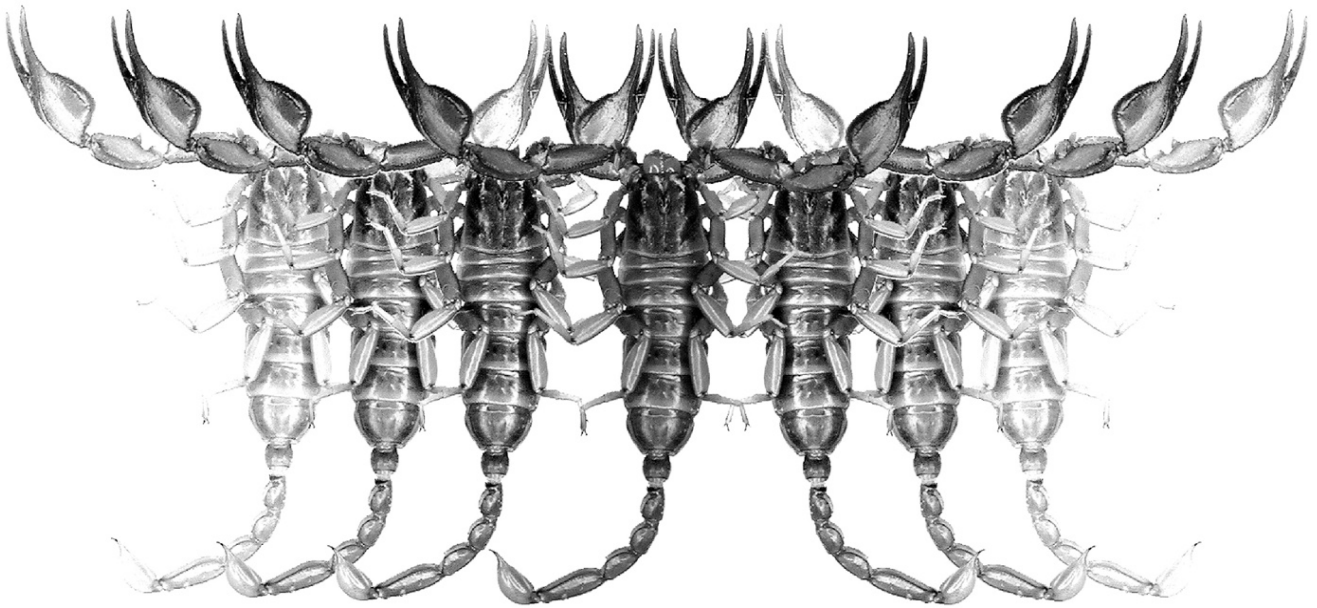


Euscorpius

Occasional Publications in Scorpiology



On some teratological scorpions in the Natural History Museum, London and checklist of the scorpiological literature on morphological anomalies (Arachnida: Scorpiones)

Danniella Sherwood & Luis F. de Armas

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Euscorpius

Occasional Publications in Scorpiology

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

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On some teratological scorpions in the Natural History Museum, London and checklist of the scorpiological literature on morphological anomalies (Arachnida: Scorpiones)

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<http://zoobank.org/urn:lsid:zoobank.org:pub:979D1CE2-FC74-4044-8346-7BBECC535B7D>

Summary

Whilst undertaking curation in the collections of the Natural History Museum, London, the senior author came across a jar of scorpions marked ‘scorpions with curled feet’. Further investigation showed this jar was full of scorpions with teratological anatomy. We hereby document and illustrate all of the specimens and discuss their respective anomalies. Furthermore, a comprehensive checklist of the literature on anomalies in scorpions, including giving the life stage and sex where known, is compiled for the benefit of future workers.

Introduction

Scorpions with teratological anatomy have been recorded in the literature, predominately these refer to deformities of the pectines (e.g. Ayrey, 2011; Šarić & Tomić, 2016; Di et al., 2018; Kovařík et al., 2018), claws (e.g. Jahanifard et al., 2008; Watz & Dunlop, 2020), legs (e.g. David, 2012; Watz & Dunlop, 2020), metasoma and/or telson (e.g. Sissom & Shelley, 1995; Jahanifard et al., 2008; Seiter & Teurel, 2014;) and genital opercula (Kovařík et al., 2018). Some specimens may exhibit multiple deformities in different parts of the body (e.g. Jahanifard et al., 2008; David, 2012; Teruel & Baldazo-Monsivaiz, 2015; Watz & Dunlop, 2020). Several previous works have compiled prior cases of teratologies (Berland, 1945; Millot & Vachon, 1949; Vachon, 1950; Matthiesen, 1989; Hjelle, 1990; Dupré & Legangneux, 1997; Dupré, 2012, 2013), some also presenting new records. Hitherto, no teratological specimens have been reported from the collections of the Natural History Museum, London (NHMUK).

Whilst recently undertaking curation of assorted jars of arachnids, the senior author discovered a jar marked ‘scorpions with curled feet’, which led her to further investigate it. It was found to contain scorpions from around the globe, in many different families, in different life stages and including both sexes. In this work, we document the teratological anatomy of each of the specimens, providing photographs of each individual deformity. We furthermore provide a review of all prior literature on scorpion anomalies available to us.

Material and methods

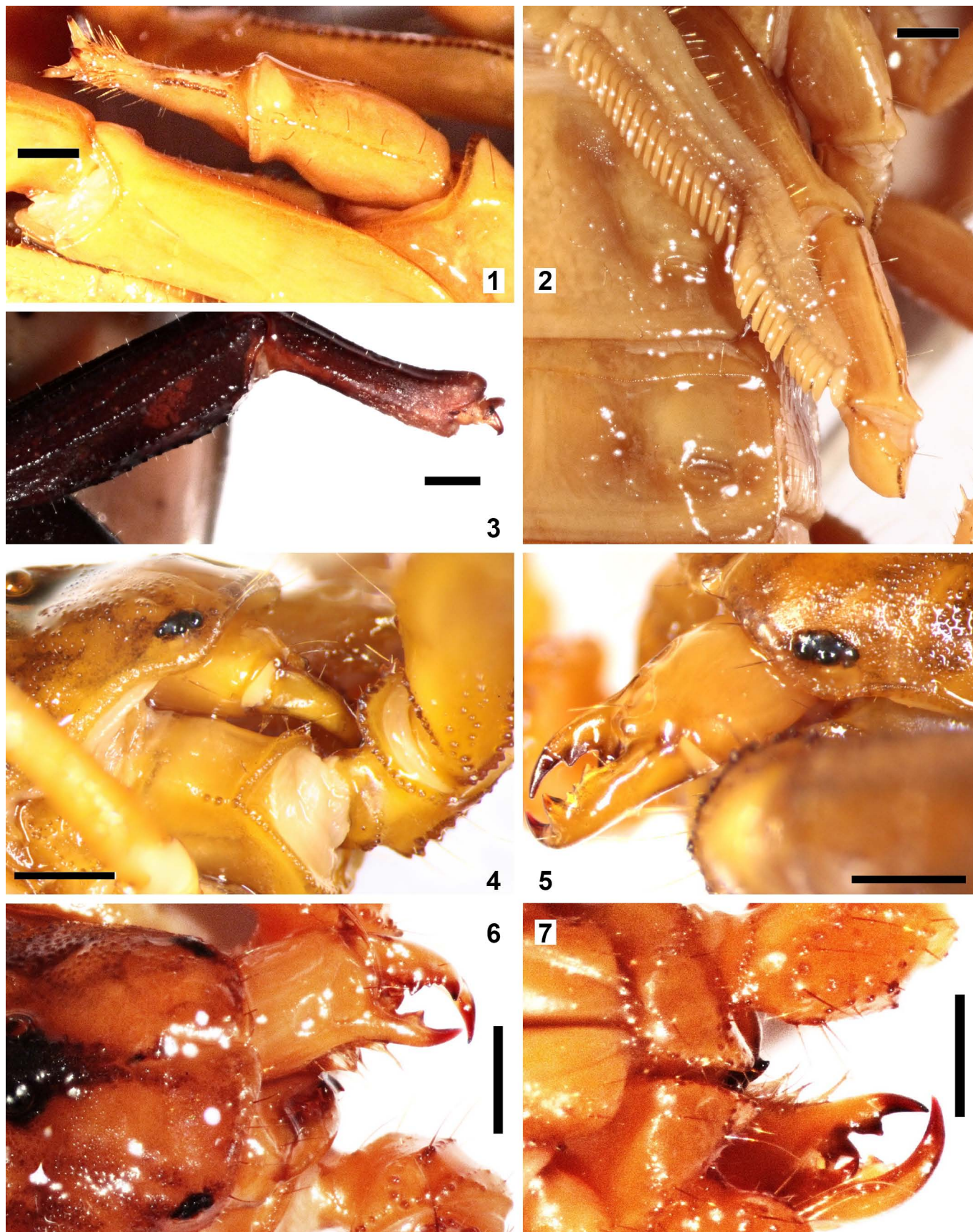
Abbreviations: NHMUK = Natural History Museum, London, UK. Photomicrographs were made using a Canon EOS 6D Mark II attached to a Leica MZ12.5 stereomicroscope, with images stacked using Helicon Focus software. Many nineteenth century specimens in the Natural History Museum, London have labels with sparse data (DS pers. obs.), so further relevant information, such as contextualising a locality, is given by us in square brackets as emphases. Anecdotal and unpublished reports are not considered here. For terminology of the pedipalp and leg segments, we mainly follow Hjelle (1990).

Results

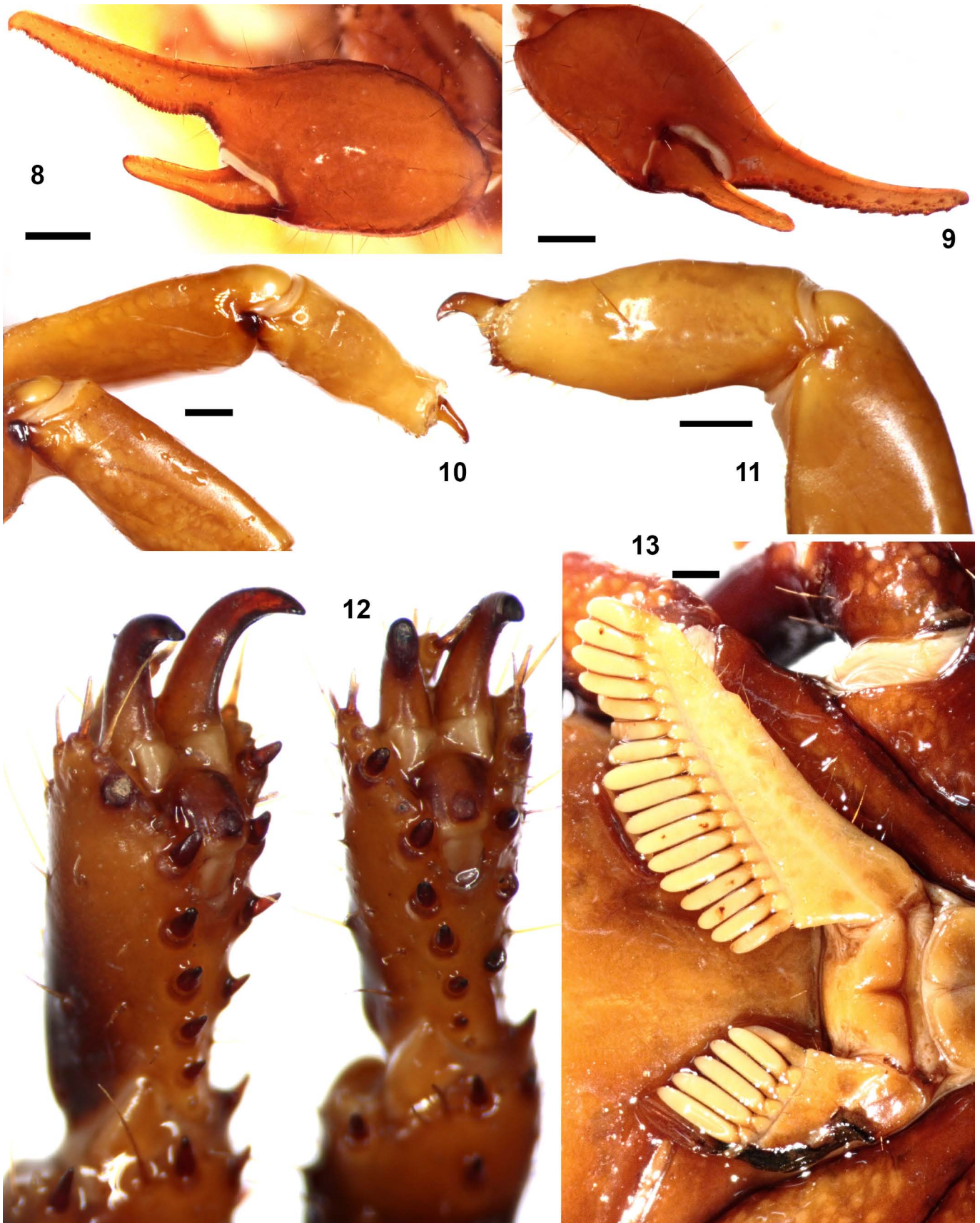
Family **Buthidae** C. L. Koch, 1837
Hottentotta scaber (Ehrenberg, 1828)
(Figures 1–2)

MATERIAL EXAMINED. 2♂ (NHMUK 015211780), BMNH 1890.12.4.1–2 [old accession number], Perim Island, [Yemen].

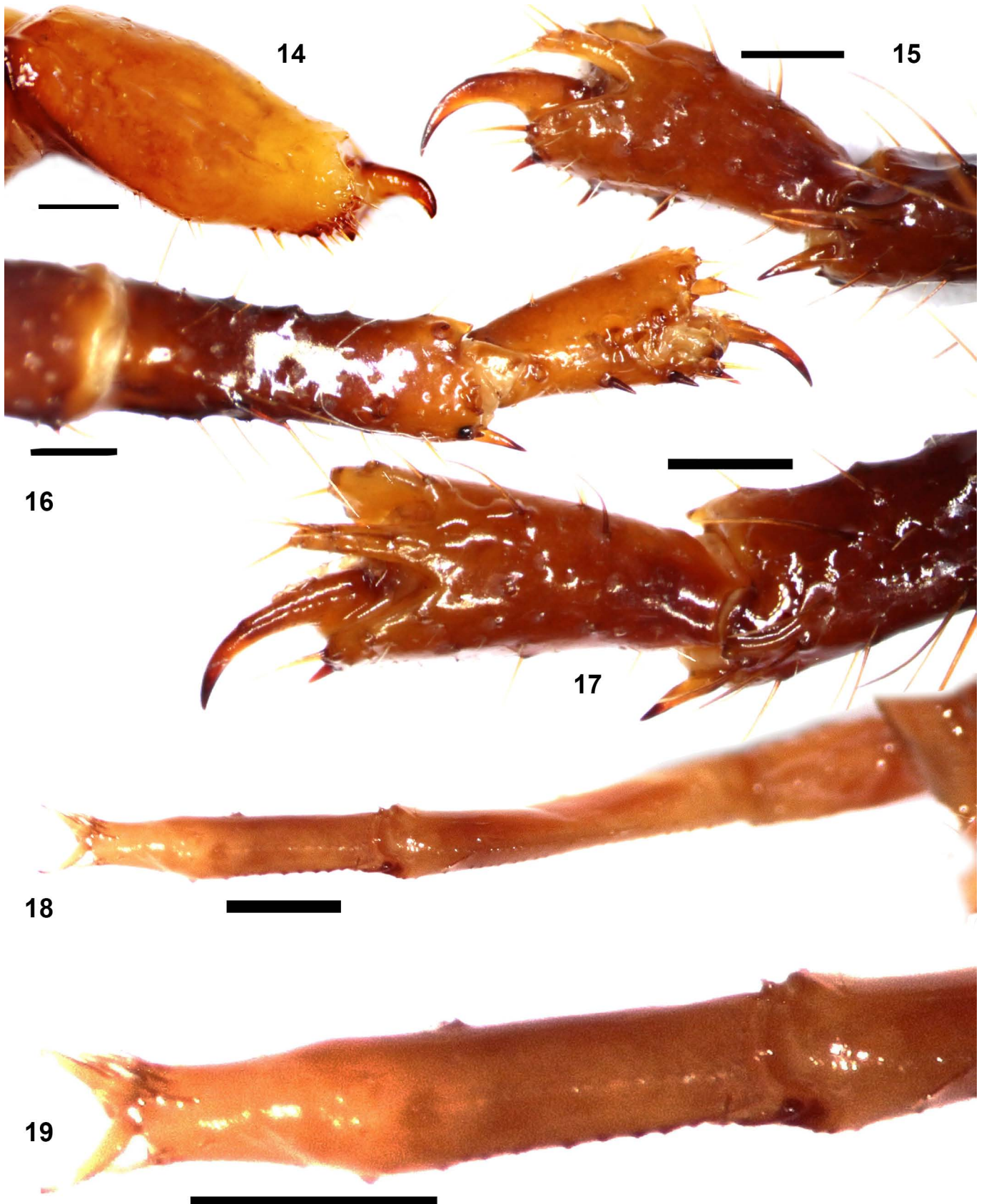
ANOMALIES. One of the males has the left leg III with two claws at the end of a short and modified femur; the other segments (i.e. patella, tibia and tarsi) are lacking (Fig. 1). The second specimen has a notably deformed left leg IV without



Figures 1–7: **Figures 1–2.** Anomalous adult males of *Hottentotta scaber* (Ehrenberg, 1828), leg III (left-hand side) (1) and leg IV (right-hand side) (2). **Figure 3:** Anomalous leg III (left-hand side), adult female of *Tityus insignis* (Pocock, 1889). **Figures 4–7:** Anomalous adult male *Hadruroides* sp. **Figure 4.** Anomalous chelicera, lateral view, **Figure 5.** Normal chelicera, lateral view. **Figures 6–7.** Chelicerae, dorsal (6) and ventral (7) views. Scale bars = 1mm.



Figures 8–13: **Figures 8–9.** Anomalous pedipalp chela (left-hand side) of adult female *Hadruioides* sp., in external (8) and internal (9) views. **Figures 10–11.** Anomalous leg IV (left-hand side) of adult male *Opisthacanthus validus* Thorell, 1876, general view of leg (10), close-up of anomalous tibia (11). **Figure 12.** Anomalous claw arising from telotarsus (left-hand side) of adult female of *Deccanometrus phipsoni* (Pocock, 1893) next to normal telotarsus. **Figure 13.** Anomalous pectines of adult female *Heterometrus longimanus* (Herbst, 1800). Scale bars = 1mm.



Figures 14–19: **Figure 14.** Anomalous leg IV (left-hand side) of adult female *Pandinurus pallidus* (Kraepelin, 1894). **Figures 15–17.** Anomalous telotarsus (left-hand side) of adult female *Sahyadrimetrus scaber* (Thorell, 1876), three different lateral views. **Figure 18–19.** Anomalous leg IV (right-hand side) of adult female *Chihuahuanus crassimanus* (Pocock 1898), general view of leg (18), close-up of anomaly (19). Scale bars = 1mm.

claws and only having the coxa, trochanter and a very short, modified, article which does not resemble any normal segment (Fig. 2).

REMARKS. A leg with claws inserted at the end of the femur was recorded for *Centruroides griseus* (see Santiago-Blay, 1986). Also, González-Sponga (2004: 60, 61, fig. 6e) described a subadult male of *Brotoeochactas garciai* having leg I with only coxa, trochanter, and a stump-like femur, without claws; nevertheless, in *H. scaber* the distal anomalous article is clearly undifferentiated and subconic.

Tityus insignis (Pocock, 1889)
(Figure 3)

MATERIAL EXAMINED. 1♀ (NHMUK 015211784), BMNH 1889.4.13.23 [old accession number], St. Lucia, [Lesser Antilles].

ANOMALY. The left leg III of this specimen has a single claw at the apex of the patella, with absence of the tibia, and tarsi (Fig. 3).

REMARKS. Legs lacking the tibia and tarsi, with the claws implanted in the patella, have also been recorded for at least three other Neotropical species, but always having two claws, not a single claw (Armas, 1977: fig. 2 C; González-Sponga, 2004: figs. 3e, 6c). In two other species, the patella is the last segment, but it has no claws (González-Sponga, 2004: figs. 6f, 8d). Armas (2018: 4, 6, fig. 3) described the right leg I of the female holotype of *Microtityus eustatia* Armas, 2018 as having, after the femur, a short unidentified segment (modified patella?) with claws.

Family **Caraboctonidae** Kraepelin, 1905
Hadruidoidea sp.
(Figures 8–9)

MATERIAL EXAMINED. 1♂ (NHMUK 015211785), The Andes, [coll.] P. O. Simons; 1♀ (NHMUK 015211786), The Andes, [coll.] P. O. Simons.

ANOMALIES. A male and female of *Hadruidoidea* sp. from an unspecified locality in the Andes both present deformities. The male specimen has the right chelicera malformed and tiny (Figs. 4–7). The female has the left pedipalp chela with very short movable finger, which also has an irregular row of denticles and absence of a basal lobe (Figs. 8–9).

REMARKS. Pedipalp chela with one of the fingers shorter than the other, and also having anomalies in the number and pattern of the rows of denticles, has been described for some species (Lourenço, 1984: fig. 14; Crucitti & Chine, 1994: 19–20, fig. 2; González-Sponga, 2004: 61, figs. 6b, 7b).

Family **Hormuridae** Kraepelin, 1905
Opisthacanthus validus Thorell, 1876
(Figures 10–11)

MATERIAL EXAMINED. 1♂ (NHMUK 015211782), ‘King Wi Town 76.70’ [sic].

ANOMALIES. The left leg IV is anomalous; it has no tarsi, instead a single claw emerges from a malformed tibia (Figs. 10–11).

Family **Scorpionidae** Latreille, 1802
Deccanometrus phipsoni (Pocock, 1893)
(Figure 12)

MATERIAL EXAMINED. 1♀ (NHMUK 015211778), BMNH 1894.8.21.4 [old accession number], Millgivi Gille, [coll.] Mr. Daler.

ANOMALY. Left leg I has fused tarsi with deformed left-hand claw, its apex is blunted and it is marginally shorter than the normal right-hand claw (Fig. 12).

Heterometrus longimanus (Herbst 1800)
(Figure 13)

MATERIAL EXAMINED. 1 ♀ (NHMUK 015211779), BMNH 1888.22 [old accession number], N. W. Borneo.

ANOMALY. An adult female which possesses an anomalous right-hand comb, very short, with only six teeth (Fig. 13); left pectinal comb has 17 teeth.

REMARKS. Similar anomaly has been recorded for other scorpions (Crucitti & Chine, 1994: 21, fig. 3; González-Sponga, 2004: 55, fig. 2).

Pandinurus pallidus (Kraepelin, 1894)
(Figure 14)

MATERIAL EXAMINED. 1♀ (NHMUK 015211781), BMNH 1897.6.20.1 [old accession number], Banara [= Barawa], Somalia.

ANOMALY. The left leg IV of this female specimen lacks the tarsi, and a claw is emergent from the tibia (Fig. 14).

REMARKS. We suspect “Banara” is a phonetic misspelling of Barawa, which is the type locality of this species. Misspelled locality names are common in arachnid specimens which were accessioned in the Victorian era (DS pers. obs.). Thus, this specimen may be topotypic.

Work	Family	Taxon	Life stage and sex	Anomaly/anomalies
Pliny (70 AD)	Buthidae	<i>Androctonus crassicauda</i> (Olivier, 1807)	Unknown	Complete duplication of metasoma. Note: Species identification follows Dupré & Legangneux (1997).
Seba (1735)	Unknown	' <i>Scorpio africanus</i> ' [invalid nomen]	Unknown	Complete duplication of metasoma.
Alpin (1735)	Unknown	Unknown	Unknown	Complete metasomal duplication in a Egyptian scorpion.
Pavesi (1881)	Euscorpiidae	<i>Alpiscorpius germanus</i> (C. L. Koch, 137) [as <i>Euscorpium germanicus</i>]	imm, unknown	Duplication of structures from mesosomal segment IV onwards.
Bateson (1894)	Scorpionidae	<i>Heterometrus longimanus</i> (Herbst 1800) [as <i>Palamanæus borneensis</i>]	Unknown	Aculeus duplicated and bifurcate, specimen not deposited in NHMUK. Further cites Pavesi (1881) and the <i>Scorpio africanus</i> specimen of Seba (1735).
Berland (1913)	Buthidae	<i>Centruroides infamatus</i> (C. L. Koch, 1844)	imm. (first instar)	Complete duplication of metasoma from segment II upwards.
Brauer (1917)	Euscorpiidae	<i>Euscorpium carpathicus</i> (Linnaeus, 1767)	Embryos, unknown	Duplication of prosoma, including from mesosomal segment IV onwards.
Pawlowsky (1917)	Buthidae	<i>Isometrus maculatus</i> (DeGeer, 1778)	Adult ♂	Malformation of the spermatophore.
Campos (1918)	Buthidae	<i>Centruroides margaritatus</i> (Gervais, 1841) [as <i>Centurus margaritatus</i>]	Adult ♀	Duplication of metasoma from segment I onwards.
Campos (1930)	Buthidae	<i>Centruroides margaritatus</i> (Gervais, 1841) [as <i>Centurus margaritatus</i>]	Adult ♂	Anomalous formation and fixation point of the palpal maxilla and deformity of the palpal femur.
Franganillo (1937)	Buthidae	<i>Centruroides gracilis</i> (Latreille, 1804)	Nymph I, unknown	Duplication of structures from mesosomal segment III onwards.
Sergent (1942)	Buthidae	<i>Androctonus australis</i> (Linnaeus, 1758)	Unknown	Duplication of the aculeus.
Vachon (1946)	Buthidae	<i>Androctonus australis</i> (Linnaeus, 1758) [as <i>Prionurus australis</i>]	Unknown	Specimen 1: Reduction and malformation of the pectines. Specimen 2: Leg III malformed from femur downwards, with abnormal growths, the apical growth with distal claws. Note: abstract only, no illustrations.
Sergent (1946)	Buthidae	<i>Buthacus leptochelys</i> (Ehrenberg, 1829)	Adult, unknown	Duplication of structures from mesosomal segment IV onwards.
		<i>Androctonus australis</i> (Linnaeus, 1758)	Unknown	Triplication of the aculeus.
Millot & Vachon (1949)	Buthidae	<i>Androctonus crassicauda</i> (Olivier, 1807)	Unknown	Duplication of metasoma from segment I onwards.
Vachon (1950)	Scorpionidae	<i>Scorpio maurus</i> Linnaeus, 1758	Adult ♀	Duplication of claws on tarsomere II.
Vachon & Serfaty (1950)	Buthidae	<i>Hottentotta alticola</i> (Pocock, 1895) [as <i>Buthotus alticola</i>]	Adult ♀	Duplication of metasoma from segment I onwards.
Vachon (1952)	Buthidae	<i>Androctonus crassicauda</i> (Olivier, 1807)	Adult, unknown	Duplication of structures from mesosomal segment IV onwards.
		<i>Buthacus leptochelys</i> (Ehrenberg, 1829)	Adult, unknown	Duplication of structures from mesosomal segment IV onwards. This is the same specimen recorded by Sergent (1947).
Vachon (1953)	Buthidae	<i>Androctonus crassicauda</i> (Olivier, 1807)	Adult ♀	Duplication of metasoma from segment I onwards.
Vachon (1954)	Euscorpiidae	<i>Euscorpium</i> sp. [as <i>Euscorpium carpathicus</i> (Linnaeus, 1767)]	Nymphs, unknown	Damaged legs of nymphs observed regenerating with anomalous structures at apex of damaged segment(s).
Vachon (1957)	Euscorpiidae	<i>Euscorpium</i> sp. [as <i>Euscorpium carpathicus</i> (Linnaeus, 1767)]	Nymphs, unknown	Damaged legs of nymphs observed regenerating with anomalous structures at apex of damaged segment(s). Same specimens recorded by Vachon (1954).
Lewis (1954)	Unknown	Unknown	imm., unknown	An immature scorpion with complete duplication of the metasoma was found and brought to the Jamaica Museum.
Shulov & Amatai (1955)	Buthidae	<i>Leiurus hebraeus</i> Lowe, Yagmur & Kovařík, 2014 [as <i>Leiurus quinquestriatus</i>]	Subadult, unknown	Duplication of aculeus.
Briseño (1963)	Buthidae	<i>Centruroides noxius</i> Wood, 1863	imm. (pre-nymph or larva),	Duplication of metasoma from segment I onwards.

Work	Family	Taxon	Life stage and sex	Anomaly/anomalies
Rosin & Shulov (1963)	Diplocentridae	<i>Nebo hierichonticus</i> Simon, 1872	Nymphs	Specimen 1: Right leg II with absence of tibia and tarsi, underwent ecdysis and apex of leg II gained an abnormally small process with claws.
				Specimen 2: Right leg III with tibia snapped off, underwent ecdysis and subsequently gained a single small but not malformed claw at apex.
				Specimen 3: Extensive deformities, including abnormal pectines, a crack in the carapace, right leg II and absence of IV tibia, but tarsi present. After ecdysis, the pectines and leg II did not change, the carapace crack healed and telotarsus grew in size, but with some anomalies.
				Specimen 4: Right tibia III damaged, after ecdysis an anomalous and blunt-apexed structure appeared, developed a small tibia with two claws after another ecdysis.
Rosin (1964)	Scorpionidae	<i>Scorpio maurus</i> Linnaeus, 1758	Adult ♂	Left tibia III anomalous and with two claws emergent from apex, other segments missing.
Matthiesen (1970)	Buthidae	<i>Tityus bahiensis</i> (Perty, 1833)	Adult ♀	Abnormal anastomosis in ovariterus.
		<i>Tityus serrulatus</i> Lutz & Mello, 1922	Nymphs	Numerous profoundly malformed nymphs, one of which was found enclosed in the first segment of the mother's metasoma, with its own metasoma malformed as a result of its abnormal positioning. Another situated near its mother's brain.
		<i>Rhopalurus rochai</i> (Borelli 1910)	Nymphs	Metasoma malformed as a result of abnormal positioning in the mother.
Williams (1971)	Buthidae	<i>Centruroides sculpturatus</i> (Wood, 1863)	Adults, unknown	Specimen 1: Fully-formed duplication of telson.
				Specimen 2: Duplication of metasoma from segment I onwards.
Balazuk (1972)	Euscorpiidae	<i>Euscorpius</i> sp. [as <i>Euscorpius carpathicus</i> (Linnaeus, 1767)]	Adult ♀	Malformation and partial fusion of mesosomal segments II–III.
Vachon (1972)	Buthidae	<i>Isometrus maculatus</i> (DeGeer, 1778)	Adult ♂	Telson with an anomalous lateral vesicle that resembles a second aculeus.
Armas (1976)	Diplocentridae	<i>Didymocentrus bermudezi</i> (Moreno, 1938)	Adult ♀	One supernumerary trichobothrium on the external surface of the patella.
		<i>Cazierius gundlachii</i> (Karsch, 1880) [as <i>Didymocentrus gundlachii</i>]	Adults 2♀	Specimen 1: Carapace anomalous, lacking one left ocellus and all three ocelli on the right side; additionally, the anterior margin is irregular in shape. Specimen 2: Absence of the right ocelli.
		<i>Didymocentrus sanfelipensis</i> Armas, 1976	Adult ♂	Carapace posteriorly fused to tergite I.
Armas (1977)	Buthidae	<i>Heteroctenus junceus</i> [as <i>Rhopalurus junceus</i>]	Adult ♀	Telson with an extra spiniform process, similar to an aculeus.
		<i>Centruroides anchorellus</i> Armas, 1976 [as <i>C. anchorellus</i> ssp.]	Adults 2♂1♀	Specimen 1 (♂): Right leg I with anomalous patella and the claws arising from its apex. Specimen 2 (♂): Left leg II with anomalous femur, from which a malformed article with claws arises. Specimen 3 (♀): Metasomal segments dorsally and laterally depressed, with intercarinae invaginations, likely as consequence of ecdysial process.
		<i>Centruroides gracilis</i>	Subadult, unknown	Complete duplication of metasoma, last mesosomal segment partially modified.
		<i>Centruroides guanensis</i> Franganillo, 1931 [as <i>C. guanensis cubensis</i> Moreno, 1939 and <i>C. aguayoi</i> Moreno, 1939]	Adults ♀♀	Specimen 1: Pedipalp right patella subcylindrical, lacking some dorsal carinae and trichobothria. Specimen 2: Left leg III with tarsi fused and dorsal median lobe small. Specimen 3: Left chelicera having a supernumerary tooth in the ventral border. Specimen 4: Right leg I with tibia and tarsi fused, deformed, without claws; also, leg II (right) with fused tarsi and small claws.
		<i>Tityus bahiensis</i> (Perty, 1834)	Adult ♀	Right leg I lacks telotarsus, claws are small, arising from basitarsus.
Matthiesen (1978)	Buthidae	<i>Tityus serrulatus</i> Lutz & Mello, 1922	Adult ♀	Duplication of aculeus.
Matthiesen (1979)	Buthidae	<i>Tityus obscurus</i> (Gervais, 1843) [as <i>Tityus cambridgei</i> Pocock, 1897]	Embryo, unknown	Duplication of carapace, eyes and pedipalps, asymmetrical, right-hand structures smaller and metasoma folded dorsally.
Matthiesen (1981)	Buthidae	<i>Tityus serrulatus</i> Lutz & Mello, 1922	Unknown	Duplication of aculeus in three specimens.

Work	Family	Taxon	Life stage and sex	Anomaly/anomalies	
Lourenço (1984)	Buthidae	<i>Tityus fasciolatus</i> (Pessoa, 1935)	Adults ♂♀, imms.	Malformation of the granules of the pedipalp movable finger.	
			Adults ♂♂ ♀♀, imm.	Specimen 1: Absence of one or more eyes. Specimen 2: Fusion of two eyes into a single anomalous structure. Specimen 3: One eye abnormally smaller than others. Specimen 4: Presence of one extra eye.	
		<i>Tityus mattogrossensis</i> Borelli, 1901	Unknown	Pedipalp fixed finger very short.	
		<i>Tityus metuendus</i> Pocock, 1897	Unknown	Presence of one extra eye on each side of the carapace.	
Santiago-Blay (1986)	Buthidae	<i>Centruroides griseus</i> (C. L. Koch, 1844)	Imm. ♀	Dorsal internal carina of the pedipalp femur incomplete.	
			Adult ♀	Malformed and larger than normal movable finger of the left pedipalp.	
			Adult ♂	Coalescent non-basal rows of denticles in right pedipalp movable finger.	
			Adult ♂	Area of pedipalp at base of fixed finger with indentation.	
			Adult ♂	Femur (exact leg not stated) with claws at apex, other segments missing.	
			imm., unknown	Terminal claws (unknown leg) enlarged and bifurcate.	
			Adult ♂	Aculeus deformed and curved underneath telson, abnormal protuberance on dorsal face of telson.	
		<i>Centruroides bani</i> Armas & Marcano Fondeur, 1987 [as <i>Centruroides</i> sp.]	Unknown	Left comb with an additional fulcrum.	
			Unknown	Malformed and short fixed finger of chelicera.	
			Unknown	Telotarsus with enlarged dorsal median lobe.	
			Unknown	Absence of a supernumerary granule on the pedipalp movable finger.	
		<i>Isometrus maculatus</i> (DeGeer, 1778)	Adult ♂	Absence of supernumerary granule in the left pedipalp movable finger.	
			Adult ♀	Metasomal carinae abnormal.	
		<i>Tityus michelii</i> Armas, 1982	Adult ♀	Total absence of one of the dorsal carinae on a metasomal segment.	
		<i>Tityus obtusus</i> (Karsch, 1879)	Adult ♀	Incomplete dorsal median carina on a metasomal segment.	
			Adult ♀	Absence of one of the denticles of the primary row of right-hand fixed finger.	
			Adult ♀	First three teeth of right-hand pectine deformed.	
			Adult ♀	Scarification on mesosomal segments III and IV.	
		<i>Tityus</i> sp.	Adult ♀	Anomalous protuberance in ventral submedian carina of a metasomal segment.	
			Adult ♀	Abnormal indentation of outer faces of chela and its movable finger.	
		<i>Heteronebo portoricensis</i> Francke, 1978	Adult ♂	An extra protuberance on dorsal metasomal carina.	
			Adult ♀	Absence of lateral eyes on left side.	
			Adult ♀	Fusion of tarsomeres I and II.	
			Adults ♂♀	One extra tubercle on the pedipalp chela.	
		Diplocentridae	<i>Cazierius garridoi</i> Armas, 2005 [as <i>Cazierius</i> sp.]	Adult ♂	Right side of carapace malformed.
				Adult ♂	Malformed and short pedipalp movable finger.
				Unknown	Leg claws arising from tarsomere I (basitarsus).

Work	Family	Taxon	Life stage and sex	Anomaly/anomalies
Matthiesen (1989)	Buthidae	<i>Tityus serrulatus</i> Lutz & Mello, 1922	Unknown	Pectinal abnormalities: (1) two teeth with a single fused base; (2) presence of two teeth fused in a single one; (3) abnormal protuberance at apical edge of the last external cell; (4) two distal teeth situated almost 90 degrees outwards in comparison to normal teeth; (5) reduction of bristles above the pectines; (6) abnormally smaller teeth and (7) absence of one or more teeth.
		<i>Tityus bahiensis</i> (Perty, 1833)	Unknown	Malformation of the telson and aculeus.
Armas & Hernández (1989)	Buthidae	<i>Centruroides edwardsii</i> (Gervais, 1843) [as <i>C. margaritatus</i> (Gervais, 1841)].	Adults ♀♀	Specimen 1: Right leg II with claws at the end of an anomalous article [fused tarsi]. Specimen 2: Ocular tubercle with a single eye and superciliary carinae abnormal.
Armas (1990)	Buthidae	<i>Centruroides guanensis</i> Franganillo, 1931	Adult ♂	Last mesosomal segment partially divides, with two complete metasomas.
Cao López & Solorzano Hernández (1991)	Buthidae	<i>Centruroides gracilis</i> (Latreille, 1804)	imm. (nymph 5), unknown	Left pedipalp with patella and chela fused.
Armas & Marcano Fondeur (1992)	Buthidae	<i>Microtityus barahona</i> Armas & Teruel, 2012 [as <i>Microtityus consuelo</i> Armas & Marcano Fondeur, 1987]	Adult ♀	Left leg I lacks tarsi, claws are reduced and arising from the tibia.
		<i>Microtityus consuelo</i> Armas & Marcano Fondeur, 1987	Adults ♀♀	Specimen 1: Right leg I with telotarsus small, globose, claws small. Specimen 2: Left pedipalp femur lacks the internal basal tubercle and the trichobothrium <i>i2</i>
		<i>Microtityus solegladi</i> Armas & Teruel, 2012 [as <i>Microtityus consuelo</i> Armas & Marcano Fondeur]	Adult ♂	Posterior margin of the carapace with a small notch, tergite I slightly anomalous.
	Hormuridae	<i>Opisthacanthus lepturus</i> (Palisot de Beauvois, 1805) [as <i>O. laevicauda</i> Thorell, 1877]	Adult ♀	Left leg I with fused tarsi; legs II-IV with malformed basitarsus and anomalous cheliceral dentition.
Sissom & Shelley (1995)	Buthidae	<i>Centruroides vittatus</i> (Say, 1821)	Subadult ♀	Complete metasomal duplication.
Armas, Cao & Solorzano (1995)	Buthidae	<i>Centruroides gracilis</i> (Latreille, 1804)	Nymphs I, unknown	Specimen 1: Triplication of metasoma, with presence of six telsons.
				Specimen 2: Duplication of metasoma.
Dupré & Legangneux (1997)	Euscorpidae	<i>Tetratrachobothrius flavicaudis</i> (De Geer, 1778)	imm.	Complete duplication of prosoma.
Armas (1998)	Buthidae	<i>Centruroides edwardsii</i> Gervais, 1843	Adult ♂	Two additional pairs of claws and dactyls on leg IV basitarsus.
Peretti (2000)	Bothriuridae	<i>Bothriurus bonariensis</i> (Koch 1842)	Adult ♂	Malformed genital operculum: only one plate present.
Kovařík (2003)	Hemiscorpiidae	<i>Hadruioides lunatus</i> (L. Koch, 1867)	Adult ♀	Telson abnormal and aculeus absent.
Teruel (2003)	Bothriuridae	<i>Centromachetes pococki</i> (Kraepelin, 1894)	Adult ♀	Teratological indentation of dorsal and ventral surfaces of the chela as mechanical effect of the male chela pressure during courtship behaviour with female newly moulted.
		<i>Urophonius granulatus</i> Pocock, 1898	Adult ♀	Ibid.
	Buthidae	<i>Androctonus crassicauda</i> (Olivier, 1807)	Adult ♀	Ibid.
		<i>Alayotityus nanus</i> Armas, 1973	Adult ♀	Ibid.
		<i>Alayotityus juraguaensis</i> Armas, 1973	Adult ♀	Ibid.
		<i>Centruroides gracilis</i> (Latreille, 1804)	Adults 7♀	Ibid.
		<i>Centruroides anchorellus</i> Armas, 1976	Adult ♀	Ibid.
		<i>Centruroides baracoae</i> Armas, 1976	Adults 3♀	Ibid.
		<i>Centruroides margaritatus</i> (Gervais, 1841)	Adult ♀	Ibid.
		<i>Hottentotta franzwernerii gentili</i> (Pallary, 1924)	Adult ♀	Ibid.
		<i>Hottentotta socotrensensis</i> (Pocock, 1889)	Adult ♀	Ibid.

Work	Family	Taxon	Life stage and sex	Anomaly/anomalies
Teruel (2003)	Buthidae	<i>Hottentotta trilineata</i> (Peters, 1861)	Adult ♀	Ibid.
		<i>Lychas mucronatus</i> (Fabricius, 1798)	Adult ♀	Ibid.
		<i>Lychas obsti</i> Kraepelin, 1913	Adult ♀	Left chelicera with an extra tooth on fixed finger.
		<i>Mesobuthus eupeus</i> (C. L. Koch, 1839)	Adult ♀	Teratological indentation of dorsal and ventral surfaces of the chela as mechanical effect of the male chela pressure during courtship behaviour with female newly moulted.
		<i>Mesobuthus gibbosus</i> (Brullé, 1832)	Adult ♀	Ibid.
		<i>Microtityus jaumei</i> Armas, 1974	Adult ♀	Mesosomal segment V longitudinally divided, segment VII dorsally fused to caudal I.
		<i>Orthochirus innessi</i> Simon, 1910	Adult ♀	Teratological indentation of dorsal and ventral surfaces of the chela as mechanical effect of the male chela pressure during courtship behaviour with female newly moulted.
		<i>Parabuthus pallidus</i> Pocock, 1895	Adult ♀	Ibid.
		<i>Heteroctenus garridoi</i> Armas, 1974 [as <i>Rhopalurus garridoi</i>]	Adult ♀	Ibid.
		<i>Heteroctenus junceus</i> (Herbst, 1800) [as <i>Rhopalurus junceus</i>]	Adults 13 ♀	Ibid.
	<i>Tityus discrepans</i> (Karsch, 1879)	Adult ♀	Ibid.	
	Chactidae	<i>Brotheas gervaisi</i> Pocock, 1893	Adult ♀	Ibid.
	Chaerilidae	<i>Chaerilus truncatus</i> Karsch, 1879	Adult ♀	Ibid.
	Diplocentridae	<i>Cazierius gundlachii</i> (Karsch, 1880)	Adults 2 ♀	Specimen 1: Tergite I divided longitudinally. Specimen 2: Tergite III divided longitudinally.
			Adults 2 ♀	Tergite I partially divided longitudinally.
			Adult ♀	Tergite II partially divided longitudinally.
		<i>Cazierius parvus</i> Armas, 1984	Adult ♀	Teratological indentation of dorsal and ventral surfaces of the chela as mechanical effect of the male chela pressure during courtship behaviour with female newly moulted.
		<i>Didymocentrus krausi</i> Francke, 1978	Adult ♀	Ibid.
	Euscorpiidae	<i>Tetrarichobothrius flavicaudis</i> (DeGeer, 1778) [as <i>Euscorpium flavicaudis</i>]	Adult ♀	Ibid.
		<i>Megacormus gertschi</i> Diaz, 1966	Adult ♀	Ibid.
	Hemiscorpiidae	<i>Hemiscorpius lepturus</i> Peters, 1861	Adult ♀	Ibid.
	Ischnuridae	<i>Liocheles australasiae</i> (Fabricius, 1775)	Adult ♀	Ibid.
	Caraboctonidae	<i>Caraboctonus keyserlingi</i> Pocock, 1893	Adult ♀	Ibid.
<i>Hadruioides lunatus</i> (L. Koch, 1867)		Adult ♀	Ibid.	
Scorpionidae	<i>Javanimetrus cyaneus</i> (C. L. Koch, 1836) [as <i>Heterometrus cyaneus</i>]	Adult ♀	Ibid.	
	<i>Pandinus imperator</i> (C. L. Koch, 1841)	Adult ♀	Ibid.	
González-Sponga (2004)	Buthidae	<i>Centruroides gracilis</i> (Latreille, 1804)	Adult ♀	Right leg I with malformed trochanter; femur and other articles are lacking.
			Subadult, unknown	Metasomal segment IV malformed, from which two fifth segments arise, each with telson.
		<i>Rhopalurus laticauda</i> Thorell, 1876	Adult ♂	Right pectinal comb malformed, short and missing some distal teeth.
			Adult ♂	Leg IV (side not indicated) with tarsi absent, small anomalous structure with apical claws emergent from tibia.
			Adult ♂	Right leg I with malformed tibia with stump at apex.

Work	Family	Taxon	Life stage and sex	Anomaly/anomalies
González-Sponga (2004)	Buthidae	<i>Rhopalurus laticauda</i> Thorell, 1876	Adult ♀	Left leg I with stump arising from the femur and ending in two claws.
			Adult ♀	Right leg III with modified patella ending in a short claw; tibia and tarsi are lacking.
		<i>Tityus carabobensis</i> González-Sponga, 1987	Adult ♂	Anterior margin of carapace with a large notch, median eyes absent, carapace carinae and granulation abnormal.
		<i>Tityus clathratus</i> C. L. Koch, 1845	Adult ♀	Anterior margin of carapace deformed, median eyes and lateroanterior carinae absent.
			Adult ♀	Anterior margin of carapace and median eyes deformed, right median eye smaller than normal; extra, abnormal, carinae present.
			Adult ♂	Metasomal segment IV malformed.
			Adult ♂	Right pectinal comb abnormally short, numerous teeth of irregular shape, some fused.
			Adult ♂	Legs III and IV of the same side: III has fused tibia and tarsi with claw at apex. IV with fused tarsi ending in two claws.
			Adult ♀	Left leg I with patella elongate and fused tarsi with two claws at apex.
		<i>Tityus discrepans</i> (Karsch, 1879)	Adult ♀	Pedipalp chela with elongate and malformed fingers, fixed finger with curvature in middle and without trichobothria.
			Adult ♀	Right leg IV telotarsus having a depression with four minute claws inside.
		<i>Tityus neoespartanus</i> González-Sponga, 1996	Adult ♀	Right leg II with fused tibia and tarsi, ending in two claws.
		<i>Tityus riocaurensis</i> González-Sponga, 1996	Adult ♂	Right leg IV with fused tibia tarsi, ending in two claws.
		<i>Tityus</i> sp.	Adult ♂	Presence of three extra metasomal segments (two are very short); aculeus emergent from apex of eighth segment, without vesicle.
	Chactidae	<i>Broteas camposi</i> González-Sponga, 1972	Imm., ♀	Left leg IV with femur stump-shaped, other articles are lacking.
			Adults 3♂	Specimen 1: Leg IV (unknown side) stump-shaped, telotarsus partially developed, with small claws.
		Specimen 2: Right leg II with fused tarsi, telotarsus ending in a lateral tubercle, claws at the end.		
		<i>Broteas libinallyi</i> González-Sponga, 1978	Adult ♀	Left leg II with tibia and tarsi fused in a short, pyramidal article, two claws in the apex.
		<i>Broteas perezramirezi</i> González-Sponga, 1996		Right pectinal comb with external and median areas malformed, also with two proximal teeth very short.
		<i>Broteas</i> sp.	Adult ♀	Right leg II with telotarsus very short, two claws.
<i>Broteochactas bilbaoi</i> González-Sponga, 1978		Adult ♀	Right leg II with telotarsus very short, two claws.	
<i>Broteochactas garciai</i> González-Sponga, 1978		Adults 2♀1♂	♀1: With short pedipalp fixed finger and distal trichobothria lacking.	
			♀2: The claws are arising from the patella apex, tibia and tarsi are lacking.	
1♂ subadult		Adult ♂: Leg I (unknown side) with femur and patella irregular in form, claws arising from the patella apex.		
	Subadult ♂: Right leg I with only coxa, trochanter and femur, but the last is irregular in form.			
<i>Broteochactas leoneli</i> González-Sponga, 1977	Adult ♂	Left leg III with patella truncate, apically rounded, without claws.		
<i>Broteochactas neblinensis</i> González-Sponga, 1991	Adult ♀	Left pedipalp with malformed chela, including trichobothriotaxy.		
<i>Broteochactas santanai</i> González-Sponga, 1978	Adult ♂	Right pedipalp chela with fixed finger distally engrossed and lacking most trichobothria.		
<i>Broteochactas venezuelensis</i> González-Sponga, 1996 [cited under genus <i>Cayooca</i>]	Adult ♀	Right leg II with fused tarsi ending in two claws.		

Work	Family	Taxon	Life stage and sex	Anomaly/anomalies
González-Sponga (2004)	Chactidae	<i>Brotochactas vestigiales</i> González-Sponga 1977 (cited under the genus <i>Taurepania</i>)	Adult ♀	Left leg IV with an anomalous short article arising from the patella, without claws.
		<i>Brotochactas</i> sp.	Adult, ♀	Left leg I with tibia distally swollen and slightly fused to the basitarsus, the latter is also swollen.
		<i>Chactas barbacoensis</i> González-Sponga, 1987	Adult, ♂	Left leg I with telotarsus malformed, two claws in the apex.
		<i>Chactas gansi</i> González-Sponga, 1974	Adults 3 ♀	Specimen 1: Right leg IV with fused tibia and tarsi, which are represented by a short, pyramidal structure.
				Specimen 2: Right leg II with tibia and tarsi fused in a malformed article, ending in two claws.
				Specimen 3: Right leg IV with patella apically malformed, ending in a short anomalous article with two claws.
			1 imm. ♀	Right leg III with truncate patella (remainder articles are lacking).
			1 imm. ♂	Left leg I with tibia and tarsi malformed, ending in two claws.
		<i>Chactas laevipes</i> Karsch, 1879	Adult ♂	Each pectinal comb having fused the first pair of teeth.
		<i>Teuthraustes reticulatus</i> González-Sponga, 1991	Adult ♀	Sternum with malformed edges and sinuous furrows on median and right side.
	Diplocentridae	<i>Tarsoporosus flavus</i> (González-Sponga, 1983) [cited under the genus <i>Diplocentrus</i>]	imm. ♂	Left leg I with tibia and tarsi fused in a short pyramidal article, without claws.
<i>Tarsoporosus kugleri</i> (Schenkel, 1932) [cited under the genus <i>Diplocentrus</i>]		Adult ♀	A leg has two retrolateral excrescences in the femoro-patellar articulation.	
	Adult ♂	Telson and aculeus malformed.		
Mattoni (2005)	Bothriuridae	<i>Bothriurus coriaceus</i> Pocock, 1893	Adults ♀♀	Specimen 1: Mesosomal segments IV and V longitudinally divided. Specimen gravid.
				Specimen 2: Mesosomal segment IV longitudinally divided, segment V fused with half of segment VI. Specimen gravid.
		<i>Bothriurus noa</i> Maury, 1984	Adult ♀	Mesosomal segment III longitudinally divided.
	<i>Brachistosternus roigalsinai</i> Ojanguren Affilastro, 2002	Adult ♀	Right-hand joint of mesosomal segment I fused with left half of segment II, right-hand side of segment II fused to anterior of segment III.	
Karataş & Kürtüllü (2006)	Buthidae	<i>Androctonus crassicauda</i> (Olivier, 1807)	Adult ♂	Left pedipalp novi-segmented, with presence of two trochanters, femora and patellae.
Graham (2006)	Superstitioniidae	<i>Superstitionia donensis</i> Stahnke, 1940	Adult ♂	Malformation of denticles on left pedipalp chela.
Jahanifard <i>et al.</i> (2008)	Buthidae	<i>Orthochirus</i> sp. [as <i>Paraorthochirus</i> sp.]	Adult ♀	Right pedipalp severely deformed, ending in a single and also an anomalous finger (the movable?), which arises from the trochanter.
			Subadult ♀	Fixed finger of right pedipalp teratological and 1/3 the size of moveable finger.
		<i>Hemiscorpius</i> sp.	Adult ♂	Telson with malformed bulb and absence of aculeus.
Martín-Frías <i>et al.</i> (2009)	Buthidae	<i>Centruroides gracilis</i> (Latreille, 1804)	Adults ♂♂, ♀♀	Specimen 1 (♀): Left pectinal comb very small.
				Specimen 2 (♂): Aculeus small.
				Numerous specimens: (a) eleven specimens with pectines having 1–6 teeth very small in one or both combs; (b) three specimens without pectines; (c) several specimens having some teeth total or partially fused. In other specimens a diastema was observed as result of the lack of 1–3 teeth.

Work	Family	Taxon	Life stage and sex	Anomaly/anomalies
De Sousa <i>et al.</i> (2009)	Buthidae	<i>Tityus quirogae</i> De Sousa, Manzanilla, Parrilla-Álvarez, 2006	Adults 6 ♂ 15 ♀	6♀4♂ with very small pectinal teeth.
				1 ♀ with two or more fused pectinal teeth.
				1 ♀: Right pedipalp with trichobothrium d2 in the dorsal surface of the femur.
				2♀1♂ lacking one trichobothrium in the fixed finger (one of the females also had some very small pectinal teeth).
				1 ♀ with enlarged subaculear tubercle.
				1 ♀ 1♂ lacking trichobothrium <i>Eb3</i>
				Note: supposed anomalies of the carapace's anterior median notch development are herein not included as anomalies because they may just be intraspecific variation.
Teruel & Ove Rein (2009)	Vaejovidae	<i>Vaejovis mexicanus</i> C. L. Koch, 1836	Adult ♀	Right chelicera of reduced size, attributed to problems in ecdysis.
Lourenço & Hypolite (2010)	Euscorpidae	<i>Tetratrichobothrius flavicaudis</i> (De Geer, 1778)	imm. ♀	Complete metasomal duplication.
El-Hennawy	N/A	N/A	N/A	Reproduction of photograph of hieroglyph showing scorpion with partial mesosomal duplication.
Ayrey (2011)	Vaejovidae	<i>Vaejovis lapidicola</i> Stahnke, 1940	Adult ♀	Pectines short and anomalous, fusion of pectinal teeth.
David (2012)	Scorpionidae	<i>Scorpio fuscus</i> (Ehrenberg, 1829)	Adult ♀	Right leg III missing, sternum malformed, coxa IV on right-hand side anomalous.
Tate <i>et al.</i> (2013)	Vaejovidae	<i>Pseudouroctonus peccatum</i> Tate <i>et al.</i> , 2013	Adult ♀	Left chelicera with bifurcation of the median denticle. Anomaly present in holotype female.
Seiter & Teruel (2014)	Buthidae	<i>Tityus obscurus</i> (Gervais, 1843)	imm., unknown	Anomalous segment II of metasoma, partial duplication of metasoma from segment III upwards.
		<i>Centruroides nitidus</i> (Thorell, 1876)	Adult ♀	Anomalous segment VII of metasoma, partial duplication of metasoma from segment VIII upwards.
Teruel & Baldazo-Monsivaiz (2015)	Buthidae	<i>Mesomexovis punctatus</i> (Karsch, 1879)	Adult intersex	Presence of a second pair of short, anomalous, pectines, each with six teeth. Specimen is also a hermaphrodite and gynandromorph.
Galvis & Flórez-D. (2016)	Scorpionidae	<i>Opisthacanthus elatus</i> (Gervais, 1843)	Adult ♀	Partial duplication of telson and duplication of aculeus.
Teruel & Reyes (2016)	Buthidae	<i>Centruroides guanensis</i> Franganillo, 1931	imm., unknown	Complete metasomal duplication.
Šarić & Tomić (2016)	Euscorpidae	<i>Euscorpis carpathicus</i> (Linnaeus, 1767)	Adult ♀	Both pectines abnormally short and with six teeth on each comb.
Di <i>et al.</i> (2018)	Euscorpidae	<i>Scorpiops luridus</i> Qi, Zhu & Lourenço, 2005	Subadult ♂	Genital opercula and pectines replaced by legs and abnormal sternite with presence of a malformed book lung.
Kovařík <i>et al.</i> (2018)	Buthidae	<i>Neobuthus gubanensis</i> Kovařík <i>et al.</i> , 2018	Adults 2♂	Specimen 1: Right pectinal comb anomalous, with five teeth.
				Specimen 2: Genital opercula with sclerites medially overlapped and right operculum fused and non-articulate; presence of a single genital papilla.
Cupul-Magaña <i>et al.</i> (2018)	Buthidae	<i>Centruroides elegans</i> (Thorell, 1876)	imm. ♀	Metasoma duplicated from penultimate mesosomal segment upwards. Specimen died in its second postembryonic stage.
Lowe & Kovařík (2019)	Buthidae	<i>Teruelius flavopiceus</i> (Kraepelin, 1901)	imm.	Anomalous second metasomal segment, metasoma duplicated from third segment upwards. Specimen died in its second ecdysis.
Waltz & Dunlop (2020)	Hemiscorpidae	<i>Opisthacanthus asper</i> (Peters, 1861)	imm. ♀	Left pedipalp stuck during ecdysis, amputated by pet hobbyist. Left pedipalp regrown with anomalies, specimen maintained in captivity by hobbyist.
	Buthidae	<i>Olivierius caucasicus</i> (Nordmann, 1840)	imm., unknown	Accidentally amputated terminal articles of two legs during an ecdysis, regrown with anomalies.
Alqahtani & Badry (2021)	Buthidae	<i>Parabuthus liosoma</i> (Ehrenberg, 1828)	Adult ♀	Duplication of aculeus.
Sadine (2021)	Buthidae	<i>Androctonus amoreuxi</i> (Audouin, 1826)	Adult ♀	Duplication and bifurcation of aculeus.

Work	Family	Taxon	Life stage and sex	Anomaly/anomalies
Salabi <i>et al.</i> (2021)	Buthidae	<i>Hottentotta zagroensis</i> Kovařík, 1977	Adult ♂	Triplication of aculeus, 'normal' aculeus well-formed, dorsal anomalous aculeus about half the normal size, ventral anomalous aculeus short and blunt with malformed apex.
Yağmur <i>et al.</i> (2021)	Scorpionidae	<i>Scorpio kruglovi</i> Birula, 1910	Adult ♀	Fixed finger of left chelicera abnormal in shape and denticulation.
Yağmur <i>et al.</i> (2022)	Buthidae	<i>Mesobuthus turcicus</i> Kovařík <i>et al.</i> , 2022	Adult ♀	Severe deformity of right-hand pectine.
Borba Feitosa <i>et al.</i> (2022)	Buthidae	<i>Tityus pusillus</i> Pocock, 1893	Two scorpplings	Conjoined twins, fused by malformed metasomae.
Kurt, Yağmur & Çelik (2023)	Buthidae	<i>Mesobuthus mesopotamicus</i> (Penther, 1912)	Adult ♂	Left leg II regenerated, pretarsus emergent from tibia, metatarsus missing.
Afifeh & Al-Saraireh (2023)	Scorpionidae	<i>Scorpio granulomanus</i> Al-Saraireh, Yağmur, Abu Afifeh & Amr, 2023	Adult ♀	Right plate of genital operculum with abnormal shape.
Yağmur & Yağmur (2023)	Scorpionidae	<i>Scorpio kruglovi</i> Birula, 1910	Adult ♀	Fusion of two distal-most teeth of right pectine.

Table 1. Checklist of literature reports of teratological scorpions published prior to the present work. Nomenclature is updated to the most recent publications, if species were misidentified this is given into square brackets [] for completeness. With one exception, we don't focus here on gynandromorph and/or hemaphrodite specimens, as we consider this phenomenon to be separate (e.g. Williams & Lee, 1975; Francke, 1978; Maury, 1983; Armas, 1984; Cokendolpher & Sissom, 1988; Armas, 1990b). The gynandromorph reported by Teruel & Baldazo-Monsivaiz (2015) also has an additional teratology and is thus included. Mattoni (2005) reports several intersexual scorpions, but mainly focuses on teratological specimens of normal sex, only the latter are included here. Chromatic aberrations are also excluded from this list.

Sahyadrimetrus scaber (Thorell, 1876)
(Figures 15–17)

MATERIAL EXAMINED. 1 ♀ (NHMUK 015211783), Travancore, [India], [coll.] Ferguson.

ANOMALY. The left telotarsus has a malformed and shortened tarsal claw (Figs. 15–17).

REMARKS. An anomaly to one of the tarsal claws was also found in *D. phipsoni* (see above).

Family **Vaejovidae** Thorell, 1876
Chihuahuanus crassimanus (Pocock 1898)
(Figures 18–19)

MATERIAL EXAMINED. 1 ♀ (NHMUK 015211777), Texas, [USA].

ANOMALY. The right leg IV has two claws arising from the femur, other segments are lacking (Fig. 18–19).

REMARKS. See remarks under *Hottentotta scaber*.

Discussion

Deformities in scorpions occur in many ways, some as a result of injury (e.g. Vachon, 1954, 1957; Rosin & Shulov, 1963; Rosin, 1964), but some probably occur from genetic abnormalities, although this area needs further studies. The most spectacular teratological forms are those of metasoma duplication. Partial or complete metasomal duplication has been reported in at least 16 works of scientific literature (Pavesi, 1881; Berland, 1913; Campos, 1918; Franganillo, 1937; Millot & Vachon, 1949; Vachon & Serfaty, 1950; Vachon, 1952, 1953; Lewis, 1954; Briseño, 1963; Williams, 1971; Armas *et al.*, 1995; Sissom & Shelley, 1995; Lourenço & Hypolite, 2010; Seiter & Teruel,

2014; Galvis & Flórez-D., 2016; Teruel & Reyes, 2016; Lowe & Kovařík, 2019). Furthermore, a scorpion with such a partial duplication is depicted in hieroglyphs in the tomb of Seti I (a ruler of Dynasty XIX) (Figs. 20–21) over seven centuries ago (El-Hennawy, 2011) and was recorded later by Pliny the Elder in 70 AD (Secundus, 70, see Millot & Vachon, 1949). Other relatively well represented malformations in the literature are some on the developing stages (e.g. Fig. 22; Brauer, 1917, Rosin & Shulov, 1962; Matthiesen, 1979). The constant improvement of camera equipment also means that many anomalies can be documented photographically since the early 2000s (e.g. Kovařík, 2003; Figs. 23–24). Recent workers have also been able to document how a specimen with a duplicated metasoma navigates ecdysis in life (Lowe & Kovařík, 2019; Figs. 25–30; Teruel & Seiter, 2014), and have shown that pectines are unable to be regenerated (Stemme, 2023).

In the specimens from NHMUK, we found only cases of appendage deformity. Nonetheless, these represent further records of leg, pectines and cheliceral teratologies, some originating from topotypic localities, and some representing first-records for their respective genera and/or species. Such work would not have been easy had a previous (and, regrettably, unknown) individual not separated these scorpions into a dedicated jar. This work thus demonstrates both the importance of museum collections for studies on morphology, and the significant value that is to be found in consciously-curated material preserved for posterity in such collections. Malformations of the legs seem to be the most common anomaly, and is likely underreported only as an artefact, as stated by Vachon (1946).

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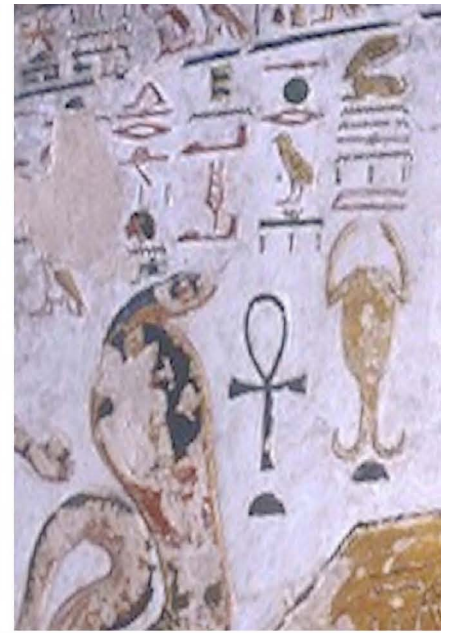
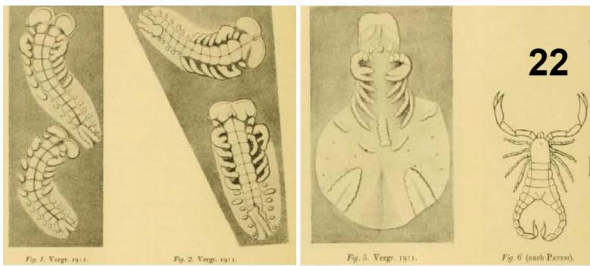


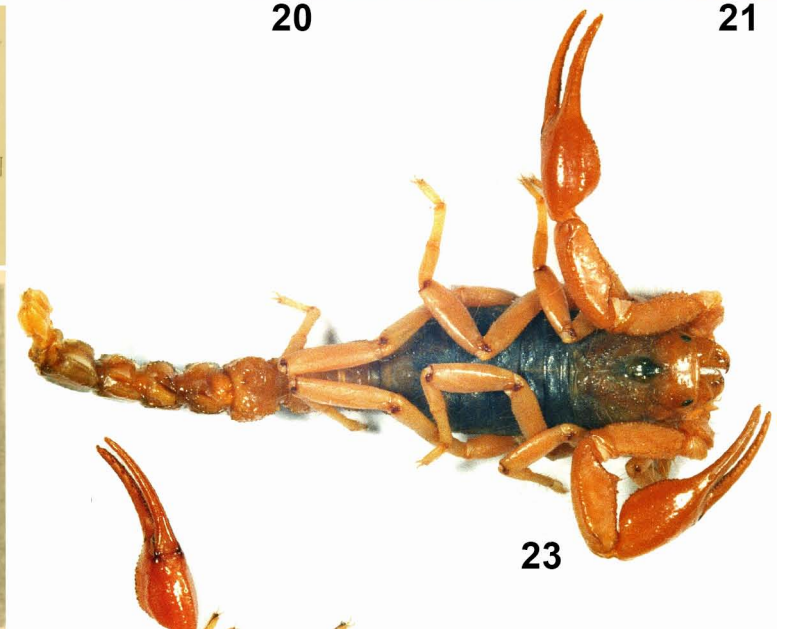
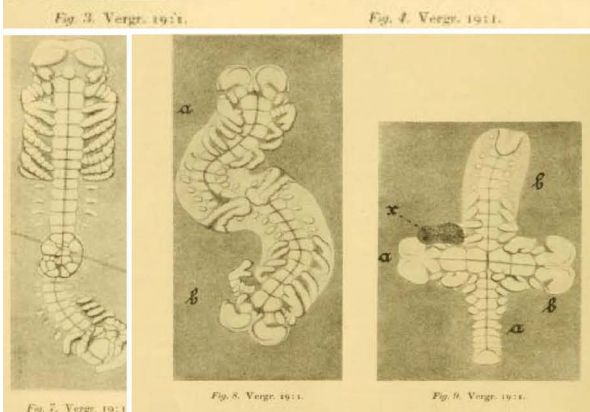
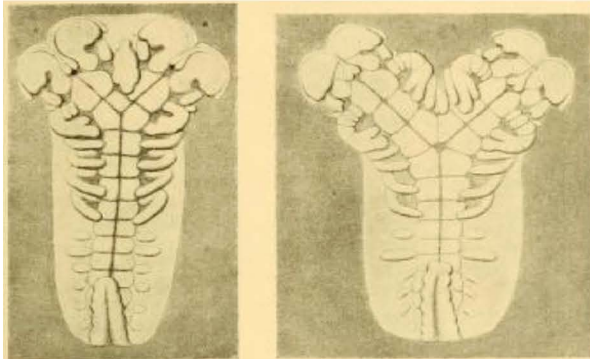
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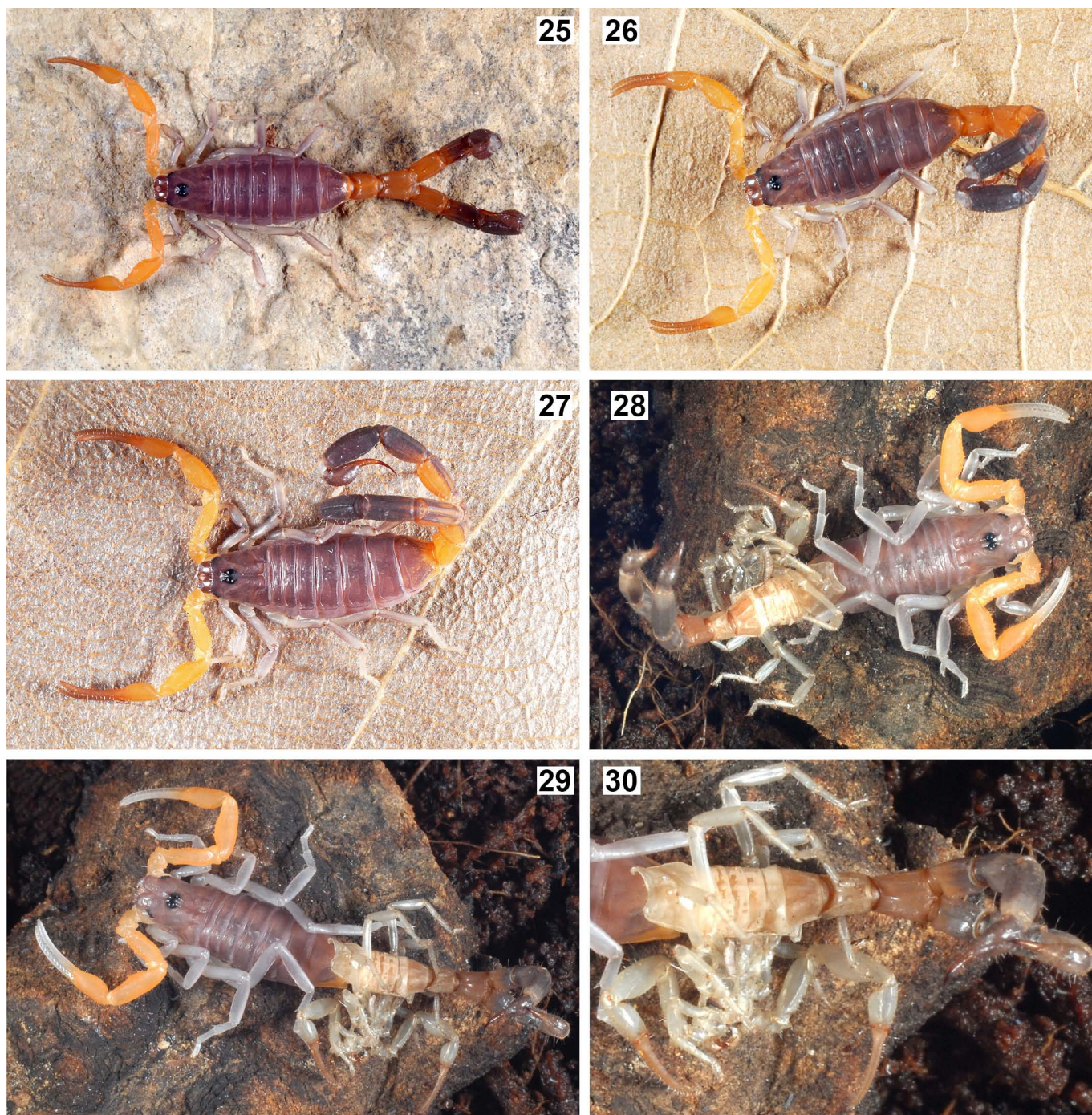


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Figures 20–24: **Figures 20–21:** Partial duplication of a scorpion metasoma found in hieroglyphs in tomb of Seti I. **Figure 20.** General image. **Figure 21.** Close-up of anomalous scorpion. Adapted from El-Hennawy (2011); photographs by Francis Dzikowski (Theban Mapping Project, American Research Center in Egypt). **Figure 22.** A compilation of illustrations of anomalous scorpion embryos by Brauer (1917). **Figures 23–24.** Recent example of an anomalous scorpion, *Hadruroides lunatus* (L. Koch, 1867) adult female, adapted from Kovařík (2003) in dorsal (23) and ventral (24) views.



Figures 25–30 *Teruelius flavopiceus* (Kraepelin, 1901) juvenile reported by Lowe & Kovařík (2019), various views in life, including during ecdysis. Photographs courtesy of František Kovařík.

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