Zoology in the Middle East
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tzme20

Records of scorpions from the Palestinian Territories, with the first chromosomal data (Arachnida: Scorpiones)

Mazin B. Qumsiyeh [a], Ibrahim N.A. Salman [a], Michael Salsaa' [a] & Zuhair S. Amr [b]

[a] Faculty of Science, Bethlehem University, and Palestine Museum of Natural History, Bethlehem, Palestine

[b] Department of Biology, Jordan University of Science and Technology, Irbid, Jordan

Published online: 14 May 2013.

To cite this article: Mazin B. Qumsiyeh, Ibrahim N.A. Salman, Michael Salsaa' & Zuhair S. Amr (2013): Records of scorpions from the Palestinian Territories, with the first chromosomal data (Arachnida: Scorpiones), Zoology in the Middle East, 59:1, 70-76

To link to this article: http://dx.doi.org/10.1080/09397140.2013.795070

Zoology in the Middle East, 2013
Vol. 59, No. 1, 70–76, http://dx.doi.org/10.1080/09397140.2013.795070

Records of scorpions from the Palestinian Territories, with the first chromosomal data (Arachnida: Scorpiones)

Mazin B. Qumsiyeh[1*], Ibrahim N. A. Salman[1], Michael Salsaa'[1], Zuhair S. Amr[2]

[1]*Faculty of Science, Bethlehem University, and Palestine Museum of Natural History, Bethlehem, Palestine.* [2]*Department of Biology, Jordan University of Science and Technology, Irbid, Jordan*

Seven species were collected from several habitats in the West Bank, namely *Leiurus quinquestriatus*, *Androctonus crassicauda*, *Compsobuthus werneri*, *Orthochirus scrobiculosus*, *Hottentotta judaicus*, *Nebo hierichonticus*, and *Scorpio maurus*. Karyotypic data on *Leiurus quinquestriatus* (2n=22), *Hottentotta judaicus* (2n=16), and *Scorpio maurus fuscus* (2n=52) are reported here for the first time.

Keywords: Scorpions, Arachnida, Palestinian Territories, karyotype.

Introduction

The order Scorpiones is a fascinating group of arthropods with over 2000 described species. Its taxonomy continues to undergo revision and new species are described as new data accumulate from morphology, cytogenetics, and DNA. In the Levantine countries, some initial faunal work on scorpions was done by Vachon (1966, 1974), Levy, Amitai, and Shulov (1970, 1973), Levy and Amitai (1980), followed by studies by Amr & Al-Oran (1994), Lourenço (1999, 2002), Kabakibi, Khalil, and Amr (1999), Lourenço, Modrý, and Amr (2002), Stathi and Lourenço (2003).

A recent review showed that the karyotypes of only some 60 out of the over 2000 known species of scorpions have been studied (Schneider, Zacaro, Pinto-da-Rocha, Candido, & Cella, 2009). The only study on scorpion chromosomes in the Middle East was done in Egypt on some members of the genus *Androctonus* (Moustafa, Alaa, Sarhan, & Yaseen, 2005).

Our study focused on the West Bank (Bethlehem, Hebron, Nablus, and Ramallah districts, and the Jordan valley) and includes the first findings on the chromosomes of three species.

Material and methods

Scorpions were collected during the day, by turning over pebbles and other objects under which they hide, and at night, by walking and scanning the ground with ultraviolet flash lights. All specimens are deposited in the recently created Palestine Natural History Museum (PMNH), Bethlehem, Palestinian Territories.

Material has been collected from the following localities: Artas: 31°69'N, 35°19'E; – Al-Auja: 31°95'N, 35°46'E; – Beit Ommar: 31°62'N, 35°10'E; – Beit Jala: 31°72'N, 35°19'E; – Beit Sahour: 31°70'N, 35°22'E; – Bil'in: 31°93'N, 35°07'E; – Dar Salah near Ubaidiya: 31°72'N, 35°27'E; – Fasayil, Jordan Valley: 32°04'N, 35°44'E; – Jabal Al Masateeh, near Bil'in: 31°93'N, 35°08'E; – Jebel Kafr Neemah, near Deir Ibzia: 31°93'N, 35°10'E; – Nasrya: 32°24'N, 35°40'E.– Susya: 31°39'N, 35°12'E; – Wadi Fukeen: 31°71'N, 35°10'E; – Za'atra: 31°67'N, 35°26'E;

*Corresponding author. Email: mazin@qumsiyeh.org

Karyotyping of scorpion species was done from gonadal tissues dissected in saline solution by the method described by Schneider et al. (2009). We found that the success rate is variable and depends on the seasonality of reproduction in these scorpions (see notes in results and discussion).

Results

Family Buthidae C. L. Koch, 1837

Leiurus quinquestriatus (Ehrenberg, 1828)

Material: Bethlehem District: Za'tra (PMNH1387, ♀, 11.xi.2010; PMNH1390, ♂, 13.xi.2010; PMNH1392, ♀, 13.xi.2010; PMNH1393, ♀, 13.xi.2010; PMNH1405, ♀, 22.xi.2010; PMNH1450, 8.iii.2011, PMNH1451 8.iii.2011, PMNH1479, 18.viii.2011, PMNH1573, ♀, 21.vi.2012); Dar Salah, (PMNH1411, ♀, 1.xii.2010; Auja (PMNH1567, ♂, 10.xii.2010; PMNH1421, ♀, 23.i.2011; PMNH1423, ♀, 23.i.2011; – Hebron District: Susiya, (PMNH1536, ♀, 6.15.2012; PMNH1537, ♀ with 20 embryos, 15.vi.12012; PMNH1538, ♂, 15.vi.2012; PMNH1540, ♂, 15.vi.2012; PMNH1541, ♂, 15.vi.2012; – Nablus District: Nasrya, (PMNH1546, ♀, 21.vi.2012; PMNH1547, ♂, 21.vi.2012; PMNH1548, ♀, 21.vi.2012; PMNH1550, ♀, 21.vi.2012;, PMNH1551, ♂, 21.vi.2012; PMNH1552, ♂, 21.vi.2012; PMNH1553, ♂, 21.vi.2012; Jordan Valley: Wadi Fasayil, (PMNH1561 22.vi.2012 ♂, PMNH1563 22.vi.2012 ♂, PMNH1564 ♂, 22.vi.2012; PMNH1565, ♂, 22.vi.2012; PMNH1566, ♂, 22.vi.2012).

This is the most common species in the West Bank. 31 specimens of the 70 scorpions collected by us (43%) belong to this species. It was a ubiquitous species found mostly in rocky arid regions (not noted in the forested or Mediterranean climate area). The scorpions were very abundant in some areas. For example, in the hills near Wadi Fasayil in the Jordan valley we found scorpions on average about one in every 2 square metres. Females with 15-20 developed embryos were collected during May and June. The number of pectinal teeth ranged between 31 and 38 (average 34) in males (n=10) and 23 and 35 (average 30) in females (n=14).

Androctonus crassicauda (Olivier, 1807)

Material: Jordan Valley: Al Auja (PMNH1404, ♀, 16.xi.2010).

There are many previous records of this species from arid areas in the Palestinian Territories and nearby countries (Levy & Amitai, 1980, Amr & El-Oran, 1994). A total of 25 pectinal teeth was counted in this female, which was collected in less rocky terrain in the Jordan valley (arid region near an oasis).

Compsobuthus werneri (Birula, 1908)

Material: Bethlehem District: Za'tara (PMNH1402, ♂, 13.xi.2010); Beit Sahour, (PMNH1403, ♀, 13.xi.2010; PMNH1424, ♀, 23.i.2011; PMNH1570, ♀ with 8 embryos, 21.vi.2012).

This species was only found in the Bethlehem District in our collection. One female collected in June had eight embryos. The number of pectinal teeth was 11-11 and 18-18 in two females and 18-18 in a male.

Orthochirus scrobiculosus (Grube, 1873)

Material: Jordan Valley: Al-Auja (PMNH1420, ♀, 27.xii.2010; PMNH1422, ♀, 29.xii.2010); Wadi Fasayil (PMNH1558, ♀ with 12 embryos, 22.vi.2012; PMNH1562, ♀, 22.vi.2012; PMNH1569, ♂, 22.vi.2012).

These two new localities represent the northernmost record for the species (see Levy & Amitai, 1980; Amr & El-Oran, 1994). The pectinal teeth in two females were 14-14 and

15-15. The species was collected from hammada desert habitats with loose reddish soil along the main highway in the Jordan Valley. One female was found with 12 embryos. This species is associated with arid habitats.

Hottentotta judaicus (Simon, 1872)

Material: Bethlehem District: Beit Sahour (PMNH1574, ♀, 21.vi.2012; PMNH1575, ♀, 21.vi.2012; PMNH1576, ♂, 21.vi.2012; PMNH1386 ♂, 11.x.2010; PMNH1388, ♀, 13.xi.2010; PMNH1389, ♀, 13.xi.2010; PMNH1391, ♀, 13.xi.2010; PMNH1449, ♀, 1.viii.2011); Beit Jala (PMNH1476, ♂, 15.viii. 2011; PMNH1480, 22.viii.2011; PMNH1498, 20.xii.2011; PMNH1499, ♀, 9.i.2012; PMNH1555, ♂, 21.vi.2012); Wadi Fukeen (PMNH1462, ♂, 8.vi.2011; PMNH1472, ♀, 8.xii.2011; PMNH1504, ♀, 25.v.2012; PMNH1513, ♀, 25.v.2012); – Hebron District: Beit Ommar (PMNH1539, ♀ with 16 embryos, 15.vi.2012).

This is a strictly Mediterranean species known from forested areas as well as open habitats dominated by *terra rossa* soil. We also found it in cultivated fields (olives, almonds, figs). Kovařík (2007) revised the genus and described several new species. We have collected this species in the Bethlehem district from several localities. The range of the pectinal teeth number is 25 to 30 (average 27.6) in males (N=5) and 23-30 (average 28.1) in females (N=9).

Family Diplocentridae Karsch, 1880

Nebo hierichonticus (Simon, 1872)

Material: Bethlehem District: Wadi Fukeen (PMNH1503, ♀ 25.v.2012); – Ramallah District: Jebel Kafr Ne'mah (PMNH1527, ♀, 30.v.2012).

The type specimen described by Simon (1872) was from the Jordan Valley. A revision of the genus *Nebo* was made by Francke (1980), who recognised six species including three new species. Pectinal counts on our two female specimens showed 13-13 and 15-15 teeth.

Family Scorpionidae Latreille, 1802

Scorpio maurus fuscus (Ehrenberg, 1829)

Material: Bethlehem District: Wadi Fukeen (PMNH1461, ♂, 18.ix.2011; PMNH1489, ♂, 18.ix.2011); Ertas, (PMNH1543, ♂, 17.vi.2012); – Ramallah District: Bil'in (PMNH1477, ♂, 16.viii.2011); Jabal-Al-Masateh, near Deir Ibzi' (PMNH1520, ♀ with over 12 embryos, 30.v.2012; PMNH1528, ♀ with several embryos, 30.v.2012); – Jordan Valley: Wadi Fasayil (PMNH1559, ♀ with 15 well developed embryos, 22.vi.2012).

Species of the genus *Scorpio* are widespread from Morocco to Iran and from Turkey to Yemen (Hendrixson, 2006). The one species in Palestine has two colour forms described as two different subspecies: *S. maurus fuscus* and *S. m. palmatus* (Ehrenberg, 1828), which show differences in the length of the genital operculum in the female, other minor morphological differences, and a striking difference in coloration. The number of pectinal teeth was 10 to14 in males (N=3) and 8-8, 9-9, and 10-10 in females (N=3). Females with 12-15 embryos were found during May and June.

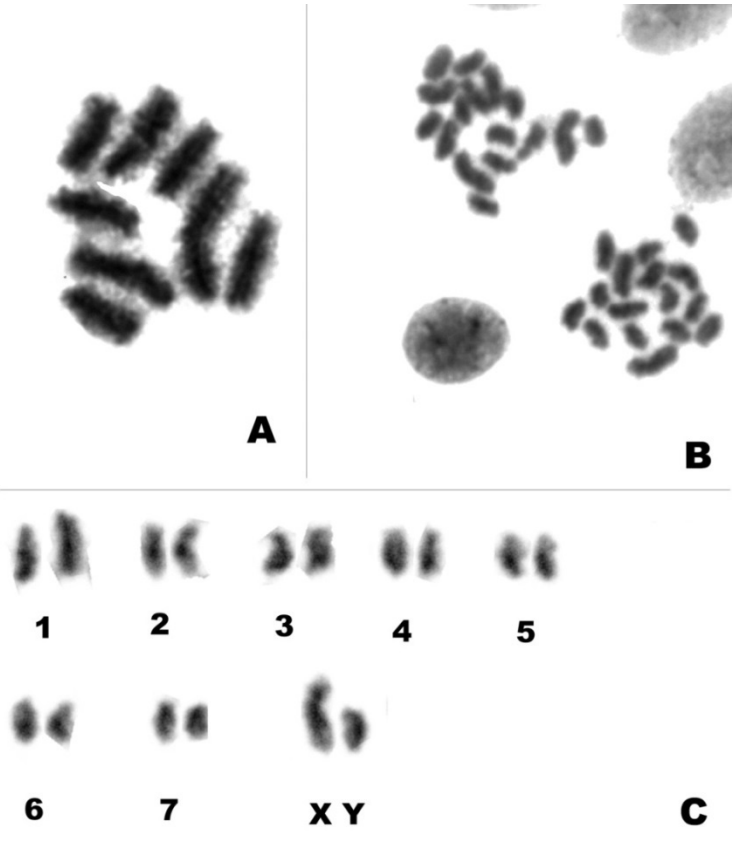

Figure 1. Cytogenetics in *Hottentotta judaicus*. A. Diplotene with 8 homologues. B. A slide field with two metaphases each with 2n=16. C. Metaphase karyotype.

Chromosomal study results

We report here the first karyotypes of *Hottentotta judaicus* to have 2n=16 chromosomes, confirmed by diplotene (8 homologues) in 6 specimens from different locations (specimens PMNH1386, 1411, 1462, 1476, 1480 and 1513; Figure 1). There were three pairs of metacentrics and the other chromosomes were acrocentric. Karyotypes from both males and females of *Leiurus quinquestriatus* show a diploid number of 22 confirmed with diplotene findings of 11 pairs (Figure 1). We could not definitely distinguish the X and Y chromosomes in males but they are probably pair 1 in Figure 2. Our chromosomal data on *Scorpio maurus fuscus* are based on one male from from Ertas near Bethlehem. The diploid number was 52 from five metaphases although the quality did not allow us to distinguish X and Y chromosomes (Figure 3).

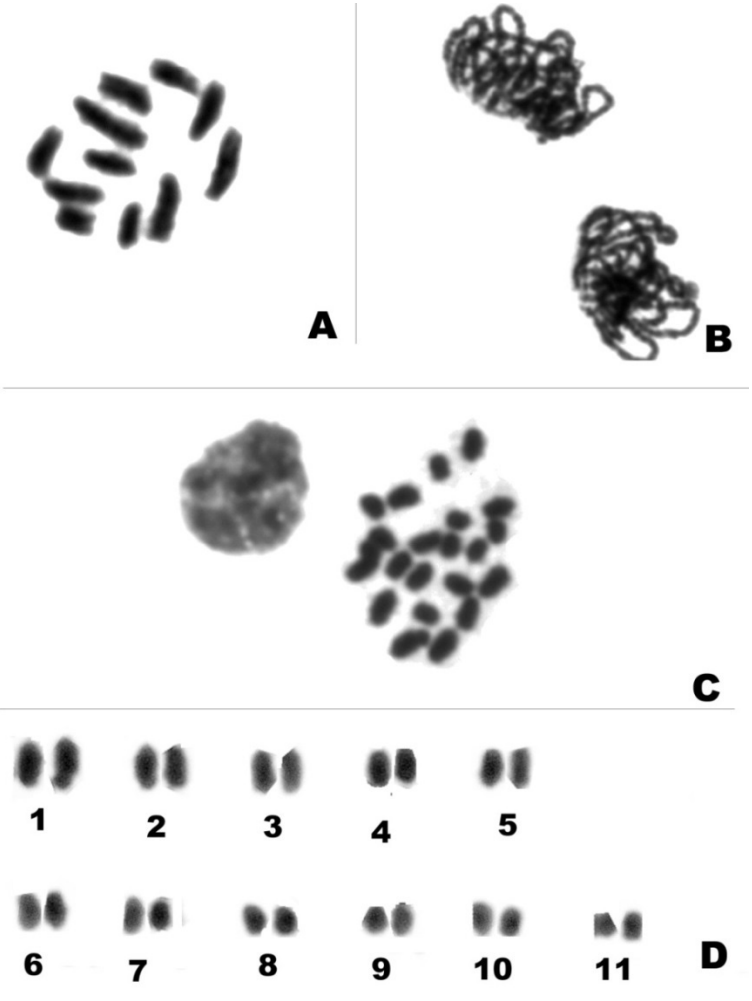

Fig. 2. Cytogenetics in a male *Leiurus quinquestriatus*. A. Meiotic diplotene. B. Pachytene. C. Mitotic metaphase. D. Karyotype from metaphase.

Discussion

Variation in the chromosomal number within scorpions is very large compared to other arachnids. Chromosomal numbers have been reported from as low as 2n=5 to as high as 2n=175 (Schneider et al., 2009). However, care must be taken when gonadal tissues are used to identify metaphases of meiosis and they must be distinguished from the diplotene of meiosis, a confusion that probably explains the odd number of chromosomes reported in some papers. Most species of the family Buthidae exhibit a predominance of Mattos, Cella, Candido, Carvalho, and Schneider (2012) studied the karyotype of 11 species of Buthidae in Brazil with diploid numbers ranging from 6 to 28. In other low diploid numbers (2n=24) and holocentric chromosomes (Soleglad & Fet, 2003).

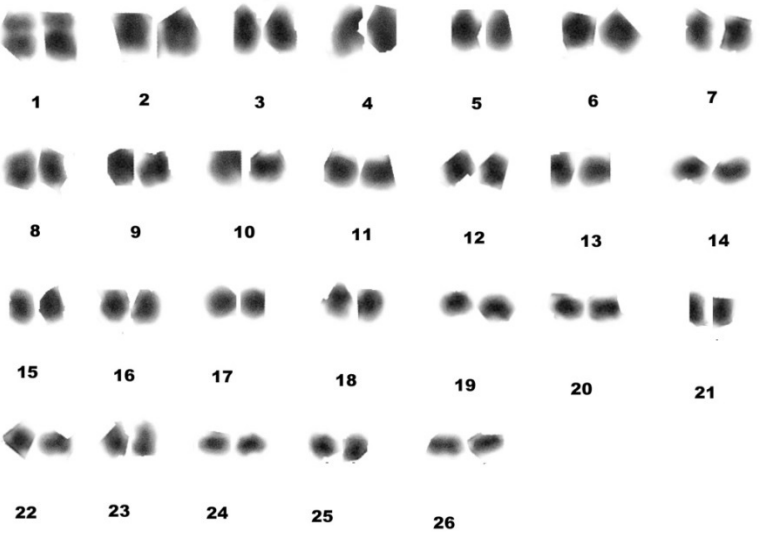

Fig. 3. Metaphase of male *Scorpio maurus fuscus* from Ertas.

families such as the Bothriuridae, species of the genus *Brachistosternus* showed a diploid number of 42 to 46 (Rodríguez-Gil, Ojanguren-Affilastro, Barral, Scioscia, & Mola, 2009).

The karyotypes reported here for three species of scorpions are the first in the Eastern Mediterranean region and the first reports on these three species. In Iran, the karyotype for *Odontobuthus* species was 2n=22 and in *Buthacus* sp. 2n=14 (Khazzab & Farzanpei 1998). Moustafa et al. (2005) studied the karyotypes of four species of the genus *Androctonus* in Egypt (*A. australis, A. bicolor, A. amoreuxi* and *A. crassicauda*), and all these species exhibited the same diploid chromosome number of 2n=24.

The African *Hottentotta trilineatus* was reported to have a 2n=24 (Newlands & Martindale, 1980), compared to 2n=16 for *H. judaicus* in the present study. We obtained a diploid number of 52 for *Scorpio maurus fuscus.* The high diploid number in Scorpionidae compared to Buthidae was already noted by Schneider et al. (2009).

The taxonomy of scorpions is still undergoing significant revision (Soleglad & Fet, 2003) and in our region new species are being described based on morphology (Lourenço et al., 2002, 2010). Further studies on the karyotypes of Middle Eastern scorpions could help address phylogenetic relationships among extant species and resolve some systematic questions including the possible identification of new species.

References

Amr, Z. S., & Al-Oran, R. (1994). Systematics and distribution of scorpions (Arachnida, Scorpionida) in Jordan. *Bollettino di Zoologia, 61,* 185–190.

Francke, O. F. (1980). Revision of the genus *Nebo* Simon (Scorpiones: Diplocentridae). *Journal of Arachnology, 8,* 35–52.

Hendrixson, B. E. (2006). Buthid scorpions of Saudi Arabia, with notes on other families (Scorpiones: Buthidae, Liochelidae, Scorpionidae). *Fauna of Arabia, 21,* 33–120.

Kabakibi, M. M., Khalil, N., & Amr, Z. (1999). Scorpions of Southern Syria. *Zoology in the Middle East, 17,* 79–89.

Khazzab, M., & Farzanpei, R. (1998). *A study to establish the Iranian scorpion karyotype as a new method for their accurate classification* [in Farsi] (Unpublished Report). Tehran: Agricultural Scientific Information and Documentation Centre, Agricultural Research and Education Organization.

Kovařík, F. (2007). A revision of the genus *Hottentotta* Birula, 1908, with descriptions of four new species (Scorpiones, Buthidae). *Euscorpius, 58,* 1–107.

Levy G., & Amitai, P. (1980). *Fauna Palaestina. Arachnida I: Scorpiones.* Jerusalem: The Israel Academy of Science and Humanities.

Levy G., Amitai, P., & Shulov, A. (1970). *Leiurus quinquestriatus hebraeus* (Birula, 1908) (Scorpiones: Buthidae) and its systematic position. *Israel Journal of Zoology, 19,* 231–242.

Levy G., Amitai, P., & Shulov, A. (1973). New scorpions from Israel, Jordan and Arabia. *Zoological Journal of the Linnean Society, 52,* 113–140.

Lourenço, W. R. (1999). On the phylogenetic position of the genus *Birulatus* Vachon, 1973 (Scorpiones, Buthidae) and redescription of *Birulatus haasi*. *Zoology in the Middle East, 18,* 107–111.

Lourenço, W. R. (2002). Further morphological considerations on the genus *Birulatus* Vachon (Scorpiones, Buthidae), with the description of a new species from Israel. *Revista Iberica de Aracnologia, 6,* 141–145.

Lourenço W. R., Modrý, D., & Amr, Z. (2002). Description of a new species of *Leiurus* Ehrenberg, 1828 (Scorpiones, Buthidae) from the South of Jordan. *Revue Suisse de Zoologie, 109,* 635–642.

Lourenço, W. R., Yağmur, E. A., & Duhem, B. (2010). A new species of *Buthus* Leach, 1815 from Jordan (Scorpiones: Buthidae). *Zoology in the Middle East, 49,* 95–99.

Mattos, V. F., Cella, D. M., Candido, D. M., Carvalho, L. S., & Schneider, M. C. (2012). High chromosome variability and presence of multivalent associations in buthid scorpions. *Resumos de II Epacito-Encontro Paulista di Citogenetica, 22 a 24 de abril de 2012, Ribeirão Preto, SP, Brasil.*

Moustafa, M. A., Alaa, A. M., Sarhan, M. H., & Yaseen, A. E. (2005). Chromosomal studies on four Egyptian scorpion species of genus *Androctonus* (Family: Buthidae). *Cytologia, 70,* 161–165.

Newlands, G., & Martindale, C. B. (1980). The buthid scorpion fauna of Zimbabwe-Rhodesia with checklists and keys to the genera and species, distributions and medical importance (Arachnida: Scorpiones). *Zeitschrift für angewandte Zoologie, 67,* 51–77.

Rodríguez-Gil, S. G., Ojanguren-Affilastro, A. A., Barral, L. M., Scioscia, C. L., & Mola, L. M. (2009). Cytogenetics of three species of scorpions of the genus *Brachistosternus* from Argentina (Scorpiones: Bothriuridae). *Journal of Arachnology, 37,* 331–337.

Schneider, M. C., Zacaro, A. A., Pinto-da-Rocha, R., Candido, D. M., & Cella, D. M. (2009). A comparative cytogenetic analysis of 2 Bothriuridae species and overview of the chromosome data of Scorpiones. *Journal of Heredity, 100,* 545–555.

Simon, E. (1872). Arachnides de Syrie, rapportés par M. Charles Piochard de la Brûlerie. *Annales de la Société Entomologique de France, Series 5, 11,* 245–264.

Soleglad, M. E., & Fet, V. (2003). High-level systematics and phylogeny of the extant scorpions (Scorpiones: Orthosterni). *Euscorpius, 11,* 1–175.

Stathi, I., & Lourenço, W. (2003). Description of a new scorpion species of the genus *Birulatus* Vachon, 1974 (Scorpiones, Buthidae) from Syria. *Zoology in the Middle East, 30,* 105–110.

Vachon, M. (1966). Liste des scorpions connus en Egypte, Arabie, Israel, Liban, Syrie, Jordanie, Turquie, Irak, Iran. *Toxicon, 4,* 209–218.

Vachon, M. (1974). Étude des caractères utilisés pour classer les familles et les genres de scorpions (Arachnides). *Bulletin du Muséum National d'Histoire Naturelle, Paris, 140,* 859–958.