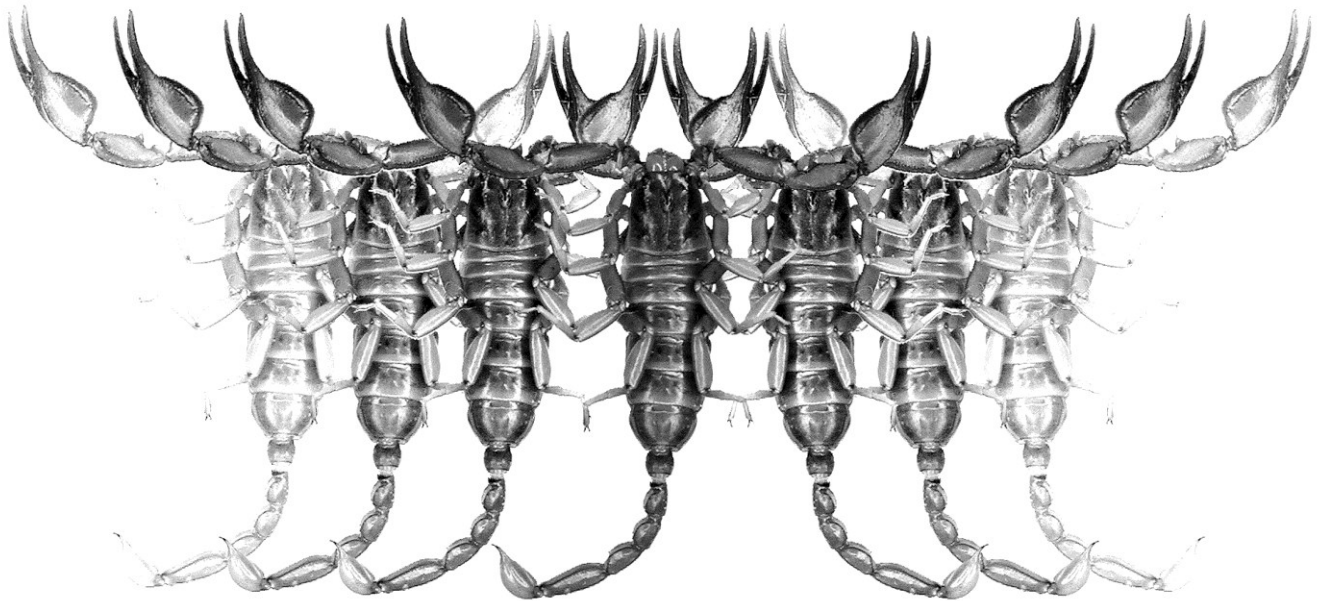


Euscorpium

Occasional Publications in Scorpiology



**Redescription of *Androctonus bicolor* Ehrenberg, 1828, and
Description of *Androctonus turieli* sp. n. from Tunisia
(Scorpiones: Buthidae)**

Rolando Teruel and František Kovařík

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Redescription of *Androctonus bicolor* Ehrenberg, 1828, and description of *Androctonus turieli* sp. n. from Tunisia (Scorpiones: Buthidae)

Rolando Teruel¹ and František Kovařík²

¹ Centro Oriental de Ecosistemas y Biodiversidad, Museo de Historia Natural "Tomás Romay", José A. Saco # 601, esquina a Barnada, Santiago de Cuba - 90100, Cuba. rteruel@bioeco.ciges.inf.cu

² P. O. Box 27, CZ - 145 01, Praha 45. Czech Republic, www.kovarex.com/scorpio

<http://zoobank.org/urn:lsid:zoobank.org:pub:9CFB25E3-7300-497E-884D-E73163E22267>

Summary

We redescribe *Androctonus bicolor* Ehrenberg, 1828, a scorpion species widely distributed across northeast Africa and the Middle East, on the basis of the study of nine original syntypes and supplementary material from its entire distribution area. In order to stabilize nomenclature, we also designate a lectotype, update its diagnosis according to modern standards, and provide a full illustrated complement to facilitate the recognition of this species as compared to all of its congeners. Also, a new, closely related species from eastern Tunisia is described.

Introduction

The members of the highly venomous genus *Androctonus* Ehrenberg, 1828, are very well known to scorpion taxonomists. In fact, one of them was amongst the first species officially described in taxonomy (Linné, 1758; Fet et al., 2002). Their medium to large size, very robust appearance, attractive coloration ranging from pale yellow to pitch black, and simplicity for captive breeding and rearing (plus a little bit of morbid fascination too), have firmly placed them amongst the most popular and widely traded animals in the pet circuit. Further, some species are common in their natural habitats, thus, they are also well represented in museum collections worldwide and many taxonomic papers have been published, although only a few represent true complete or partial revisions and catalogs: the interested reader will find two updated lists in Turiel (2013) and Teruel et al. (2013).

One of the most confusing species is *Androctonus bicolor* Ehrenberg, 1828, mostly because its types have not been re-examined and the taxonomic diagnosis has never been updated according to modern standards. The first problem is that the original description is very poor and contains ambiguous data that have been misinterpreted or overlooked by most posterior authors (see the Comments section below). The type series is currently deposited at the Zoology Museum of the Humboldt University, Berlin, Germany (ZMB).

Second, several subspecies have been described in, assigned to, or synonymized with *A. bicolor* (C. L. Koch, 1839; Caporiacco, 1932; Vachon, 1952; Fet & Lowe, 2000; Kovařík & Whitman, 2005; Lourenço, 2005), but the nominal taxon has never been critically revised, with a single exception. Levy & Amitai (1980) did not study the original syntypes, but had available a large amount of specimens from North Africa and the Middle East, on the basis of which they provided an excellent morphological characterization complemented by several high-quality illustrations, and highlighted also the main problems with the taxonomic identity of its subspecies and closely related taxa.

In a very recent paper, Teruel et al. (2013) described a closely related species from northwestern Egypt and discussed the current status of *A. bicolor* and all those taxa that had been formerly regarded at least once as its subspecies. Thanks to the valuable help of Jason Dunlop and Anja Friederichs from ZMB, we received on loan nine of the original syntypes of *A. bicolor*. Their detailed study confirmed the preliminary conclusions of Teruel et al. (2013). In order to stabilize the nomenclature of this taxon, we herein designate the single adult male as the lectotype and produce a detailed and widely illustrated redescription, according to the modern standards ruling the taxonomy of the genus, which will turn all further work on this complex of species easier and sounder. Besides, while examining our specimens referable to this complex we identified a new species from a coastal locality in eastern Tunisia, which is described in the present contribution.

Methods & Material

Nomenclature and measurements follow Stahnke (1970), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for trichobothriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977), pedipalp chela carinae (Acosta et al., 2008, as interpreted by Armas et al., 2011), and sternum (Soleglad & Fet, 2003). Unless otherwise noted, all morphologically diagnostic characters mentioned in the text refer to adults of both sexes.

Specimens studied herein are preserved in 80% ethanol and deposited in the personal collections of the authors, to which the following name-based abbreviations have been applied: RTOC, the first author's collection (followed by catalogue number, with collecting and identification labels originally written in Spanish), and FKCP, the second author's collection. The types of *A. bicolor* are deposited at the Zoology Museum of the Humboldt University, Berlin, Germany (ZMB).

Systematics

Androctonus bicolor Ehrenberg, 1828 (Figures 1–18; Table 1)

Androctonus bicolor Ehrenberg, in Hemprich & Ehrenberg, 1828: pl. II, fig. 4; Hemprich & Ehrenberg, 1829: 358. For further nomenclatural history see Fet & Lowe (2000: 70–71) and Teruel et al. (2013: 5–10).

TYPE LOCALITY AND TYPE DEPOSITORY. Egypt, ZMB.

TYPE MATERIAL. "Ägypten Ehrberg" [**Egypt**, leg. Ehrenberg]; 1♂ lectotype herein designated, 1♀ 5 juvenile paralectotypes, (ZMB-137, Figs. 1–18). See also "Comments" section below for additional paralectotypes labeled ZMB-138.

OTHER EXAMINED MATERIAL. **Egypt**, 2006, without further data, 1 juvenile ♀ (RTOC: Sco.0336), 3♀ (FKCP); northern part, 2011, leg. A. Tolba, 3♂ 7♀ 1 juvenile♀ (RTOC: Sco-0555). **Israel**, Hadarom, 'Arad; April 2, 1998, leg. A. Schmidt, 1♂ (RTOC: Sco-0107).

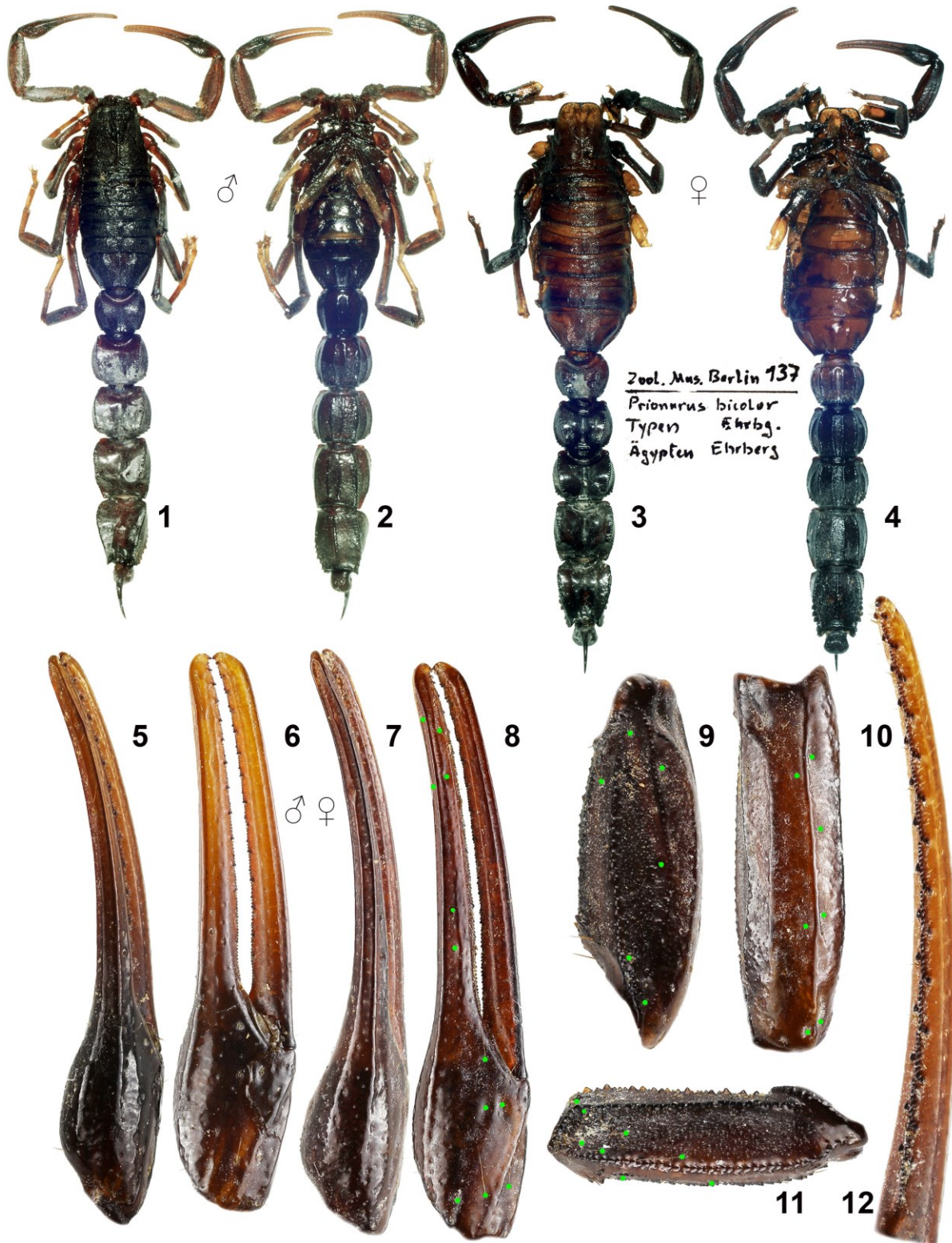
DIAGNOSIS (updated). Adult size small to moderately large (males 56–62 mm, females 64–81 mm) for the genus. Coloration basically blackish brown to pitch black; pedipalps and legs apically yellowish, but with carinae infuscate and intercarinal dark reticulations; metasoma with all carinae infuscate. Pedipalps long and slender, with hand conspicuously narrower than patella and very weakly carinate; fixed and movable fingers with 12–13 and 13–14 principal rows of denticles,

respectively, basal lobe/notch combination absent. Carapace densely granulose, with anterior and posterior median carinae strong. Sternite V with a large smooth patch in adult males, VI–VII with four carinae. Metasoma very robust and deep (both sexes have segments I–III and frequently also IV wider than long, and all segments wider than deep), with 10-10-10-8-5 complete to essentially complete carinae, most of which are coarsely serrate to crenulate; segments II–IV dorsolateral carinae with 1–2 enlarged terminal denticles; segment V ventrolateral carinae with 5–6 widely flared to lobate denticles and anal arch with 3–5 very poorly defined round lobes; all intercarinal spaces glossy and smooth to sparsely granulose, with a few coarse punctures laterally on V and telson vesicle. Telson slender, with vesicle small but globose, and aculeus longer than vesicle. Leg bristlecombs well developed on I–III, poorly defined on IV. Pectines with 24–28 teeth (mode 25 and 27) in males, and 19–22 (mode 21) in females.

REDESCRIPTION (adult male lectotype, herein designated). Coloration (Figs. 1–2) essentially uniformly blackish to unaided eye; ocular tubercles, eyes and distal part of aculeus even darker. Chelicerae deeply infuscate to very densely reticulate. Pedipalps and legs progressively lighter apically, becoming yellowish, but with all carinae infuscate and dark reticulations between carinae. Pectines yellowish. Sternite V with the smooth patch pale yellowish. Metasoma with all carinae plus the apical portion of all segments infuscate. Telson uniformly blackish, only with distal half of aculeus darker. CHELICERAE. With dentition typical for the genus; tegument polished and smooth except on dorsodistal portion of manus, which possesses coarse granules arranged in longitudinal ridges.

CARAPACE. Trapezoidal, slightly wider than long and with all carinae strongly granulose, but not fused into any particular configuration; tegument very densely covered by medium-sized and small granules; anterior margin very shallowly V-shaped, with some pairs of stout macrosetae; median eyes separate by more than one ocular diameter; five pairs of lateral eyes: three large and aligned, plus two small and slightly offset.

MESOSOMA. Tergites very densely covered by uniformly medium-sized and small granules; I–VI with three carinae (median and submedians), which are strong and granulose, but not projected beyond posterior margin; VII with five carinae (median, submedians and laterals) which are strong and serrate. Sternum standard for the genus: type 1, relatively small, and markedly triangular in shape. Pectines very long (extending around midpoint of leg IV trochanter), narrow and densely setose; tooth count 25/25; basal plate heavily sclerotized and about as long as wide, anterior margin with strong median indentation, posterior margin convex. Sternites III–VI smooth, glossy and sparsely setose, spiracles very elongate and



Figures 1–12: *Androctonus bicolor* Ehrenberg, 1828. **Figures 1–2, 5–6, 12.** Dorsal (1) and ventral (2) views, right pedipalp chela dorsal (5) and external (6) and right movable finger internal (12), ♂ lectotype. **Figures 3–4, 7–11.** Dorsal (3) and ventral (4) views, right pedipalp chela dorsal (7) and external (8), pedipalp patella dorsal (9) and external (10) and pedipalp femur dorsal (11), ♀ paralectotype. The original label is also included in the plate.



Figures 13–18: *Androctonus bicolor* Ehrenberg, 1828, metasoma and telson. **Figures 13–15.** Dorsal (13), ventral (14) and lateral (15) views, ♀ paralectotype. **Figures 16–18.** Dorsal (16), ventral (17) and lateral (18) views, ♂ lectotype.

slit-like; III without granulose lateral areas; V with smooth patch very large, widely subtriangular and bulky, translucent yellowish and conspicuously paler than the rest of the plate; VI sparsely granulose, with two pairs of costate to subcostate carinae: submedians weak and coarse, laterals stronger and finer; VII densely granulose, with two pairs of strong and costate to subcrenulate carinae.

METASOMA AND TELSON (Figs. 16–18). Metasoma very sparsely setose, with all segments very robust and deep (I–III wider than long, IV only slightly longer than wide, and V longer than wide; all segments wider than deep); intercarinal tegument of dorsal surface with granulation becoming progressively reduced to smooth towards distal segments and forming arrowhead-shaped patches on I–III, on lateral and ventral surfaces moderately gran-

ulose but not forming a clearly reticulate pattern; dorsal furrow moderately shallow and narrow on all segments; I–III with ten complete to almost complete carinae (lateral inframedian carinae becomes less defined on the basal portion of II–III), IV with eight, and V with five: dorsolateral carinae on I–IV coarsely subserrate to subdentate and progressively raised with 1–2 enlarged terminal denticles, lateral supramedian carinae and lateral inframedian carinae coarsely subcrenate to serrato-crenulate and progressively raised distally, ventrolateral carinae coarsely subcostate to subgranulose and even on I–IV, irregularly dentate and progressively raised distally on V with 4–5 triangularly flared denticles, anal arch with 2–3 very poorly defined round lobes. Telson slender and sparsely setose; vesicle small but somewhat globose (1.36 times longer than wide, 1.14 times wider than deep), tegument glossy and essentially smooth, only with some coarse punctures and a coarse but very poorly defined ventromedian carinae; subaculear tubercle insinuated by a coarse granule flanked by the subaculear setal pair; aculeus very long and thick, longer than vesicle, and evenly curved.

LEGS. Legs long, slender, and only sparsely setose; bristlecombs well-developed on I–III, poorly defined on IV (most setae are now missing, but their large and raised areolae warrant recognition); all carinae smooth to subserrate; intercarinal tegument smooth to coriaceous; tibial spurs absent from I–II, well developed on III–IV; prolateral and retrolateral pedal spurs long and slender in all legs; ventral surface of all tarsomere II sharply edged and with two ventrosubmedian rows of spiniform setae, without median row of spinules; claws long and evenly curved.

PEDIPALPS (Figs. 5–6, 12). Pedipalps long and slender, only very sparsely setose and orthobothriotaxic A-β. Femur slender and straight; all carinae strong and finely granulose; intercarinal tegument finely granulose. Patella long, slender and straight; all carinae moderately strong and finely subgranulose to costate; intercarinal tegument minutely granulose. Chela with hand narrower than patella, oval (1.45 times longer than wide) and with all carinae obsolete to weakly costate and smooth, intercarinal tegument smooth and glossy, with subtle traces of coarse reticulations dorsally and dorsoexternally; fingers long and slender (movable finger 2.48 times longer than underhand), evenly curved and with basal lobe/notch combination only very subtly insinuated, essentially absent, fixed fingers with 13 principal rows of granules; movable fingers with 14 principal rows of granules and three terminal granules (large terminal denticle not included).

FEMALE (adult paralectotype, Figs. 3–4, 7–11, 13–15, Tab. 1). In general is similar to the male, but there is a slight sexual dimorphism evidenced by: **1)** mesosoma relatively wider; **2)** pedipalps with hand slightly shorter

and less oval in shape; **3)** genital papillae absent; **4)** pectines much smaller and with non-overlapping, lower tooth counts; **5)** sternite V with smooth patch poorly defined and not bulky but concave; **6)** ventrolateral carinae of metasomal segment V with the flared denticles large and lobate.

VARIATION. The size differences among adults studied by us seem to indicate the existence of two size-classes in each sex; inside the same class, males are consistently smaller than females (Tab. 1). Levy & Amitai (1980) stated that adult females may attain a size larger than 90 mm and gave actual measurements of adult male and female 72 and 85 mm long, respectively; these ranges are larger than those we examined, but it is not clear if these authors actually examined more than one species.

Diagnostically relevant morphometric ratios revealed a direct correlation between size and expression of sexual secondary dimorphism: larger specimens invariably showed the highest degree of intersexual differentiation (Tab. 1). This trend is widespread in the order Scorpiones and has already been observed in other members of this genus studied recently (Kovařík & Ahmed, 2013; Teruel et al., 2013).

Count of teeth per pecten varied as follows: in males 24 (1), 25 (4), 26 (1), 27 (3), 28 (1), and in females 19 (3), 20 (3), 21 (8), 22 (4); as it can be seen, females are more homogeneous for this character. Levy & Amitai (1980) recorded counts of 23–29 (mode 26–28) in males and 19–24 (mode 21–23) in females, but it is not clear if these authors inadvertently pooled data from more than one species.

The number of principal rows of denticles varied from 12–13 and 13–14 in fixed and movable fingers, respectively; in all cases variation corresponded to poorly defined basalmost rows. Levy & Amitai (1980) gave the same numbers for the movable finger, but provided no data on fixed finger.

AFFINITIES. Amongst the 22 species currently recognized as valid in this genus (Turjel, 2013; Teruel et al., 2013), only *A. tenuissimus* and *A. sergenti* Vachon, 1948, do share with *A. bicolor* the following combination of three characters in adults of both sexes: **1)** coloration uniformly dark reddish brown to blackish; **2)** pedipalps very slender, with chelae much narrower than patella; **3)** pedipalp fingers without basal lobe/notch combination. All other species of *Androctonus* which have the same coloration also possess adult pedipalp chelae wider than patella, and with basal lobe/notch combination of fingers present at least in males.

Of them, the easiest to separate is *A. sergenti*: it differs remarkably from *A. bicolor* by having a smooth and coarsely punctate metasoma at least in males (Fig. 35), less attenuate pedipalps, and much more reduced granulation and carination on the body and appendages.

Dimensions		♂ Lectotype	♂ Egypt	♂ Egypt	♀ Egypt	♀ Paralectotype	♀ Egypt
Carapace	L / W	7.0 / 7.2	7.1 / 7.4	7.5 / 8.0	7.7 / 9.0	9.2 / 9.8	9.5 / 10.5
Mesosoma	L	13.2	15.9	16.2	15.5	25.0	24.9
Tergite VII	L / W	4.2 / 7.2	4.0 / 7.5	4.5 / 7.8	4.6 / 9.0	6.1 / 11.1	6.3 / 11.8
Metasoma	L	35.9	37.7	38.4	41.0	45.3*	46.5
Segment I	L / W / H	4.6 / 6.2 / 4.5	4.7 / 5.9 / 4.5	5.0 / 6.1 / 5.0	5.2 / 6.5 / 5.0	6.1 / 7.6 / 5.6	6.0 / 7.5 / 5.5
Segment II	L / W / H	5.4 / 6.7 / 4.6	5.5 / 6.8 / 5.0	5.5 / 7.1 / 5.3	6.0 / 6.9 / 5.0	6.8 / 8.2 / 6.7	6.5 / 8.5 / 6.1
Segment III	L / W / H	5.5 / 6.7 / 5.1	5.6 / 7.4 / 5.5	5.6 / 7.7 / 5.2	6.0 / 7.6 / 5.5	6.8 / 9.1 / 6.5	7.0 / 9.0 / 6.5
Segment IV	L / W / H	6.8 / 6.4 / 4.9	6.9 / 7.2 / 5.2	7.1 / 7.7 / 5.9	7.6 / 7.4 / 5.7	8.4 / 8.5 / 6.3	8.4 / 8.7 / 6.4
Segment V	L / W / H	6.8 / 5.6 / 4.0	7.4 / 6.4 / 4.0	7.6 / 6.9 / 4.6	7.9 / 7.4 / 4.5	9.1 / 7.5 / 5.1	9.2 / 7.5 / 5.5
Telson	L / W / H	6.8 / 2.5 / 2.2	7.6 / 2.6 / 2.1	7.6 / 2.8 / 2.2	8.3 / 3.2 / 2.4	8.1* / 3.7 / 2.9	9.4 / 3.4 / 2.9
Pedipalp	L	24.7	24.6	25.8	27.3	31.2	31.0
Femur	L / W	6.2 / 1.8	5.9 / 1.9	6.2 / 1.8	6.4 / 2.0	7.9 / 2.3	7.5 / 2.3
Patela	L / W	7.2 / 2.4	7.0 / 2.3	7.4 / 2.6	8.0 / 2.6	9.2 / 3.2	9.1 / 3.2
Chela	L	11.3	11.7	12.2	12.9	14.1	14.4
Hand	L / W / H	3.5 / 2.0 / 2.1	3.2 / 1.9 / 2.2	3.3 / 2.0 / 2.2	3.4 / 2.0 / 2.3	3.5 / 2.5 / 2.7	3.8 / 2.5 / 2.8
Movable finger	L	7.8	8.5	8.9	9.5	10.6	10.6
Total	L	56.1	60.7	62.1	64.2	79.5*	80.9

Table 1: Measurements (mm) of the two adult types of *Androctonus bicolor* from ZMB and four additional adult topotypes from RTOC. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (H), left (L), right (R). **Notes:** a) telson vesicle length is not given because it narrows evenly into aculeus, without any clear definition point; b) incomplete measurements due to aculeus tip broken are marked with an asterisk (*).

Furthermore, *A. sergenti* is locally endemic in a small area of the high Anti-Atlas Mountains of south-central Morocco (Vachon, 1952).

The closest relative of *A. bicolor* is *A. tenuissimus*, but it can be readily distinguished from the former on the basis of the following unambiguous characters: **1)** pedipalps conspicuously more attenuate, with femur, patella, and chela much longer; **2)** pedipalps with carinae remarkably stronger and intercarinal tegument much more densely granulose, especially on chela; **3)** pedipalp patella moderately curved inwards; **4)** pedipalp fixed and movable fingers with 13–14 and 14–15 principal rows of denticles, respectively; **5)** metasoma less deeper and much more slender (segments II, IV and V longer than wide in both sexes, in females also segments I and III), with carinae much finer and intercarinal tegument densely granulose and never glossy; **6)** ventrolateral carinae on metasomal segment V with the flared denticles sharp and much more regular; **7)** carapace and tergites with all carinae sharper and intercarinal granulation finer and more regular. Further, the secondary sexual dimorphism in *A. tenuissimus* is very obvious even to unaided eye, while adults of *A. bicolor* can be reliably sexed only after microscopic examination of the genital operculum and pectines. Besides, adults of these two species widely overlap in size, color and pectinal tooth counts, but there is a slight but consistent trend in *A. tenuissimus* to be somewhat larger, lighter (dark reddish brown), and to possess higher counts.

DISTRIBUTION. This scorpion has been widely recorded from North Africa and the Middle East, but its true distribution needs to be clarified because most of those literature records are partially based in misidentifications of closely related taxa (Levy & Amitai, 1980; Teruel et al., 2013). For this reason we do not present a map here pending further studies, but can already disclose that the only occurrences confirmed by us are from northern Egypt through Israel (see the Examined material section above).

ECOLOGICAL NOTES. In accordance with the poor taxonomic knowledge prevailing in *A. bicolor* to date, very scarce information has been published on its ecology. The most detailed data are available from Levy & Amitai (1980), who stated that in the Middle East this scorpion lives under large rocks in a wide variety of soils from sand dunes to rocky desert, it is more common inland than along Mediterranean coast, it sometimes enters houses, and females give birth to 30–40 offspring mostly in August.

COMMENTS. The type locality of *A. bicolor* and the exact composition of its type series require some clarification. As timely elucidated by Braunwalder & Fet (1998), the

original description is a plate with a Latin binomen included, but in the text subsequently issued as the intended description, Ehrenberg (*in* Hemprich & Ehrenberg, 1829: 358) declared to have examined 13 specimens and gave the distribution as "Libyan coast, Syria and Sinai", but also explicitly stated in the same page that the plate which actually represents the original description was based on specimens from Egypt. In the only two major revisions published to date on this species (Levy & Amitai, 1980; Fet & Lowe, 2000), both statements have been confused or overlooked: the type series has been declared to contain only nine specimens and/or the type locality has been given as the coastal plain of Libya, Syria, and Sinai.

We requested on loan the type series of *A. bicolor* and received two vials. The one coded ZMB-137 contains one adult male, one adult female and five juveniles, and its label reads Egypt as the collecting place (Figs. 1–4). As we designated this male as the lectotype of *A. bicolor*, Egypt becomes its type locality according to Recommendation 76.2 of the Code (ICZN, 1999: 71); by the way, this concurs with the original statement of Ehrenberg (*in* Hemprich & Ehrenberg, 1829: 358). The second bottle coded ZMB-138 is labeled "Syria-Ehrenberg" and contains only two very badly preserved, small juvenile paralectotypes (total length around 26 mm), which are impossible to identify accurately; thus, we decided not to cite them inside the type material of *A. bicolor*, especially because they could belong to another species of *Androctonus*.

The whereabouts of the remaining four specimens originally mentioned by Ehrenberg (*in* Hemprich & Ehrenberg, 1829) are currently unknown, but based on external evidence we suspect that they correspond at least to two parcels that could be lost now. For example, Levy & Amitai (1980: 23) mentioned that "*A young specimen of A. bicolor was collected by Hemprich & Ehrenberg (1829) in Beirut, Lebanon*", which seems to indicate that it was one of Ehrenberg's missing syntypes. And as the syntypes examined by us did not bear any label indicating Sinai (the other toponym mentioned in the original description), we think this most likely corresponds to a second parcel with the remaining three missing syntypes. Already, Braunwalder & Fet (1998) mentioned only the same syntypes studied by us (seven coded ZMB-137, two coded ZMB-138); thus, it seems that the remaining syntypes have long been missing or misplaced.

In the original description of *A. tenuissimus*, Teruel et al. (2013: 6–10) discussed the identity of all taxa that have been described or regarded at least once as subspecies of *A. bicolor*. All arguments exposed therein remain intact after our present examination of the types of the latter, thus, it is unnecessary to repeat them here and the interested reader is referred to that paper for fur-

Dimensions		♀ Holotype	♀ Paratype (FKCP)
Carapace	L / W	8.9 / 9.0	9.1 / 10.3
Mesosoma	L	18.4	29.0
Tergite VII	L / W	5.2 / 9.7	6.6 / 12.1
Metasoma	L	46.2	49.6
Segment I	L / W / H	6.0 / 6.8 / 5.1	6.5 / 7.5 / 5.7
Segment II	L / W / H	7.0 / 7.7 / 5.7	7.6 / 8.4 / 6.2
Segment III	L / W / H	7.1 / 7.8 / 6.2	7.9 / 8.5 / 6.9
Segment IV	L / W / H	8.6 / 7.8 / 5.9	9.5 / 8.1 / 7.2
Segment V	L / W / H	9.3 / 6.9 / 4.7	9.8 / 7.9 / 5.5
Telson	L / W / H	8.2 / 2.9 / 2.6	8.3 / 3.2 / 2.6
Pedipalp	L	29.6	30.4
Femur	L / W	7.4 / 2.2	7.5 / 2.2
Patela	L / W	8.9 / 2.8	9.2 / 3.0
Chela	L	13.3	13.7
Hand	L / W / H	3.8 / 2.4 / 2.5	3.6 / 2.5 / 2.6
Movable finger	L	9.5	10.1
Total	L	73.5	87.7

Table 2: Measurements (mm) of two adult types of *Androctonus turieli* sp. n. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (H), left (L), right (R). **Note:** telson vesicle length is not given because it narrows evenly into aculeus, without any clear definition point.

ther information. Nevertheless, we will discuss the status of *A. aeneas*, whose taxonomic history can be very briefly summarized as follows: it was described from "North Africa" at species level by C. L. Koch (1839), but its status has been highly controversial, being regarded either as a valid species (e.g., Vachon, 1952) or as a junior synonym of *A. bicolor* (e.g., Kraepelin, 1899; Lourenço, 2005), sometimes with subspecies-level (e.g., Vachon, 1958; Fet & Lowe, 2000); last, Teruel et al. (2013) stated that it should be regarded best as a *nomen dubium*.

Most of this problematic situation is due to the loss of the types (Fet & Lowe, 2000) and that the original description of C. L. Koch (1839) lacks any useful characters that allow the distinction of *A. aeneas* from its close relatives. The only other choice would have been to examine topotypes, but the type-locality is simply "North Africa", a very large and ecologically complex area that actually hosts several closely related species of this complex. Further, Vachon (1952) attempted a detailed taxonomic interpretation of *A. aeneas*, but unfortunately it was not based on the (already lost) types and it clearly included more than one taxon. Thus, as we have demonstrated that the original binomen *Androctonus aeneas* C. L. Koch, 1839 cannot be applied to any actual taxon unambiguously (or at least not arbitrarily), that its types are lost, and that the type locality is not precise, we regard it formally as a *nomen dubium*.

***Androctonus turieli* Teruel et Kovařík, n. sp.**

(Figures 19–34, 36; Table 2)

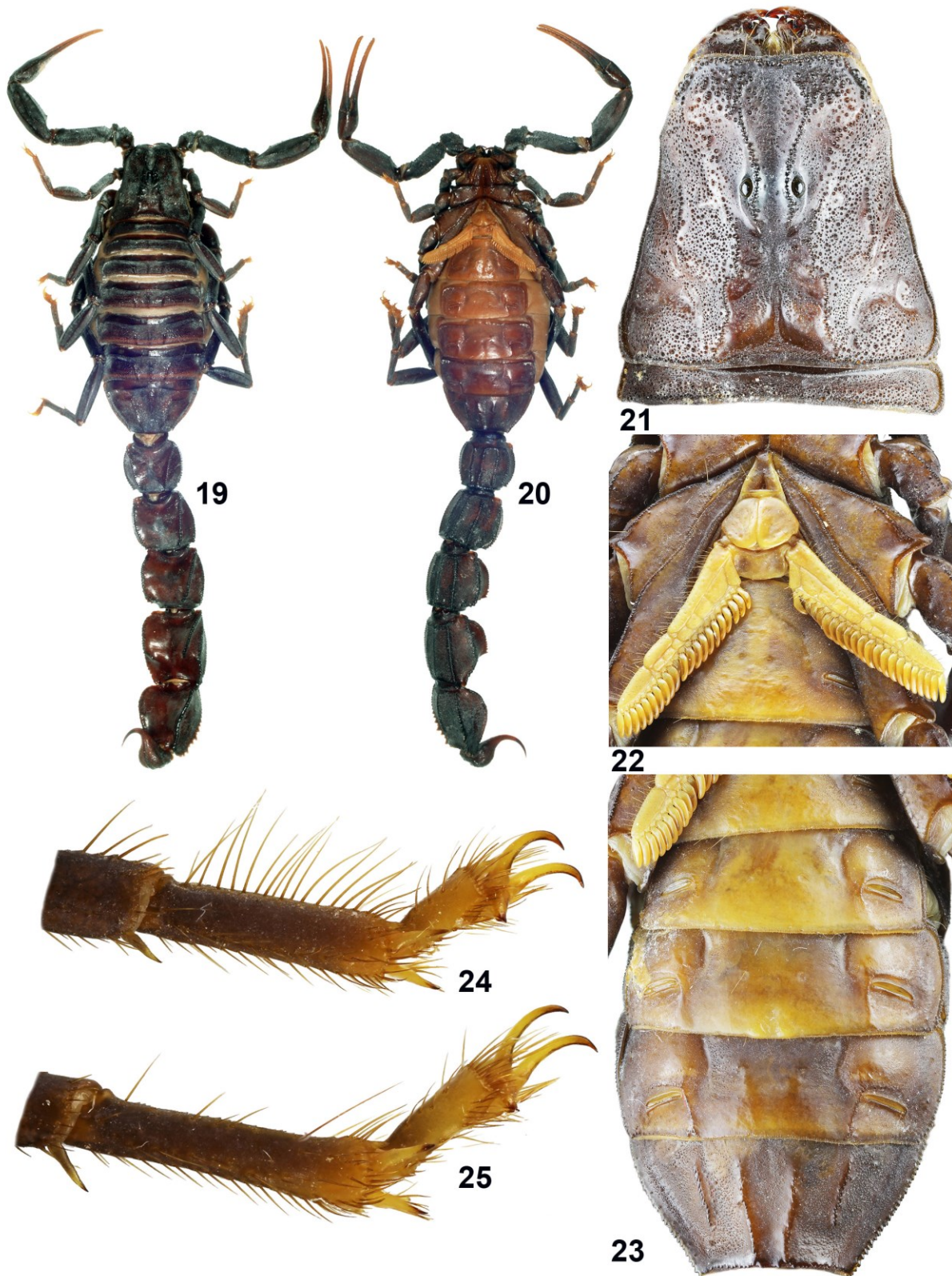
<http://zoobank.org/urn:lsid:zoobank.org:act:5EFE22DA-DAB2-48C1-920A-4573754E774B>

TYPE LOCALITY AND TYPE DEPOSITORY. Tunisia, near Sfax [= Safaqis]; FKCP.

TYPE MATERIAL. **Tunisia**, near Sfax [= Safaqis], 1980, 1♀ holotype (Figs. 21–34, FKCP), 1♀ paratype (Figs. 19–20, FKCP), 1♀ paratype (RTOC), 2 juvenile ♂ paratypes (FKCP).

ETYMOLOGY. It is a pleasure to name this species after our friend Carlos Turiel (Neuss, Germany), who is a young scorpologist especially devoted to the genus *Androctonus*.

DIAGNOSIS. Adults large (females 73–88 mm, adult males unknown) for the genus. Coloration basically dark reddish brown; pedipalps and legs apically yellowish. Pedipalps long and slender, with hand conspicuously narrower than patella and weakly carinate; fixed and movable fingers with 14–15 principal rows of denticles, basal lobe/notch combination absent. Carapace densely granulate, with anterior and posterior median carinae strong. Sternite V with a smooth patch in both sexes (larger and bulkier in males), III without carinae, IV–V with two carinae, VI–VII with four carinae. Metasoma robust and deep (females have segments I–III wider than long, and all segments wider than deep), with 10-10-8-8-5 complete to essentially complete carinae, most of which are coarsely serrate to crenulate; segments II–IV dorsolateral carinae with 1–2 enlarged terminal denticles; segment V ventrolateral carinae with 4–5 acutely flared denticles and anal arch with 3–5 poorly defined crenate lobes; all intercarinal spaces densely granulate. Telson slender, with vesicle small but somewhat globose, and aculeus remarkably longer than vesicle. Leg bristlecombs well developed on I–III, poorly defined on IV. Pectines with 28 teeth in males and 21–23 in females.



Figures 19–25: *Androctonus turieli* sp.n. Figures 19–20. Dorsal (19) and ventral (20) views, ♀ paratype (FKCP). Figures 21–25. Carapace with chelicerae and tergite I (21), pectinal area (22), sternites III–VII (23), tarsomeres of third (24) and fourth (25) right legs, ♀ holotype.



Figures 26–31: *Androctonus turieli* sp. n., pedipalp chela dorsal (26) and external (27), pedipalp patela dorsal (28) and external (29), pedipalp femur dorsal (30), and right movable finger internal (31), ♀ holotype.

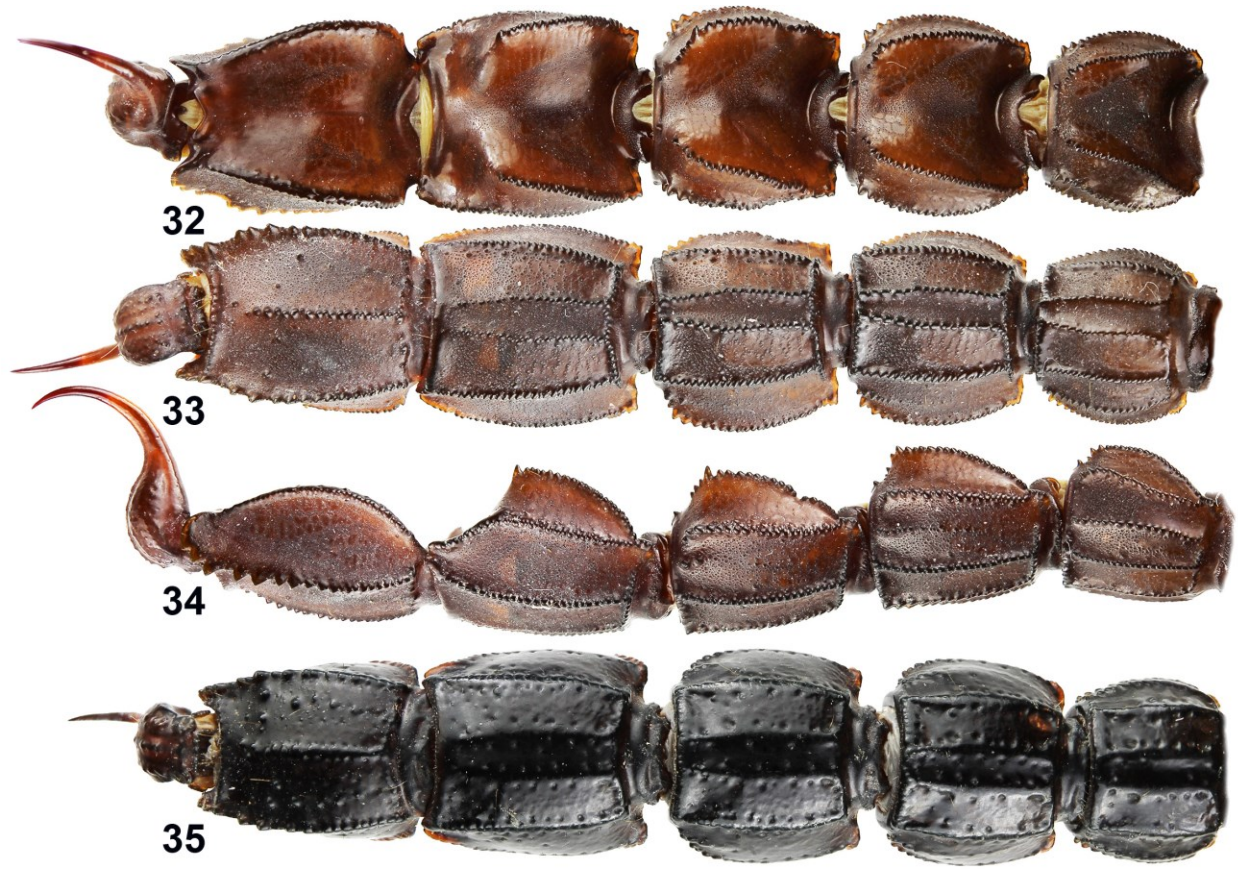
DESCRIPTION (adult female holotype). Coloration (Figs. 19–34) uniformly dark reddish brown to unaided eye; ocular tubercles, eyes and distal part of aculeus blackish. Chelicerae very deeply infuscate. Pedipalps and legs progressively lighter apically, becoming yellowish, with carinae subtly infuscate and very faint traces of dark reticulations between carinae. Pectines yellow. Sternite V with the smooth patch yellow. Metasoma with carinae infuscate. Telson uniformly dark reddish brown, only with distal half of aculeus darker.

CHELICERAE (Fig. 21). With dentition typical for the genus; tegument polished and smooth except on dorso-distal portion of manus, which possesses coarse granules arranged in longitudinal ridges.

CARAPACE (Fig. 21). Trapezoidal, slightly wider than long and with all carinae strongly granulose, but not

fused into any particular configuration; tegument very densely covered by granules of all sizes; anterior margin very shallowly V-shaped (almost straight), with one pair of stout macrosetae; median eyes separate by much more than one ocular diameter; five pairs of lateral eyes: three large and aligned, plus two small and slightly offset.

MESOSOMA (Figs. 22–23). Tergites very densely covered by granules of all sizes; I without carinae, II–VI with three carinae (median and submedians), which are moderate to strong and granulose, but not projected beyond posterior margin; VII with five carinae (median, submedians and laterals) which are strong and serrate. Sternum standard for the genus: type 1, relatively small, and markedly triangular in shape. Pectines long (reaching leg IV coxa/trochanter joint), narrow and densely setose; tooth count 22/22; basal plate heavily sclerotized



Figures 32–35: Figures 32–34. *Androctonus turieli* sp. n., metasoma and telson dorsal (32), ventral (33) and lateral (34) views, ♀ holotype. Figure 35. *Androctonus sergenti* Vachon, 1948, metasoma and telson ventral, ♂, Morocco, Anti Atlas Mts., 62 km southeast of Agadir, 30°03.35'N 09°04.4'W, 798 m a. s. l. (FKCP).

and wider than long, anterior margin with strong median indentation, posterior margin widely convex. Sternites very sparsely setose; III–VI smooth and glossy, with well-developed granulate lateral areas and spiracles very elongate and slit-like, VI finely and very densely granulate; III without carinae, IV–V with a pair of lateral carinae that surrounds spiracles anteriorly and internally reaching posterior margin of sternite, VI with two pairs of carinae (a very weakly granulate to subcostate ventrosulmedian pair and a serrate lateral pair), VII with the same two pairs of carinae, all strongly serrate; sternite V with smooth patch medium-sized, subtriangular to subcordate, moderately bulky, sulcate along midline, and yellow.

METASOMA AND TELSON (Figs. 32–34). Metasoma essentially glabrous, with all segments robust and deep (I–III wider than long, IV–V longer than wide; all segments wider than deep); intercarinal tegument of dorsal surface of I–IV smooth but with a large arrowhead-shaped granulate patches medially, flanked by a few finely granulate reticulations, of lateral and ventral surfaces densely granulate and forming a clearly reticulate

pattern; dorsal furrow moderately shallow and narrow on all segments; I–II with ten complete to almost complete carinae (lateral inframedian carinae becomes less defined on the basal third of II), III–IV with eight (even though two coarse granules remain as vestiges of the lateral inframedian carinae on the distal portion of II), and V with five: dorsolateral carinae on I–IV strongly serrato-crenulate to subdentate and progressively raised with 1–2 enlarged terminal denticles, lateral supra-median carinae strongly serrato-crenulate to subdentate and progressively raised on I–IV, moderately granulate and even on V, lateral inframedian carinae strongly serrato-crenulate on I, moderately granulate to denticulate and progressively raised on II, ventrolateral carinae strongly serrato-crenulate to subdentate and even on I–IV, strongly dentate and progressively raised distally on V with 4–5 acutely flared denticles, anal arch with 3–5 very poorly defined round lobes, ventrosulmedian carina on V strongly serrate to denticulate. Telson slender and sparsely setose; vesicle small but somewhat globose (1.34 times longer than wide, 1.13 times wider than deep), tegument glossy, with abundant coarse but

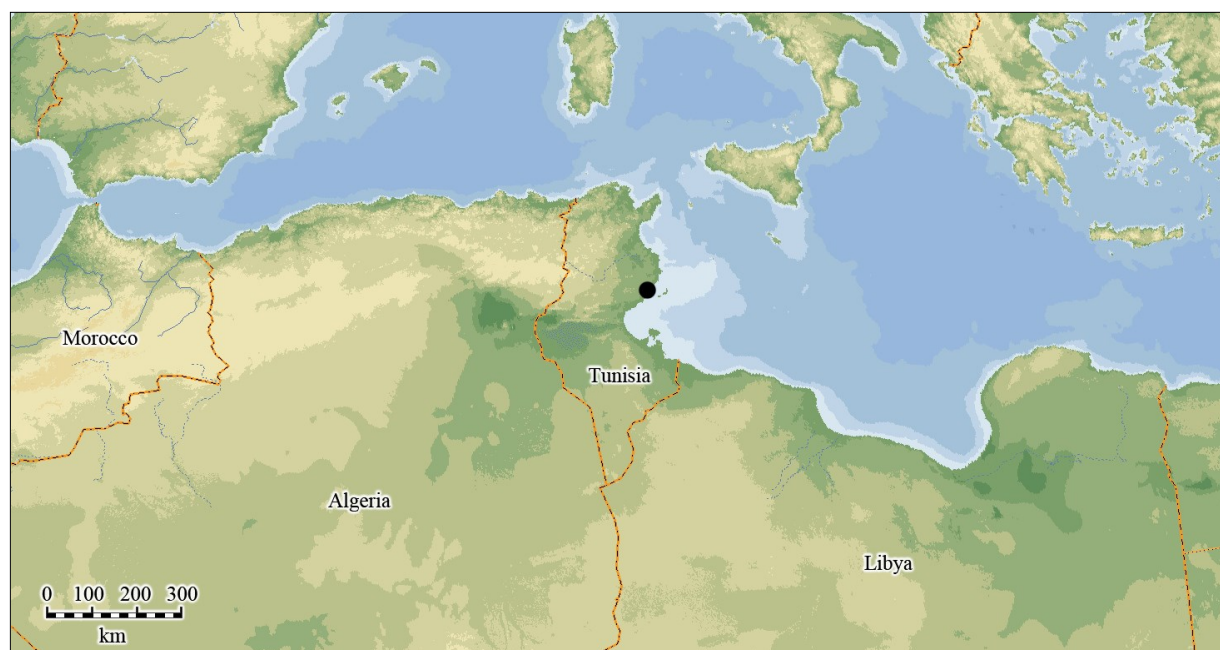


Figure 36: Type locality of *Androctonus turieli* sp.n.

weak granules and a coarse ventromedian carinae; subaculear tubercle absent; aculeus very long and moderately thick, markedly longer than vesicle, and evenly curved.

LEGS (Figs. 24–25). Legs long, slender, and only sparsely setose; bristlecombs well-developed on I–III, poorly defined on IV; all carinae smooth to subserrate; intercarinal tegument coriaceous; tibial spurs absent from I–II, very large on III–IV; prolateral and retrolateral pedal spurs long and slender in all legs; ventral surface of all tarsomere II sharply edged and with two very irregular ventrosubmedian rows of thin spiniform setae, without median row of spinules; claws long and evenly curved.

PEDIPALPS (Figs. 26–31). Pedipalps long and slender, essentially glabrous and orthobothriotaxic A-β. Femur slender and straight; all carinae moderate and finely granulose to denticulate; intercarinal tegument very finely and densely granulose. Patella slender and straight; all carinae moderate and finely granulose to costate; intercarinal tegument irregularly but finely granulose. Chela with hand narrower than patella, oval (1.58 times longer than wide) and with all carinae obsolete to weakly costate, intercarinal tegument coriaceous, with abundant minute granules on all surfaces; fingers long and slender (movable finger 2.50 times longer than underhand), evenly curved and with basal lobe/notch combination absent, fixed fingers with 15 principal rows of granules; movable fingers with 15 principal rows of granules and three terminal granules (large terminal denticle not included).

MALE (juvenile paratypes). Primary characters (i.e., not maturity-dependent) that evidence sexual dimorphism

are: **1)** genital papillae present; **2)** pectines larger and with much higher tooth counts.

VARIATION. The size differences among adults studied by us indicate the existence of two size-classes in females (Tab. 2). Diagnostically relevant morphometric ratios revealed to be positively correlated to size: the holotype and same-sized paratype (RTOC) are very similar, but the larger paratype (FKCP) has metasomal segments and pedipalps slightly more robust (Tab. 3). This correlation is a very common occurrence among scorpions and has already been documented in other members of this genus studied recently (Kovařík & Ahmed, 2013; Teruel et al., 2013).

Count of teeth per pecten varied in females as follows: 21 (1), 22 (3), and 23 (2); both juvenile male possess 28/28. Most fingers possess 15 principal rows of denticles, but in a few the two basalmost rows are poorly defined or fused to yield a count of 14.

AFFINITIES. Amongst the 22 species currently recognized as valid in this genus (Turiel, 2013; Teruel et al., 2013), only *A. bicolor*, *A. tenuissimus*, and *A. sergenti* do share with *A. turieli* sp.n. the following combination of three characters in adults of both sexes: **1)** coloration uniformly dark reddish brown to blackish; **2)** pedipalps very slender, with chelae much narrower than patella; **3)** pedipalp fingers without basal lobe/notch combination. All other species of *Androctonus* which have the same coloration also possess adult pedipalp chelae wider than patella, and with basal lobe/notch combination of fingers present at least in males.

Ratios	<i>A. bicolor</i> (n = 10)	<i>A. turieli</i> sp. n. (n = 3)	<i>A. tenuissimus</i> (n = 6)
Metasomal segment I (L/W)	0.80	0.87–0.88	1.02
Metasomal segment II (L/W)	0.76–0.87	0.90–0.91	1.02–1.08
Metasomal segment III (L/W)	0.75–0.79	0.91–0.93	1.01–1.07
Metasomal segment IV (L/W)	0.96–0.99	1.10–1.17	1.17–1.31
Metasomal segment V (L/W)	1.07–1.23	1.24–1.35	1.38–1.63
Total (L) / Pedipalp (L)	2.35–2.61	2.48–2.88	2.26–2.49
Pedipalp femur (L/W)	3.20–3.43	3.36–3.41	4.05–4.40
Pedipalp patella (L/W)	2.84–3.08	3.07–3.18	3.71–4.04
Pedipalp chela (L/W)	5.64–6.45	5.48–5.54	7.74–8.32
Pedipalp chela (L) / movable finger (L)	1.33–1.38	1.36–1.40	1.31–1.32
Total (L)	64.2–80.9	73.5–87.7	62.7–86.5

Table 3: Comparison between *Androctonus bicolor* and its closest relatives *Androctonus tenuissimus* and *Androctonus turieli* sp. n., based upon selected morphometric ratios of adult females (adult males of the latter are still known), and including type-specimens. Abbreviations: length (L), width (W).

Of them, the easiest to separate is *A. sergenti*: it differs remarkably from *A. bicolor* by having tergite I with three carinae, metasoma smooth and coarsely punctate at least in males (Fig. 35), pedipalps less attenuate, and much more reduced granulation and carination on the body and appendages. Furthermore, *A. sergenti* is locally endemic in a small area of the high Anti-Atlas Mountains of south-central Morocco (Vachon, 1952).

In fact, *A. turieli* sp.n. is most similar to *A. bicolor* and *A. tenuissimus*: apart from exhibiting its own diagnostic attributes, it shares some diagnostic characters with each of these two species and it is also essentially intermediate between them in most morphometric ratios (Tab. 3).

The best characters that unambiguously separate *A. bicolor* from *A. turieli* sp.n. are: **1)** pedipalp fixed and movable fingers with 12–13 and 13–14 principal rows of denticles, respectively; **2)** tergite I with three carinae; **3)** metasoma deeper and more robust, with carinae coarser and intercarinal tegument much less granulate and glossy; **4)** ventrolateral carinae on female metasomal segment V with the flared denticles much more irregular, larger, and lobate in shape; **5)** metasomal segments II–III with lateral inframedian carinae complete and very strong, coarsely granulate. Further, there is a slight but consistent trend in *A. bicolor* to be smaller, darker, and to possess lower pectinal tooth counts.

On the other hand, *A. tenuissimus* can be readily distinguished from *A. turieli* sp.n. by: **1)** pedipalps conspicuously more attenuate, with femur, patella, and chela much longer; **2)** pedipalps with carinae stronger and intercarinal tegument of chela more densely granulate; **3)** tergite I with three carinae; **4)** metasoma less deeper and more slender (all segments longer than wide in females), with all carinae finer.

DISTRIBUTION (Fig. 36). This scorpion is currently known only from the type locality, in the eastern coast of

Tunisia. Most of the records attributed by Vachon (1952) to *A. aeneas aeneas* most likely belong to *A. turieli* sp. n., but need to be verified.

COMMENTS. The taxonomic interpretation of *A. aeneas aeneas* made by Vachon (1952: 126–128) partially matches *A. turieli* sp. n., but the former is a *nomen dubium* (see above under *A. bicolor*).

Comparative material examined

- *Androctonus liouvillei* (Pallary, 1924)
Morocco, Oujda Province, 5 km east of El Aioun, 34°35'N 02°26'W, 28.I.2005, leg. R. H. Fouqu  et S. Be v r, 1♀ (FKCP); Boulemane Province, 32 km northeast of Missouri, 33°15'N 03°47'W, 29.I.2005, leg. R. H. Fouqu  et S. Be v r, 1♂ (FKCP); Djebel Kebdana, northwest of Selouane, 35°00'10"N 02°48'35"W, 250 m a. s. l., 23–25.IV.2009, leg. F. Kovařík, 3♂ 3♀ 2 juveniles (FKCP); Plage Aglou, northwest of Tiznit, 29°45'N 09°54'W, 6 m a. s. l., 6.V.2011, leg. P. Kab tek, 1♂ (FKCP). **Western Sahara**, Abattekh, south of Tan-Tan, 27°46'N 11°32'W, 182 m a. s. l., 7.V. 2011, leg. P. Kab tek, 1 juvenile (FKCP); Saquia el Hamra, north of Smara, 26°51'N 11°56'W, 140 m a. s. l., 8.V.2011, leg. P. Kab tek, 2 juveniles (FKCP). **Algeria**, 70 km from El Bayadh [= Qued Seggeur], 850 m a. s. l., 5.VII.1986, leg. Březina, 1♀ (FKCP).
- *Androctonus sergenti* Vachon, 1948
Morocco, High Atlas, southwest of Marrakech, near Tiznit, 11.V.1972, 1♂ (FKCP); Aoulouz, Al-atlas-al-Kabir, 20.IV.1992, leg. J za et Wrzecionko, 1 juvenile (FKCP); Agadir Province, 62 km southeast of Agadir, 30°03.47'N 09°04.98'W, 11.II.2005, leg. R. H. Fouqu  et S. Be v r, 1♀ 1 juvenile (FKCP);

Anti-Atlas Mts., 62 km southeast of Agadir, 30°03.35'N 09°04.4'W, 798 m a. s. l., 16.V. 2007, leg. F. Kovařík, 1♂ (Fig. 35) 1♀ (FKCP).

- *Androctonus tenuissimus* Teruel, Kovařík et Turiel, 2013
Egypt, Matruh Province, Marsa Matruh, 2011, leg. A. Tolba, 1♂ holotype (RTOC: Sco.0552) 2♀ paratypes (RTOC: Sco-0553); Matruh Province, Ad Dabah, 2011, leg. A. Tolba, 2♀ paratypes (RTOC: Sco-0554) 1♂ 2♀ paratypes (FKCP), 1♀ topotype (FKCP).

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