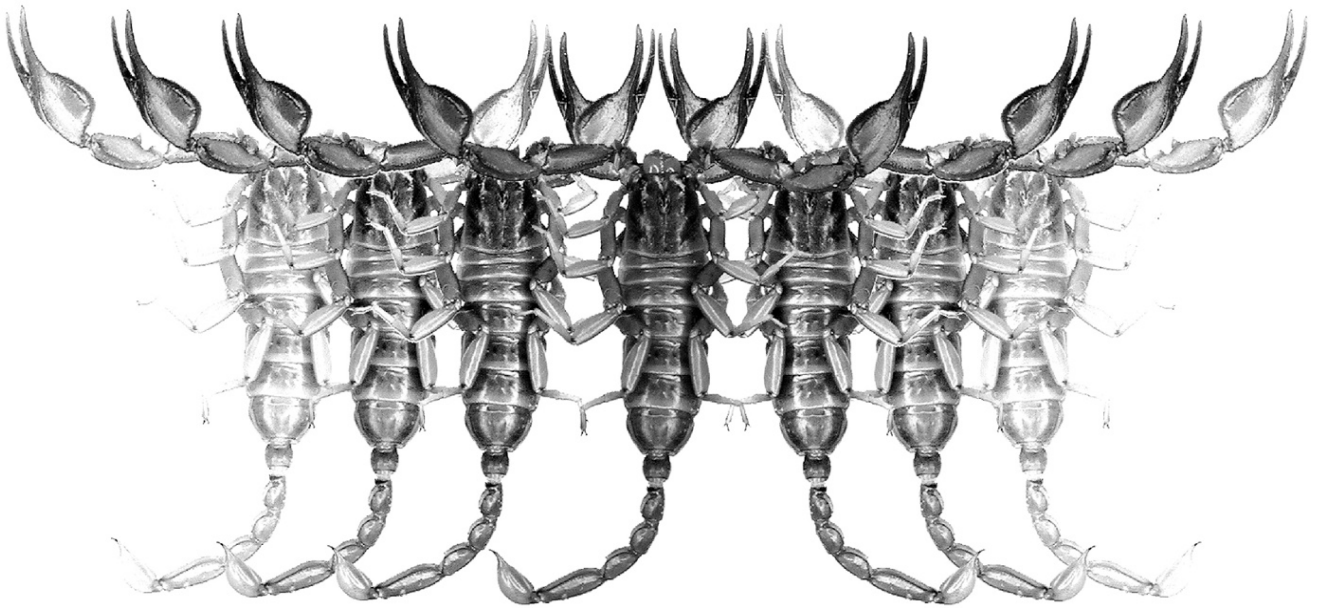


Euscorpilus

Occasional Publications in Scorpiology



**A rare telson anomaly in
Parabuthus liosoma (Ehrenberg, 1828)
(Scorpiones: Buthidae)**

Abdulaziz R. Alqahtani & Ahmed Badry

June 2021 — No. 336

Euscorpius

Occasional Publications in Scorpiology

EDITOR: **Victor Fet**, Marshall University, 'fet@marshall.edu'

ASSOCIATE EDITOR: **Michael E. Soleglad**, 'msoleglad@gmail.com'

TECHNICAL EDITOR: **František Kovařík**, 'kovarik.scorpio@gmail.com'

Euscorpius is the first research publication completely devoted to scorpions (Arachnida: Scorpiones). *Euscorpius* takes advantage of the rapidly evolving medium of quick online publication, at the same time maintaining high research standards for the burgeoning field of scorpion science (scorpiology). *Euscorpius* is an expedient and viable medium for the publication of serious papers in scorpiology, including (but not limited to): systematics, evolution, ecology, biogeography, and general biology of scorpions. Review papers, descriptions of new taxa, faunistic surveys, lists of museum collections, and book reviews are welcome.

Derivatio Nominis

The name *Euscorpius* Thorell, 1876 refers to the most common genus of scorpions in the Mediterranean region and southern Europe (family Euscorpiidae).

Euscorpius is located at: <https://mds.marshall.edu/euscorpius/>
Archive of issues 1-270 see also at: <http://www.science.marshall.edu/fet/Euscorpius>

(Marshall University, Huntington, West Virginia 25755-2510, USA)

ICZN COMPLIANCE OF ELECTRONIC PUBLICATIONS:

Electronic (“e-only”) publications are fully compliant with ICZN (*International Code of Zoological Nomenclature*) (i.e. for the purposes of new names and new nomenclatural acts) when properly archived and registered. All *Euscorpius* issues starting from No. 156 (2013) are archived in two electronic archives:

- **Biotaxa**, <http://biotaxa.org/Euscorpius> (ICZN-approved and ZooBank-enabled)
- **Marshall Digital Scholar**, <http://mds.marshall.edu/euscorpius/>. (This website also archives all *Euscorpius* issues previously published on CD-ROMs.)

Between 2000 and 2013, ICZN *did not accept online texts* as “published work” (Article 9.8). At this time, *Euscorpius* was produced in two *identical* versions: online (*ISSN 1536-9307*) and CD-ROM (*ISSN 1536-9293*) (laser disk) in archive-quality, read-only format. Both versions had the identical date of publication, as well as identical page and figure numbers. **Only copies distributed on a CD-ROM** from *Euscorpius* in 2001-2012 represent published work in compliance with the ICZN, i.e. for the purposes of new names and new nomenclatural acts.

In September 2012, ICZN Article 8. What constitutes published work, has been amended and allowed for electronic publications, disallowing publication on optical discs. From January 2013, *Euscorpius* discontinued CD-ROM production; only online electronic version (*ISSN 1536-9307*) is published. For further details on the new ICZN amendment, see <http://www.pensoft.net/journals/zookeys/article/3944/>.

Publication date: 27 June 2021

<http://zoobank.org/urn:lsid:zoobank.org:pub:E0CD517A-2DEB-4219-B140-3224A45628A9>

A rare telson anomaly in *Parabuthus liosoma* (Ehrenberg, 1828) (Scorpiones: Buthidae)

Abdulaziz R. Alqahtani¹ & Ahmed Badry^{2,*}

¹Department of Biology, College of Science, University of Bisha, P.O. Box 551, Bisha 61922, Saudi Arabia.

²Department of Zoology, Faculty of Science, Al-Azhar University, Nasr City, P.O. Box: 11751, Cairo, Egypt.

*Corresponding author: Ahmed Badry, Ph. D., email: ahmedbadry@azhar.edu.eg

<http://zoobank.org/urn:lsid:zoobank.org:pub:E0CD517A-2DEB-4219-B140-3224A45628A9>

Summary

A rare anomaly of telson vesicle with two functional aculei is observed and discussed in a *Parabuthus liosoma* (Ehrenberg, 1828) specimen collected from Jizan, Saudi Arabia.

Introduction

Morphological abnormalities of several arthropod groups have been described for various body regions. Scorpions are especially vulnerable to abnormalities related to the duplication of body segments (Teruel, 2004; Jahanifard et al., 2008). Abnormalities have been reported in many scorpion families: Bothriuridae (Teruel, 2003), Chactidae (González-Sponga, 2004), Diplocentridae (Armas, 1977), Euscorpiidae (Šarić & Tomić, 201), Hemiscorpiidae (Jahanifard et al., 2008), Iuridae (Teruel, 2003), Superstitioniidae (Graham, 2006), and Vaejovidae (Ayrey, 2011). Various abnormal structures of telson, pedipalp, and pectines have been reported in many genera of the family Buthidae, including *Androctonus*, *Alayotityus*, *Buthus*, *Centruroides*, *Hottentotta*, *Isometrus*, *Leiurus*, *Lychas*, *Mesobuthus*, *Microtityus*, *Orthochirus*, *Parabuthus*, *Rhopalurus*, *Tityus*, and *Vachoniolus* (Williams, 1971; Karataş & Kürtüllü, 2006; Jahanifard et al., 2008; de Sousa et al., 2009; Lowe, 2010; Teruel & Rein 2010; Salabi et al., 2021). The teratology of the telson was previously reported in *Hottentotta zagrosensis* Kovařík, 1997; *Leiurus quinquestriatus* (Ehrenberg, 1828); *Opisthacanthus elatus* (Gervais, 1843); and *Tityus serrulatus* Lutz & Mello, 1922 (Shulov & Amitai, 1955; Matthiessen, 1978; Galvis & Flórez-D., 2016; Salabi et al., 2021). Recently, during a comprehensive review of the personal collection of the first author, a teratology case of telson has been detected that due to its rarity deserves to be mentioned, a phenomenon not known for this species.

Material and methods

During scorpion collection from Alderb, Jizan Region in the southwestern Saudi Arabia at 17.731245°N 42.262002°E, 221 m a. s. l., 9 October 2020, by the first author, one individual of

Parabuthus liosoma (Buthidae) was observed with a rare case of abnormality in the telson. The collected scorpion was first morphologically identified according to the diagnostic characters provided by Kovařík et al. (2019) and Alqahtani & Badry (2021). The specimen was maintained in a plastic container and was provided by water and fed by crickets. Then the specimen was preserved and deposited at the Al-Azhar University Zoological Collection (AUZC), Nasr City, Cairo, Egypt. The photographs of the habitus of the specimen and the lateral view of telson were taken with a digital Canon camera (Canon EOS 6D Mark II with Canon EF 50mm f/2.5 Compact Macro Lens).

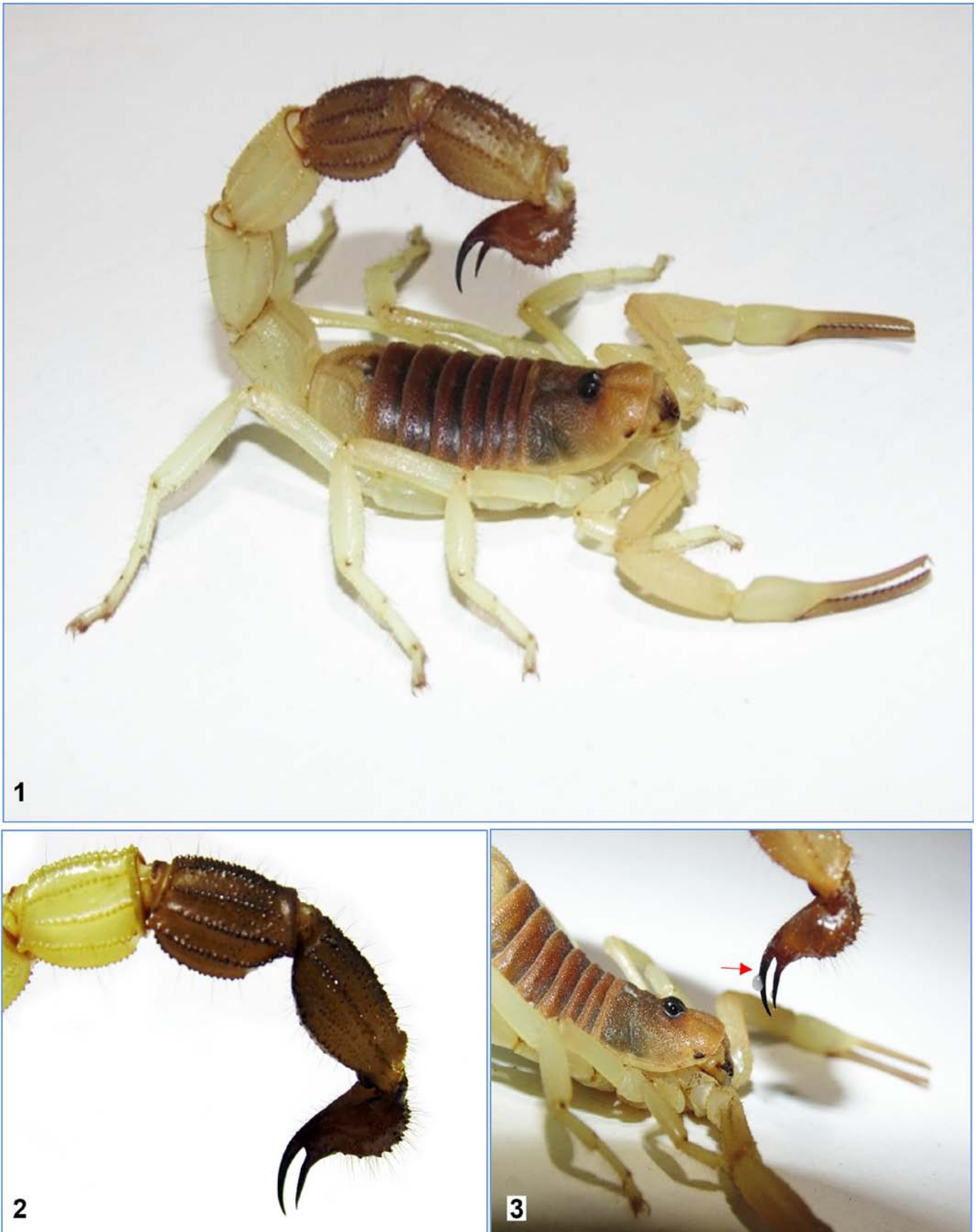
Results

In an adult female of *P. liosoma* collected from Alderb, Jizan Region in the southwestern Saudi Arabia, the prosoma, mesosoma and appendages are normal. The metasomal segments I–V and the telson are also normal in shape and structure, but the posterior of the metasoma has an anomaly of telson vesicle and aculeus (Figs. 1–2). This anomaly included the presence of two functional, different size aculei in the telson, dorsal and ventral, 6.3 and 5.1 mm long, respectively (Figs. 2–3).

The evidence of functional aculei was a milky venom droplet observed on the dorsal aculeus, and a smaller droplet on the ventral aculeus obtained by stimulating the scorpion to sting defensively as shown in Fig. 3. Also, it was observed that the scorpion used its venom apparatus to sting the prey with several successive stings after successful grasp in different positions.

Discussion

The observed teratological case in the telson of *Parabuthus liosoma* is very similar to the abnormal specimens of *Hottentotta*



Figures 1–3: *Parabuthus liosoma*, female. Figure 1. Habitus. Figures 2–3: Telson in lateral views; arrow shows dorsal aculeus.

zagrosensis, *Parabuthus heterurus* and *Opisthacanthus elatus*, illustrated in Salabi et al. (2021), Kovařík et al. (2016) and Galvis & Flórez-D (2016), respectively. However, the specimen presented here had a double aculeus that was fully functional.

Galvis & Flórez-D. (2016) refer to the malformations of structures related to the survivorship of the animal such as chelicera, chela manus, or telson as rare in comparison with others. Previous studies of scorpion abnormalities have usually focused on the morphological description of individuals collected from the natural environment, without any explanations offered (Sissom & Shelley, 1995; Mattoni et al., 2003; Teruel, 2004; Mattoni 2005; Graham, 2006; Karataş & Kürtüllü, 2006; Jahanifard et al., 2008; Seiter & Teruel, 2014). In other arthropods, anomalies and malformations occur due to temperature variations rather than bacterial infections during embryogenesis (Li & Jackson, 1996; Bouchon et al., 1998; Rigaud & Juchault, 1998; Mittmann & Wolff, 2012; Hanna & Cobb, 2006). In addition, Williams (1971) refers to the developmental anomalies that were probably associated to an abnormal midsagittal division of the posterior embryonic germ band. Duplication of body parts (mesosoma, metasoma, pectines, and aculeus) also could be interpreted as a homeotic mutation (Di et al., 2018; Kovařík et al., 2018; Sharma et al., 2014, 2015).

It is interesting to note that this scorpion succeeded in surviving in captivity and has the capacity to hunt prey using its venomous stinger and strong chela. Consequently, this specimen may have had no problem with prey capture. Rein (1993) observed that the sting use in two African *Parabuthus* species was related to the prey size and resistance. Although it is fascinating to note here that the female studied is an adult specimen with teratology in a structure related to prey capture, it is well-known that this species can kill their prey using their strong chela without applying the telson (Simard & Watt, 1990). On the other hand, the studied female shows a functional dorsal aculeus, which might have functioned well when necessary.

Acknowledgements

The authors express their gratitude to Prof. Dr. Ersen A. Yağmur, Alaşehir Vocational School, Celal Bayar University (Manisa, Turkey), and Dr. Hamdy Aly, Department of Zoology, Faculty of Science, Al-Azhar University (Assiut, Egypt), for reviewing this article and for providing valuable suggestions. Also, the authors are grateful to Prof. Dr. Victor Fet (Department of Biological Sciences, Marshall University, USA) and an anonymous reviewer for constructive comments on the earlier draft of the manuscript.

References

- ALQAHTANI, A. R. & A. BADRY. 2021. A contribution to the scorpion fauna of Saudi Arabia, with an identification key (Arachnida: Scorpiones). *Journal of King Saud University-Science*, 33(4): 101396.
- ARMAS, L. F., DE 1977. Anomalías en algunos Buthidae de Cuba y Brasil. *Poeyana*, 176: 1–6.
- AYREY, R. F. 2011. An anomaly of pectinal organs in *Vaejovis lapidicola* (Scorpiones: Vaejovidae). *Euscorpius*, 130: 1–6.
- BOUCHON, D., T. RIGAUD & P. JUCHAULT. 1998. Evidence for widespread Wolbachia infection in isopod crustaceans: molecular identification and host feminization. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, 265(1401): 1081–1090.
- DE SOUSA, L., A. VÁSQUEZ-SUÁREZ, J. MANZANILLA & T. GREGORIANI. 2009. Alteraciones morfológicas observadas en el escorpión *Tityus quirogae* (Scorpiones, Buthidae) del nordeste de Venezuela. *Boletín de la Sociedad Entomológica Aragonesa*, 45: 356–370.
- DI, Z., G. D. EDGECOMBE & P. P. SHARMA. 2018. Homeosis in a scorpion supports a telopodal origin of pectines and components of the book lungs. *BMC evolutionary biology*, 18(1): 1–7.
- GALVIS, W. & E. FLÓREZ-D. 2016. A new telson teratology in the scorpion *Opisthacanthus* Peters, 1861 (Scorpiones: Hormuridae). *Arachnology*, 17(3): 157–158.
- GONZÁLEZ-SPONGA, M. A. 2004. Arácnidos de Venezuela: cincuenta casos de malformaciones en escorpiones (Chactidae, Buthidae, Diplocentridae, Ischnuridae). *Memoria de la Fundación La Salle de Ciencias Naturales*, 157: 53–67.
- GRAHAM, M. R. 2006. Malformed pedipalp finger dentition of the scorpion *Superstitionia donensis* (Scorpiones: Superstitioniidae). *Euscorpius*, 42: 1–4.
- HANNA, C. J. & V. A. COBB. 2006. Effect of temperature on hatching and nest site selection in the Green lynx spider, *Peucetia viridans* (Araneae: Oxyopidae). *Journal of Thermal Biology*, 31(3): 262–267.
- JAHANIFARD, E., S. H. NAVIDPOUR & B. MASIHIPOUR. 2008. Pedipalp and venom vesicle anomalies in two families of scorpions (Scorpiones: Hemiscorpiidae, Buthidae) from Iran. *Pakistan Journal of Biological Sciences*, 11: 309–311.
- KARATAŞ, A. & M. KÜRTÜLLÜ. 2006. Duplication of pedipalp segments in the scorpion *Androctonus crassicauda* (Olivier, 1807) (Scorpiones: Buthidae). *Euscorpius*, 43: 1–4.

- KOVARŽÍK, F., G. LOWE, A. I. AWALE, H. S. A. ELMİ & A. A. HURRE. 2018. Scorpions of the Horn of Africa (Arachnida, Scorpiones). Part XVII. Revision of *Neobuthus*, with description of seven new species from Ethiopia, Kenya and Somaliland (Buthidae). *Euscorpium*, 271: 1–72.
- KOVARŽÍK, F., G. LOWE, H. S. ELMİ & F. ŠTÁHLAVSKÝ. 2019. Scorpions of the Horn of Africa (Arachnida: Scorpiones). Part XXI. *Parabuthus* (Buthidae) (Part II), with description of five new species from Somaliland and Ethiopia. *Euscorpium*, 290: 1–63.
- KOVARŽÍK, F., G. LOWE, J. PLÍŠKOVÁ & F. ŠTÁHLAVSKÝ. 2016. Scorpions of the Horn of Africa (Arachnida: Scorpiones). Part VII. *Parabuthus* Pocock, 1890 (Buthidae), with description of *P. hamar* sp. n. and *P. kajibu* sp. n. from Ethiopia. *Euscorpium*, 228: 1–58.
- LI, D. & R. R. JACKSON. 1996. How temperature affects development and reproduction in spiders: a review. *Journal of Thermal Biology*, 21(4): 245–274.
- LOWE, G. 2010. The genus *Vachoniolus* (Scorpiones: Buthidae) in Oman. *Euscorpium*, 100: 1–37.
- MATTHIESSEN, F. A. 1981. Anomalias da vesícula e do ferrão em *Tityus serrulatus* Lutz & Mello, 1922 (Scorpiones: Buthidae). *Ciência e Cultura* 33: 92–94
- ROSLIN, R. 1964. On regeneration in Scorpions. *Israel Journal of Zoology*, 13: 177–183.
- MATTONI, C. I. 2005. Tergal and sexual anomalies in bothriurid scorpions (Scorpiones, Bothriuridae). *The Journal of Arachnology*, 33(2): 622–629.
- MATTONI, C. I., A. V. PERETTI & L. E. ACOSTA. 2003. Patrones evolutivos en el género *Bothriurus* (Scorpiones, Bothriuridae): análisis filogenético. Unpublished PhD Thesis. *Universidad Nacional de Córdoba, Argentina*, I-vii, 249.
- MITTMANN, B. & C. WOLFF. 2012. Embryonic development and staging of the cobweb spider *Parasteatoda tepidariorum* CL Koch, 1841 (syn.: *Achaearanea tepidariorum*; Araneomorphae; Theridiidae). *Development genes and evolution*, 222(4): 189–216.
- REIN, J. O. 1993. Sting use in two species of *Parabuthus* scorpions (Buthidae). *The Journal of Arachnology*, 21: 60–63.
- RIGAUD, T. & P. JUCHAULT. 1998. Sterile intersexuality in an isopod induced by the interaction between a bacterium (*Wolbachia*) and the environment. *Canadian Journal of Zoology*, 76(3): 493–499.
- SALABI, F., H. JAFARI & A. FOROUZAN. 2021. Report of a rare anomaly in the metasoma of *Hottentotta zagrosensis* (Scorpiones: Buthidae). *Iranian Journal of Science and Technology, Transactions A: Science*, 45(2): 405–408.
- ŠARIĆ, M. & J. TOMIĆ. 2016. The first record of malformed pectines in genus *Euscorpium* (Scorpiones: Euscorpiidae). *Euscorpium*, 221: 1–10.
- SEITER, M. & R. TERUEL. 2014. Two new cases of metasomal duplication in scorpions, with notes on their reproductive biology (Scorpiones: Buthidae). *Revista Ibérica de Aracnología*, 24: 127–129.
- SHARMA, P. P., M. A. SANTIAGO, E. GONZÁLEZ-SANTILLÁN, L. MONOD & W. C. WHEELER. 2015. Evidence of duplicated Hox genes in the most recent common ancestor of extant scorpions. *Evolution & Development*, 17(6): 347–355.
- SHARMA, P. P., E. E. SCHWAGER, C. G. EXTAVOUR & W. C. WHEELER. 2014. Hox gene duplications correlate with posterior heteronomy in scorpions. *Proceedings of the Royal Society B: Biological Sciences*, 281(1792): 20140661.
- SHULOV, A. & P. AMITAI. 1955. A scorpion *Leiurus quinquestriatus* H. and E. with two stings. *Bulletin of the Research Council of Israel*, 5B: 193.
- SIMARD, J. M. & D. D. WATT. 1990. Venoms and toxins. Pp. 414–444 in Polis G.A. (ed.). *The Biology of Scorpions*. Stanford University Press, Stanford, California.
- SISSOM, W. D. & R. M. SHELLEY. 1995. Report on a rare developmental anomaly in the scorpion, *Centruroides vittatus* (Buthidae). *The Journal of Arachnology*, 23(3): 199–201.
- TERUEL, R. 2003. Nuevos casos de anomalías morfológicas en escorpiones (Scorpiones: Bothriuridae, Buthidae, Chactidae, Chaerilidae, Diplocentridae, Euscorpiidae, Hemiscorpiidae, Ischnuridae, Iuridae, Scorpionidae). *Revista Ibérica de Aracnología*, 7: 235–238.
- TERUEL, R. & J. O. REIN. 2010. A new *Hottentotta* Birula, 1908 from Afghanistan, with a note on the generic position of *Mesobuthus songi* Lourenço, Qi et Zhu, 2005 (Scorpiones: Buthidae). *Euscorpium*, 94: 1–8.
- WILLIAMS, S. C. (1971). Developmental anomalies in scorpion *Centruroides sculpturatus* (Scorpionida: Buthidae). *Pan-Pacific Entomologist*, 47(1): 76–77.