, 2004; Moerman *et al.* 2002).

Figure 11 illustrates the structure of scorpion venom glands from specimens collected from the Al-Baha region. The cross section of the *Compsobuthus werneri* telsa (Buthidae) reflects complexly folded glands, while those of *Scorpio maurus fuscus* and *Nebo hierichonticus* (Scorpionidae) show no or only simple folding, but the cuticle of *Nebo* is very thick. The telsa section of *Leiurus quinqestriatus* (Buthidae) showed very distinct complexly folded glands.

Figure 11: Cross sections of the telsa (venom glands) of scorpions collected from Al-Baha.

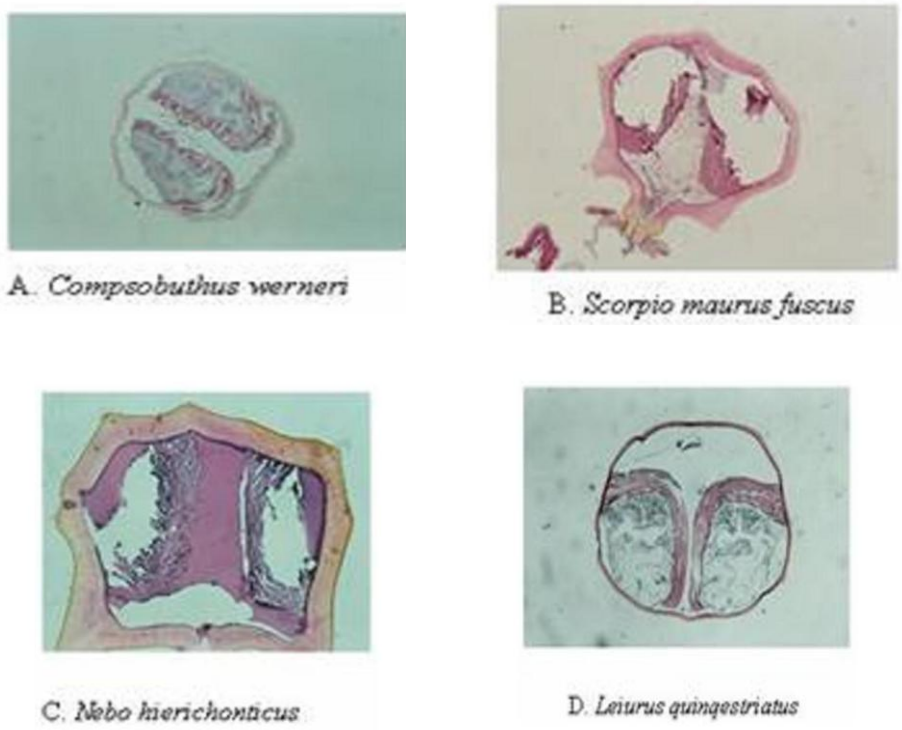


Figure 12 shows the structure of scorpion venom glands from specimens collected from Hail. The cross sections of *Buthacus leptochelys* and *Compsobuthus werneri* (Buthidae) again reflect complexly folded glands, whilst that of *Scorpio maurus kruglovi* (Scorpionidae) showed no or only simple folding. Sections of *Leiurus quinqestriatus* (Buthidae) showed very distinct complexly folded glands similar to those of the buthid species *Androctonus crassicauda* and *Androctonus bicolor*.

Figure 12: Cross sections of the telsa (venom glands) of scorpions collected from Hail region.

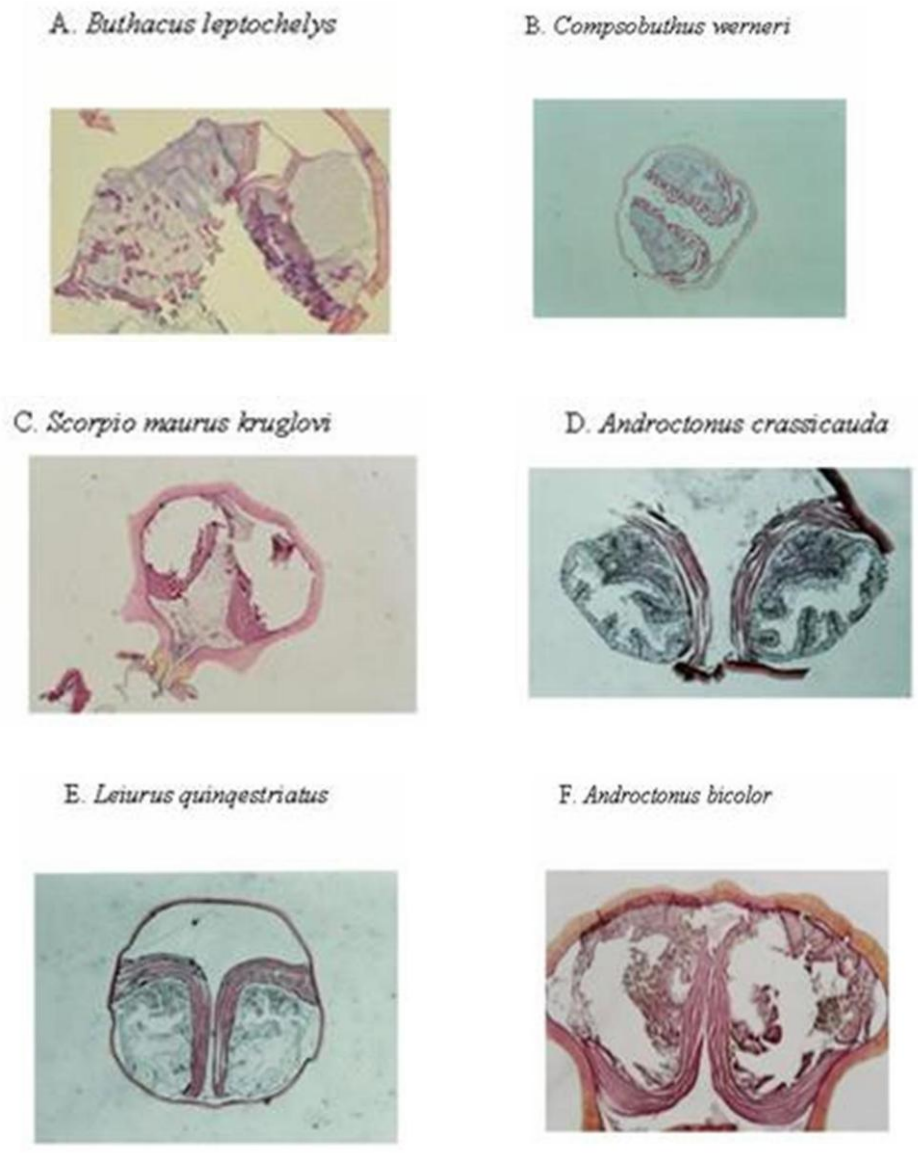
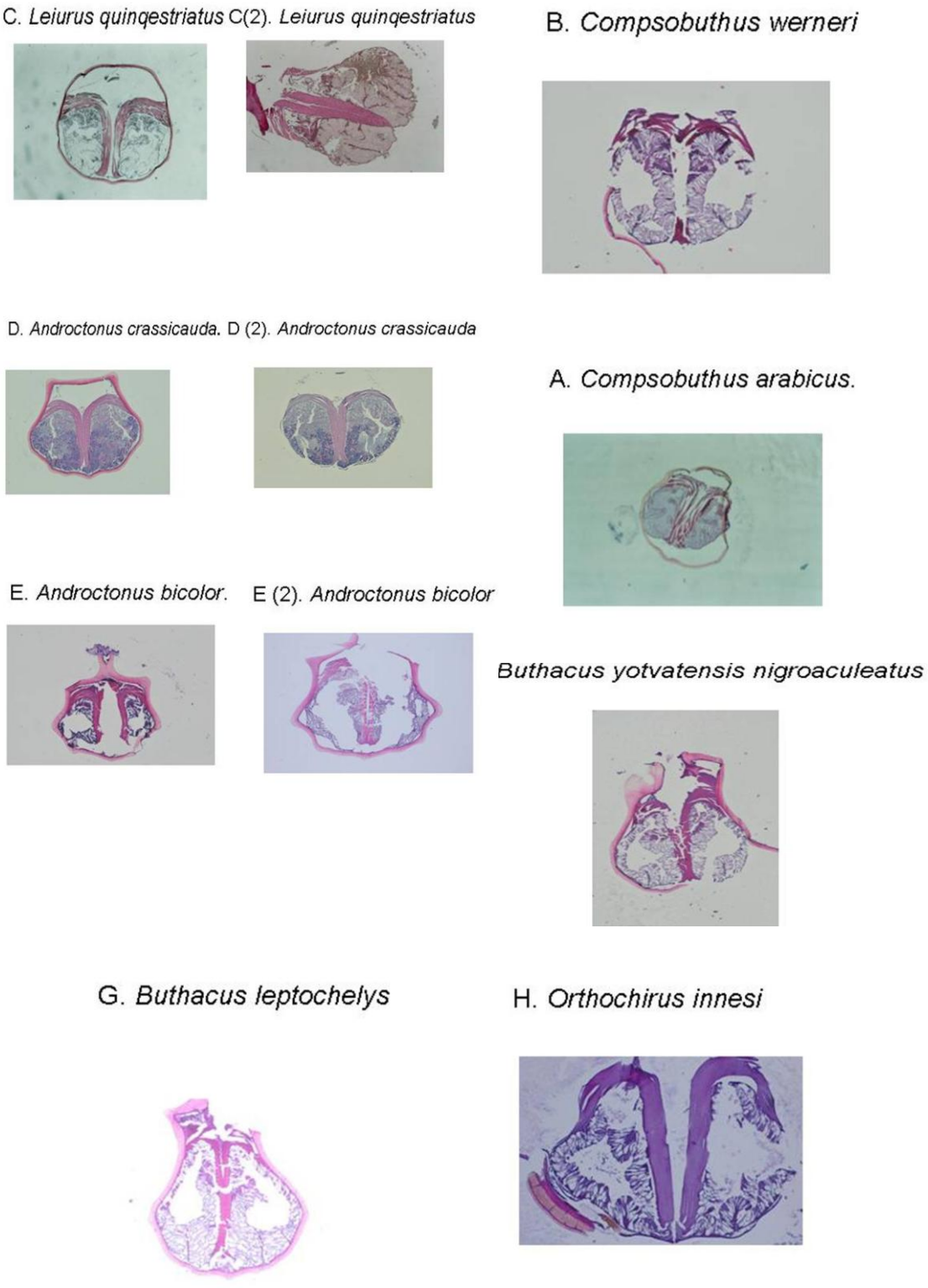


Figure 13 shows the structure of scorpion venom glands from specimens collected from the Riyadh region. The cross sections of the buthids *Compsobuthus arabicus, Compsobuthus werneri, Leiurus quinqestriatus, Androctonus crassicauda, Androctonus bicolor, Buthacus yotvatensis nigroaculeatus, Buthacus leptochelys* and *Orthochirus innesi* all reflect complexly folded glands. Those of *Leiurus quinqestriatus, Androctonus crassicauda* and *Androctonus*

bicolor showed very distinct and densely folded glands. The section of the scorpionid *Scorpio maurus kruglovi* showed no or only simple folding, with very thick cuticle.

Figure 13: Cross sections of the telsa (venom glands) of scorpions collected from the Riyadh region.



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الملخص العربى

دراسة مجموعة العقارب بالمملكة العربية السعودية

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- XI ، إدارة الصيدلية ، كلية العلوم الصحية ، جامعة الملك سعود.

الخلاصة :

تم إجراء دراسة شاملة للعقارب بمناطق المملكة الرئيسية شملت جازان، المدينة، الباحة، حائل ، والرياض بالاضافة إلى إجراء دراسة مسحية لعدد تسعة من المحافظات بالمملكة .

أظهرت العينات البالغ عددها (1440) عينة تم جمعها من منطقة جازن وجود 10 أنواع من العقارب من فصيلة BUTHIDAE ونوعين رئيسيين وفرعيين من SCORPIONIDAE ، فيما أظهرت العينات البالغ عددها (867) عينة تم جمعها من منطقة المدينة المنورة أظهرت وجود سبعة فصائل من العقارب من فصيلة BUTHIDAE ونوعين رئيسيين وفرعيين من أنواع SCORPIONIDAE وتبين بأن أحد الأنواع الفرعية من فصيلة SCORPIONIDAE وهو عقرب الحجور(سكوربيو) *SCORPIO MAURUS PLAMATUS* بحاجة إلى المزيد من التأكيد على وجوده من عدمه .

مثلت العينات البالغ عددها (2421) عينة تم جمعها من منطقة الباحة مثلت خمسة أنواع من العقارب من فصيلة BUTHIDAE ونوعين رئيسيين وفرعيين من SCORPIONIDAE , فيما مثلت العينات البالغ عددها (1921) والتي تم جمعها من منطقة حائل مثلت ثمانية أنواع من العقارب من فصيلة BUTHIDAE ونوعين رئيسيين وفرعيين من SCORPIONIDAE .

كما أظهرت الدراسة إلى أن أكثر أنواع العقارب الفرعية شيوعا بهذه المنطقة هي العقرب الجزار *SCORPIO MAURUS KRUGLOVI* والعقرب الحجور(سكوربيو) *SCORPIO MAURUS PALMATUS* (ويساورنا الشك في وجوده بهذه المنطقة) وكلا النوعين ينتميان إلى عائلة SCORPIONIDAE .

أشارت الدراسة إلى أن كلا من العقارب السوداء *ANDROCTONUS CRASSICAUDA* والعقارب البنية *LEIURUS QUINQUESTRIATUS* تستوطن منطقتي حائل والباحة بالاضافة إلى انه تم مؤخرا تسجيل وجود العقارب نوع *ANDROCTONUS BICOLOR* بمنطقتي حائل والرياض .

أظهرت العينات البالغ عددها (4164) عينة تم جمعها من منطقة الرياض أظهرت وجود تسعة أنواع من العقارب من فصيلة BUTHIDAE ونوع واحد من SCORPIONIDAE ونوعين إثنين على الاقل من العقارب نوع *HEMISCORPIUS* ونوعين فرعيين كذلك .

لم تذكر أيا من الدراسات الميدانية التي أجريت سابقا بأن هذا العدد من أنواع العقارب موجود فعليا بالمملكة العربية السعودية.

لقد أتضح بأن مملكة العقارب السعودية تشمل العقارب من عائلات BUTHIDAE ,HEMISCORPIIDAE ,SCORPIONIDAE . .

هناك على الاقل 28 نوعا رئيسيا وفرعيا من الانواع تنتمي إلى عائلات العقارب المذكورة أعلاه.

الكلمات الدليلية :

أنواع العقارب، مناطق المملكة العربية السعودية ، العقارب من فصيلة BUTHIDAE ، SCORPIONIDAE . DIPLOCENTRIDAE.