Revista Ibérica de Aracnología, nº **33** (31/12/2018): 63–72.
Grupo Ibérico de Aracnología (S.E.A.). ISSN: 1576 - 9518.

FURTHER CLARIFICATIONS ON SOME SPECIES OF THE GENUS *TITYUS*, SUBGENUS *ATREUS* (SCORPIONES: BUTHIDAE), FROM COLOMBIA AND ECUADOR, WITH THE DESCRIPTION OF A NEW SPECIES

Wilson R. Lourenço[1] & Eduardo Florez D.[2]

[1] Muséum national d'Histoire naturelle, Sorbonne Universités, Institut de Systématique, Evolution, Biodiversité (ISYEB), UMR7205-CNRS, MNHN, UPMC, EPHE, CP 53, 57 rue Cuvier, 75005 Paris, France. wilson.lourenco@mnhn.fr
[2] Instituto de Ciencias Naturales, Facultad de Ciencias, Universidad Nacional de Colombia, Bogotá.

Abstract: In a recent publication the status of the enigmatic buthid scorpion, *Tityus asthenes* Pocock, 1893 was discussed and clarified. This led to the description of a new species, *Tityus cisandinus* Lourenço & Ythier, 2017 from Ecuadorian Amazonia. All the other populations of *Tityus* (*Atreus*) distributed from Ecuador to Costa Rica, and previously suggested to be associated to *T. asthenes* (*sensu lato*), were suggested to represent possible separate species. In the present study, the neglected species *Tityus rosenbergi* Pocock, 1898, described from San Javier de Cachavi in the north of Ecuador, is re-evaluated and restated as valid. A new species of *Tityus* (*Atreus*) is also described from the rainforests of Choco, in the northern range of Colombia.
Key words: Scorpiones, Buthidae, *Tityus*, *Atreus*, taxonomy, South America.

Aclaraciones adicionales sobre algunas especies del género *Tityus*, subgénero *Atreus* (Scorpiones: Buthidae), de Colombia y Ecuador, y descripción de una especie nueva
Resumen: El estatus del enigmático escorpión bútido *Tityus asthenes* Pocock, 1893, fue recientemente discutido y esclarecido, lo cual condujo a la descripción de una especie nueva, *Tityus cisandinus* Lourenço & Ythier, 2017, de la Amazonia Ecuatoriana, sugiriéndose que todas las otras poblaciones de *Tityus* (*Atreus*) distribuidas desde Ecuador hasta Costa Rica y previamente asociadas a *T. asthenes* (*sensu lato*), pudieran representar especies diferentes. En el presente estudio, *Tityus rosenbergi* Pocock, 1898, descrita de San Javier de Cachavi en el norte de Ecuador y que, hasta ahora, permanecía olvidada, se rescata nuevamente como especie válida. Además, se describe una especie nueva de *Tityus* (*Atreus*), procedente de las selvas tropicales húmedas del departamento de Chocó, en el norte de Colombia.
Palabras clave: Scorpiones, Buthidae, *Tityus*, *Atreus*, taxonomía, Sudamérica.

Taxonomy/Taxonomía: *Tityus* (*Atreus*) *choco* **sp. n.**

Introduction

As already outlined in a previous publication (Lourenço & Ythier, 2017) the buthid scorpion *Tityus asthenes* was originally described by Pocock (1893) from Poruru in Peru, in a paper devoted to the classification of scorpions in general and including description of several new genera and species. No precision, however about the collector of the studied specimen was supplied, situation not uncommon in the publications of Pocock (Lourenço & Ramos, 2004). The description of *T. asthenes* was brief, based on a single female specimen and not followed by any illustrations. The type locality of *Tityus asthenes*, supposedly in Peru, remains unclear since no present locality with this name, including in river systems, exist in this country (Brito & Borges, 2015). Francke (1977) suggested that the correct locality is Paruro in southern Peru, however this corresponds to an arid region not compatible with many species of *Tityus* placed in the subgenus *Atreus*. Consequently, the specimen described by Pocock could have been collected in quite different regions in tropical America. Most certainly, due to a more or less general morphology, *Tityus asthenes* was associated to the group of *Tityus americanus* (= *Scorpio americanus* Linné, 1754) by Pocock (1893). In fact, this group corresponds to several scorpion species defined by a large size, with 60 to 110 mm in total length, presenting, in most cases, long and slender pedipalps in males and with an overall dark coloration. This group corresponded well to the *Tityus asthenes* group of species as defined by Lourenço (2002a), this until the more precise definition of subgenera within *Tityus* (Lourenço, 2006), which placed these large scorpions in the subgenus *Atreus* Gervais.

After the description of *T. asthenes*, several other species were described and associated to this group, namely *Tityus cambridgei* Pocock, 1897 (now *Tityus obscurus* Gervais, 1843), *Tityus championi* Pocock, 1898, *Tityus timendus* Pocock, 1898, *Tityus rosenbergi* Pocock, 1898 and *Tityus nematochirus* Mello-Leitão, 1940. The taxonomic position of these species knew a considerable variation according to different authors (see Lourenço, 1988 for details) and finally, Lourenço (1988) placed a number of these in synonymy of *Tityus asthenes*, largely based on inaccurate biogeographic patterns. Some of these were revalidated, such as *Tityus championi* by Teruel (2011) or *Tityus timendus* by Lourenço (2012). The subsequent discovery and description of several new species belonging to this group of scorpions in the last 30 years, mainly in the Amazon basin, changed the past opinion about their models of distribution and showed that most species could have less extended and much more localised ranges of distribution (Lourenço, 1997a, 2002b, 2011, 2017; see also Lourenço & Ythier, 2017 for details).

In a recent study on some scorpions from Ecuador (Ythier & Lourenço, 2017) re-opened the question about the true identity of some *Tityus* from this country, and in particular that of *Tityus asthenes* reaching different conclusions about the dark species of subgenus *Atreus* distributed in Ecuador. Previously, Lourenço (1988) suggested that *Tityus asthenes* was the most common species of the subgenus *Atreus*, being present in both the cis- and trans-Andean regions of the country. The re-examination of the type material of *Tityus asthenes* clearly attested that this species did not belonged to

the subgenus *Atreus* but rather to the subgenus *Tityus* and to the group of species *Tityus bolivianus* (Lourenço & Maury, 1985; Lourenço & Ythier, 2017). These preliminary clarifications lead to the description of one new species of the subgenus *Atreus* from the Amazon region of Ecuador. Previously to this, both cis- and trans-Andean populations of *Tityus* (*Atreus*) found in Ecuador were considered as a single one (Lourenço, 1988; Brito & Borges, 2015), however Lourenço & Ythier (2017) suggested that these two populations could most certainly be distinct since separated by the Andean mountain system. The trans-Andean populations of *Tityus* subgenus *Atreus* are now associated to the neglected species *Tityus rosenbergi* Pocock, 1898, based both on the examination of the type material but also on new material collected in Tumaco, Colombia, locality very close to the type locality of this species, San Javier de Cachavi (Fig. 1).

Furthermore, the study of specimens from the rainforests in the region of Acandi, Choco Province of Colombia, lead to the description of a new species in the subgenus *Atreus*. This species being distinct both from *Tityus* (*Atreus rosenbergi*) and from *Tityus* (*Atreus*) *championi* (Fig. 1.), two species associated to the former '*Tityus asthenes* group'.

Methods

Illustrations and measurements were produced using a Wild M5 stereo-microscope with a drawing tube and an ocular micrometer. Measurements follow Stahnke (1970) and are given in mm. Trichobothrial notations follow Vachon (1974), while morphological terminology mostly follows Vachon (1952) and Hjelle (1990).

Taxonomic treatment

Family **BUTHIDAE** C. L. Koch, 1837

Genus ***TITYUS*** C. L. Koch, 1836

Subgenus ***Atreus*** Gervais 1843

***Tityus* (*Atreus*) *rosenbergi* Pocock, 1898 (Fig. 2-5, 6-10)**

Tityus rosenbergi Pocock, 1898: 415.
Tityus rosenbergi: Mello-Leitao, 1945: 430.
Tityus rosenbergi: Lourenço, 1988: 683.

TYPE MATERIAL. Ecuador, Esmeraldas Province, San Javier de Cachavi, rain forest, 1898 (Rosenberg leg.) male holotype (NHM-London; examined). New material. Colombia, Nariño, Tumaco, Dimar (1°48'N, 78°45'W, 15 m, 10/III/2015; one male and one female collected during the night with UV light. (Estudiantes Taxonomía Animal, Universidad Nacional de Colombia, leg.), Material now deposited in the Muséum national d'Histoire naturelle, Paris.

DISTRIBUTION. Ecuador (Esmeraldas) and Colombia (Nariño) (Fig. 1).

REVISED DIAGNOSIS BASED ON THE NEW MATERIAL: A moderate species when compared with the average size of other species in the subgenus *Atreus*: male 67.7 mm and female 62.2 mm in total length (see Table I). General pattern of pigmentation reddish-brown to brown overall. Paler than in other Amazonian and Andean species of the subgenus *Atreus*. Basal middle lamella of female pectines dilated, but moderately conspicuous when compared with that of several other species of the subgenus *Atreus*. Subaculear tooth moderately long and spinoid, sharper in female. Pectinal tooth count 22-22 in male and 20-21 in female. Fixed and movable fingers of the pedipalp with 14-15 oblique rows of granules. Ventral carinae of metasomal segments II to IV parallel in configuration. Pedipalps and in particular chela fingers with a weak chetotaxy. Chela without any scalloping on the proximal dentate margin of fixed finger, in both sexes. Trichobothriotaxy A-α (alpha), orthobothriotaxic.

REDESCRIPTION based on male and female from Tumaco, Colombia. Measurements in Table I.

Coloration. Basically, reddish-brown to brown overall. Prosoma: carapace reddish-brown to dark brown with some dark pigment on the carinae. Mesosomal tergites reddish-brown with darker transverse stripes on the posterior edge of tergites I-VI. Metasomal segments I to V reddish-brown; IV and V slightly darker than the others and with some blackish regions over carinae. Vesicle: dark reddish-brown; aculeus reddish-yellow at the base and dark reddish at the tip. Venter reddish-yellow; sternites with dark zones on lateral and posterior edges; sternite V with a white triangular zone on posterior edge, better marked on male; pectines pale yellow to white. Chelicerae reddish-yellow with a dark thread; fingers blackish with dark reddish teeth. Pedipalps: reddish-brown to dark brown; fingers dark, almost blackish with the extremities yellow. Legs reddish-brown to brown.

Morphology. Carapace moderately to strongly granular; anterior margin with a strong concavity. Anterior median superciliary and posterior median carinae moderate. All furrows moderately deep. Median ocular tubercle distinctly anterior to the centre of carapace. Eyes separated by more than one ocular diameter. Three pairs of lateral eyes. Sternum subtriangular. Mesosoma: tergites moderately granular. Median carina moderate in all tergites. Tergite VII pentacarinate. Venter: genital operculum divided longitudinally; each half with a semi-triangular shape. Pectines: pectinal tooth count 22-22 in male and 20-21 in female; basal middle lamellae of the pectines dilated in the female and inconspicuously dilated in male. Sternites with a thin granulation and elongate spiracles; VII with four carinae better marked on female. Metasomal segments with 10-8-8-8-5 carinae, crenulated, better marked on female. Dorsal carinae on segments I to IV with one or two spinoid granules, weakly marked. Lateral inframedian carinae on segment I complete, crenulate; represented by 1-4 granules on II; absent from III and IV. Ventrolateral carinae moderate to strong, better crenulated on female. Ventral submedian carinae crenulate. Intercarinal spaces weakly granular. Segment V with dorsolateral, ventrolateral and ventromedian carinae better crenulated on female. Lateral intercarinal spaces weakly granular on female, smooth on male. Telson granular on both sexes, better marked on male, with long and strongly curved aculeus on both sexes. Dorsal surface smooth in both sexes; ventral surface weakly granular but better marked on male; subaculear tooth spinoid, sharper in female. Cheliceral dentition characteristic of the family Buthidae (Vachon, 1963); movable finger with two well-formed basal teeth; ventral aspect of both fingers and manus with long dense setae. Pedipalps: femur pentacarinate; patella with seven carinae; internal face of patella with several spinoid granules; chela with nine carinae better marked on female; all faces weakly granular. Femur, patella and chela fingers with a weak chetotaxy Fixed and movable fingers with 14-15 oblique rows of granules. Trichobothriotaxy; orthobothriotaxy

Table I. Measurements (in mm) of the male holotype and female paratype of *Tityus cisandinus*, male and female of *Tityus rosenbergi* (Tumaco, Colombia) and male holotype and female paratype of *Tityus choco* sp. n. (Choco, Colombia).*

Characters	*Tityus cisandinus*		*Tityus rosenbergi*		*Tityus choco* sp. n.	
	♂	♀	♂	♀	♂	♀
Total length	72.8	70.1	67.7	62.2	86.5	71.0
Carapace, length	7.6	8.1	7.2	6.9	8.2	7.5
Carapace, anterior width	5.7	5.6	5.3	4.9	5.6	5.5
Carapace, posterior width	7.9	9.0	7.4	7.4	-	-
Mesosoma length	16.9	19.2	16.1	16.6	19.8	20.1
Metasomal segments:						
I length/width	5.8 / 3.8	5.2 / 4.2	5.7 / 3.6	4.9 / 3.5	7.6 / 4.0	5.4 / 3.8
II length/width	7.8 / 3.6	6.3 / 4.1	7.0 / 3.6	6.0 / 3.4	9.4 / 4.0	6.8 / 3.6
III length/width	8.7 / 3.6	7.1 / 4.2	7.7 / 3.4	6.3 / 3.2	10.6 / 4.0	7.4 / 3.6
IV length/width	9.4 / 3.8	8.2 / 4.1	8.5 / 3.4	7.2 / 3.2	11.6 / 4.0	8.3 / 3.6
V length/width/depth	9.9 / 4.0 / 3.8	8.8 / 4.1 / 3.9	8.8 / 3.4 / 3.4	8.1 / 3.2 / 3.2	11.6 / 4.0 / 3.9	8.6 / 3.6 / 3.5
Telson length	6.7	7.2	6.7	6.2	7.7	6.9
Vesicle, width/depth	3.2 / 3.0	2.9 / 2.9	2.8 / 2.6	2.4 / 2.4	3.2 / 3.2	2.8 / 2.8
Pedipalp:						
Femur length/width	9.8 / 2.2	8.4 / 2.4	10.7 / 1.9	7.5 / 2.0	10.5 / 2.3	7.9 / 2.1
Patella length/width	10.1 / 2.6	9.1 / 3.0	11.2 / 2.3	7.7 / 2.6	10.7 / 2.9	8.2 / 3.1
Chela length/width/depth	17.4 / 2.5 / 2.3	15.7 / 2.9 / 2.8	18.2 / 2.0 / 1.8	13.7 / 2.3 / 2.1	17.9 / 3.4 / 3.2	14.5 / 3.0 / 2.9
Movable finger length	11.3	10.8	11.5	9.8	11.3	9.8

*: Chela length/width ratios in males and females: *T. cisandinus*, 6.96/5.41; *T. rosenbergi*, 9.10/5.95; *T. choco* sp. n., 5.26/4.83. For morphometric values of the male holotype of *Tityus festae* refer to Lourenço (1984).

Table II. Variation in the number of pectinal teeth in *Tityus choco* n. sp.

Sex	20-20	20-21	21-21	21-22	22-21	22-22	22-23	23-22	23-23	Total of individuals
Males pre-adults	1	2	3	-	1	3	1	-	-	11
Females	-	1	1	1	1	4	-	1	2	11
Juveniles	-	-	-	1	-	2	-	-	-	3

A-α (alpha) (Vachon, 1974, 1975). Legs: tarsus with numerous short fine setae ventrally.

Tityus (*Atreus*) *choco* sp. n. (Fig. 11-14, 15-23)

Type material. Colombia, Choco, Acandi, Sapzurro, Reserva Taccarcuna, 29/VI/2015 (Carbio team). Male holotype and 12 females, 11 pre-adult males and 3 juvenile paratypes. Holotype (ICN-As-1327-1) and paratypes (ICN-As-1327-2) deposited in the Instituto de Ciencias Naturales de la Universidad Nacional de Colombia, Bogota excepted for one female paratype deposited in the Muséum national d'Histoire naturelle, Paris.

Etymology: The specific name is placed in apposition to the generic name and refers to the geographic region, Choco where the new species was found.

Distribution. Only known from the type locality (Fig. 1).

Diagnosis: A moderate to large species when compared with the average size of other species in the subgenus *Atreus*: male 86.5 mm and female 71.0 mm in total length (see Table I). General pattern of pigmentation blackish-brown to blackish overall. Basal middle lamella of female pectines dilated, but less conspicuous when compared with that of *Tityus rosenbergi*. Subaculear tooth moderately long and spinoid, shorter than that of *Tityus rosenbergi*. Pectinal tooth count 23-23 in male holotype and 21-22 in female paratype (see Table II for variation) Fixed and movable fingers of the pedipalp with 15-15 oblique rows of granules. Ventral carinae of metasomal segments II to IV parallel in configuration. Cheliceral dentition characteristic of the family Buthidae (Vachon, 1963); basal teeth on male fixed finger trifid. Pedipalps and in particular chela fingers with a weak chetotaxy. Chela with a conspicuous scalloping of the proximal dentate margin of fixed finger. Trichobothriotaxy A-α (alpha), orthobothriotaxic. The new species may be an endemic element to the forests of the Pacific Choco.

Description based on male holotype and female paratype. Measurements in Table I.

Coloration. Basically blackish-brown to blackish overall. Prosoma: carapace reddish-brown with some dark pigment on the carinae. Mesosomal tergites blackish-brown with darker carinae. Metasomal segments I to V blackish-brown; IV and V darker than the others; all segments with blackish regions over carinae. Vesicle: blackish-brown; aculeus yellow at the base and dark reddish at the tip. Venter reddish-brown; sternites with paler zones on on the middle zones; sternite V with a white triangular zone on posterior edge, better marked on male; pectines pale yellow to white. Chelicerae reddish-yellow with a dark thread; fingers blackish with dark reddish teeth. Pedipalps: reddish-brown with chela-hand reddish; fingers dark, almost blackish with the extremities yellow. Legs reddish-brown to brown.

Morphology. Carapace moderately to strongly granular; better marked than on *Tityus rosenbergi*; anterior margin with a moderate to strong concavity. Anterior median superciliary and posterior median carinae moderate. All furrows moderately to strongly deep. Median ocular tubercle distinctly anterior to the centre of carapace. Eyes separated by more than one ocular diameter. Three pairs of lateral eyes. Sternum subtriangular. Mesosoma: tergites moderately to strongly granular; better marked on female. Median carina moderate to strong in all tergites. Tergite VII pentacarinate. Venter: genital operculum divided longitudinally; each half with a semi-triangular shape. Pectines: pectinal tooth count 23-23 in male holotype and 21-22 in female paratype; basal middle lamellae of the pectines dilated in the female but not dilated in male. Sternites with a thin granulation and elongate spiracles; VII with four carinae better marked on female. Metasomal segments with

10-8-8-8-5 carinae, crenulated, better marked on female. Dorsal carinae on segments I to IV with one inconspicuous spinoid granule, better marked on female. Lateral inframedian carinae on segment I complete, crenulate; represented by 1-4 granules on segment II of male, but absent on female; absent from III and IV. Ventrolateral carinae moderate to strong, crenulated on female, smooth on male. Ventral submedian carinae crenulate. Intercarinal spaces weakly granular. Segment V with dorsolateral, ventrolateral and ventromedian carinae crenulated on female, less marked on male. Lateral intercarinal spaces moderately granular on female, weak on male. Telson granular on both sexes better marked on female with long and strongly curved aculeus on both male and female. Dorsal surface smooth; ventral surface granular; subaculear tooth spinoid, shorter in male. Cheliceral dentition characteristic of the family Buthidae (Vachon, 1963); movable finger with two well formed, but somewhat reduced, basal teeth; basal teeth on male fixed finger trifid; ventral aspect of both fingers and manus with long dense setae. Pedipalps: femur pentacarinate; patella with seven carinae; internal face of patella with several spinoid granules; chela with nine carinae; all faces weakly granular. Femur, patella and chela fingers with a weak chetotaxy Fixed and movable fingers with 15-15 oblique rows of granules. Trichobothriotaxy; orthobothriotaxy A-α (alpha) (Vachon, 1974, 1975). Legs: tarsus with numerous short fine setae ventrally.

Relationships. The new species can be associated to other species of *Tityus* (*Atreus*) distributed both in the Amazon basin such as *Tityus obscurus* Gervais, *Tityus dinizi* Lourenço, *Tityus apicas* Lourenço and *Tityus tucurui* Lourenço, but in particular with species of *Tityus* (*Atreus*) from the Andean regions of Ecuador and Colombia, namely. *Tityus cisandinus*, and in particular with *Tityus rosenbergi* and *Tityus championi* which have the closer geographic distributions. The new species can however be distinguished by a number of features (i) a quite distinct pattern of coloration, being globally blackish, (ii) marked different morphological values, see table I, (iii) chela with a conspicuous scalloping of the proximal dentate margin of fixed finger, (iv) better marked carinae and granulations, (v) very weak chetotaxie on pedipalps, (v) basal tooth on male cheliceral fixed finger trifid. The new species is a possible endemic element to the northern Choco region of Colombia.

Comments: Teruel (2011) suggested that *Tityus championi* should be considered as an endemic element to a given region of Costa Rica and Panama and stated as follows: "aparentemente *T. championi* constituye un endemismo de la vertiente sur de la Cordillera de Talamanca, en la región fronteriza entre Costa Rica (provincia de Puntarenas) y Panamá (provincial de Chiriquí). Los registros publicados para el oriente de este último país y para Colombia (Pocock, 1902; Lourenço & Méndez, 1984; Flórez, 1991 requieren confirmación, pues posiblemente sean referibles a otras especies". Moreover, as suggested by Lourenço & Ythier (2017), the material cited by Teruel (2011) from Loreto in Peru and associated to *Tityus asthenes*, corresponds in fact to *Tityus cisandinus*, but a full confirmation would require the re-examination of the material, what however is presently not possible since the material is deposited in the private collection of this author and not accessible.

Remarks added to the ms, after the first round revision. One of the preliminary referees suggested that the new species described in this paper was not valid but in fact corresponded to *Tityus festae* Borelli, 1899. This last species was described from Tintin Darién in Panama, based on a single male specimen and remains extremely rare. In fact, after the original description the type specimen remained the only true reference for this species and was used for redescriptions both by Pocock (1902) and Lourenço (1984). In his analysis of *T. festae* Lourenço (1984) confirmed that this species was close related to *Tityus pachyurus* Pocock and *Tityus macrochirus* Pocock, with however a few morphometric differences. This opinion was maintained in subsequent publication of this author (Lourenço & Méndez, 1984; Lourenço, 1997b). It is also important to recall that in a recent publication by Kovařík et al (2013) these authors clearly associate *Tityus festae* to *Tityus pachyurus* within a suggested '*Tityus metuendus*' group. They bases their analysis on the single type specimen – the supposedly 'numerous specimens' examined from Panama, having not be listed -.

Subsequently to this necessary introduction to the status of *T. festae*, we can go back to the pontifical statement of this referee: *'The species the authors intend to describe under the name "Tityus choco" is not new. All its figures (11-23, 28-29) clearly show that it is conspecific with Tityus festae Borelli, 1899, whose holotype (an adult male deposited at Torino Zoology Museum) I have personally examined. By the way, T. festae is widespread in western Panama and northeastern Colombia (in fact, it has been recorded from there in some papers by the first author himself, i.e., WRL). Moreover, it was described from the same geographical area (Darién, in Panama-Colombia border), less than 10 km away from the type-locality of the alleged new species, which is another evidence of the conspecificity of both populations'*.

Several of these statements call for a reply: i) Referee states that he examined the type of *T. festae*; not knowing his ID we cannot be sure about the veracity of this point. In a publication by Chiarly et al. (2012) photos of the habitus of the type of *T. festae* are provided; maybe these photos could correspond to a supposed examination. (ii) *T. festae* would be a widespread species in Western Panama and northeastern of Colombia. In their extensive study about the fauna of Panamá Lourenço & Méndez (1984) examined only the holotype of *T. festae*; no other specimen was available from this country. Since the study by Lourenço (1984) *T. festae* was cited by this author eight times. In all cases all these references concerned only the male holotype, and for Colombia a female from Santa Marta, supposedly associated to this species. During 10 years the authors performed joint field work in Colombia, but no specimens of *T. festae* were collected. (iii) The type localities of *T. festae* and that of the described new species are indeed geographically close, but separated by much more than '10 km'. Besides Acandi, the type locality of the new species is located in the Caribbean Coast of Colombia and isolated from Darién in Panama by the Mountain range of 'Sierra del Darién'.

In conclusion, *T. festae* and the new species are certainly similar, as in fact most species of the *Atreus* subgenus. In most cases, identifications are impossible if not based on both sexes and precise locality data. A few characters bring some support to the new species: (i) a slender body with distinct morphometric values, (ii) dorsal carinae of metasoma without spiniform granules, (iii) chela fingers with 15-15 rows of

granules (iv) a better marked scalloping of proximal dentate margin of fixed finger, (v) cheliceral basal teeth on male fixed finger trifid. To notice that this characters was previosuly observed for *Tityus* (*Atreus*) *generaltheophiloi* Lourenço, 2017, described from Brazil (Lourenço, 2017).

To conclude, most certainly the taxonomy of the *Tityus* species belonging to the subgenus *Atreus* appears as complex and difficult to achieve to conclusive results. The aim of the studies started by Lourenço & Ythier (2017) is to try to bring some clarification to the status of several populations. The complexity of the task leads Lourenço (1988) to suggest the existence of polymorphic species to explain these sometimes minor variations. This solution however, seems not to be the best to explain the observed geographical patterns and the hypothesis of micro-endemic populations appear to fit better to the observed models. Nevertheless, only future detailed studies of micro-biogeographic will be in position to bring definitive answers.

Acknowledgements

We are most grateful to the 'Carbio team' group which collected the scorpion specimens used in the description of the new species. To the Universidad Nacional de Colombia which supported the field trip to Tumaco where the material of *Tityus rosenbergi* was collected. Photos of living specimens of *Tityus choco* sp. n. and of *Tityus rosenbergi* and those of their natural habitats were respectively supplied by Jairo Moreno (arachnologist) and Andrés Meneses (biologist); we are grateful to both. Finally our thanks go to Elise-Anne Leguin (MNHN, Paris) for the preparation of several photos and plates.

Bibliography

BRITO, G. & A. BORGES 2015. A checklist of the scorpions of Ecuador (Arachnida: Scorpiones), with notes on the distribution and medical significance of some species. *Journal of venomous animals and toxins including tropical diseases*, 21: 23. doi 10.1186/s40409-015-0023-x.

CHIARLE, A., F. KOVAŘÍK, L. LEVI & E. GAVETTI 2012. The scorpion collections (Arachnida, Scorpiones) held in the Museo Regionali di Scienze Naturali of Turin (Italy). *Arachnologische Mitteilungen*, **43**: 17-23.

FLÓREZ, E. 1991. Escorpiones de Colombia. Catálogo de Especies. *Cespedesia*, **16-17** (57-58): 117-127.

FRANCKE, O. 1977. Escorpiones y escorpionismo en el Peru VI: Lista de especies y claves para identificar las familias y los géneros. *Revista Peruana de Entomología*, **20**: 73-76.

HJELLE J. T. 1990. Anatomy and morphology. Pp. 9-63, *In*: Polis, G. A. (ed.). *The Biology of Scorpions*. Stanford Univ. Press, Stanford: 587 pp.

KOVAŘÍK F., R. TERUEL, M. A. C. COZIJN & M. SEITER 2013. *Tityus carolineae* sp. n. from Suriname and Guyana (Scorpiones: Buthidae). *Euscorpius,* **178**: 1-9.

LOURENÇO, W. R. 1984. Etude systématique de quelques espèces appartenant au complexe *Tityus forcipula* (Gervais, 1844) (Scorpiones, Buthidae). *Bulletin du Muséum national d'Histoire naturelle*, 4e sér., **6** (A3): 729-739.

LOURENÇO, W. R. 1988. La faune des scorpions de l'Equateur. I. Les Buthidae. Systématique et biogéographie. *Revue suisse de Zoologie*, **95**(3): 681-687.

LOURENÇO, W. R. 1997a. Additions à la faune de scorpions néotropicaux (Arachnida). *Revue suisse de Zoologie*, **104**(3): 587-604.

LOURENÇO, W. R. 1997b. Synopsis de la faune de scorpions de Colombie, avec des considérations sur la systématique et la biogéographie des espèces. *Revue suisse de Zoologie*, **104**(1): 61-94.

LOURENÇO, W. R. 2002a. *Scorpions of Brazil*. Les Editions de L'IF, Paris: 320 pp.

LOURENÇO, W. R. 2002b. Nouvelles additions à la faune de scorpions néotropicaux (Arachnida). *Revue suisse de Zoologie*, **109**(1): 127-141.

LOURENÇO, W. R. 2006. Nouvelle proposition de découpage sous-générique du genre *Tityus* C. L. Koch, 1836 (Scorpiones, Buthidae). *Boletin de la Sociedad Entomologica Aragonesa*, **39**: 55-67(*).

LOURENÇO, W. R. 2011. The distribution of noxious species of scorpions in Brazilian Amazonia: the genus *Tityus* C. L. Koch, 1836, subgenus *Atreus* Gervais, 1843 (Scorpiones, Buthidae). *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg*, **15**(185): 287-301.

LOURENÇO, W. R. 2012. *Tityus* (*Atreus*) *timendus* Pocock, 1898 (Scorpiones, Buthidae), an enigmatic scorpion from Ecuador. *Acta biologica Paranaense*, Curitiba, **41**(1-2): 1-8.

LOURENÇO, W. R. 2017. Scorpions from Brazilian Amazonia, with a description of two new species from 'Serra da Mocidade National park in the State of Roraima (Scorpiones: Buthidae, Chactidae). *Arachnida – Rivista Aracnologica Italiana,* **12**: 2-17.

LOURENÇO, W. R. & E. A. MAURY 1985. Contribution à la connaissance systématique des scorpions appartenant au 'complexe' *Tityus bolivianus* Kraepelin, 1895 (Scorpiones, Buthidae). *Revue Arachnologique*, **6**(3): 107-126.

LOURENÇO, W. R. & E. MENDEZ 1984. Inventario preliminar sobre la fauna de escorpiones de Panamá, con algunas consideraciones taxonómicas y biogeográficas. *Revista de biología tropical*, **32**(1): 85-93.

LOURENÇO, W. R. & E. C. B. RAMOS 2004. New considerations on the status of *Tityus magnimanus* Pocock, 1897 (Scorpiones Buthidae), and description of a new species of *Tityus* from the State of Roraima, Brazil. *Revista Ibérica de Aracnologia*, **10**: 285-291(*).

LOURENÇO, W. R. & E. YTHIER 2017. Description of *Tityus* (*Atreus*) *cisandinus* sp. n. (Scorpiones: Buthidae) from Ecuadorian Amazonia, with comments on some related species. *Arachnida – Rivista Aracnologica Italiana*, **15**: 18-34.

MELLO-LEITÃO, C. DE 1945. Escorpiões sul-americanos. *Arquivos do Museu Nacional*, **40**: 7-468.

POCOCK, R. I. 1893. Notes on the classification of scorpions, followed by some observations upon synonymy, with descriptions of new genera and species. *Annals and Magazine of Natural History*, Ser. 6, **12**: 303-330.

POCOCK, R. I. 1898. Descriptions of some new scorpions from Ecuador. *Annals and Magazine of Natural History* (**7**), 1: 413-422.

POCOCK, R. I. 1902. *Arachnida, Scorpiones, Pedipalpi and Solifugae.* Biologia Centrali-Americana. Taylor & Francis, London. 71 pp.

STAHNKE, H. L. 1970. Scorpion nomenclature and mensuration. *Entomological News*, **81**: 297-316.

TERUEL, R. 2011. La verdadera identidad de *Tityus championi* Pocock, 1898 (Scorpiones: Buthidae). *Boletin de la Sociedad Entomologica Aragonesa*, **48**: 367-373(*).

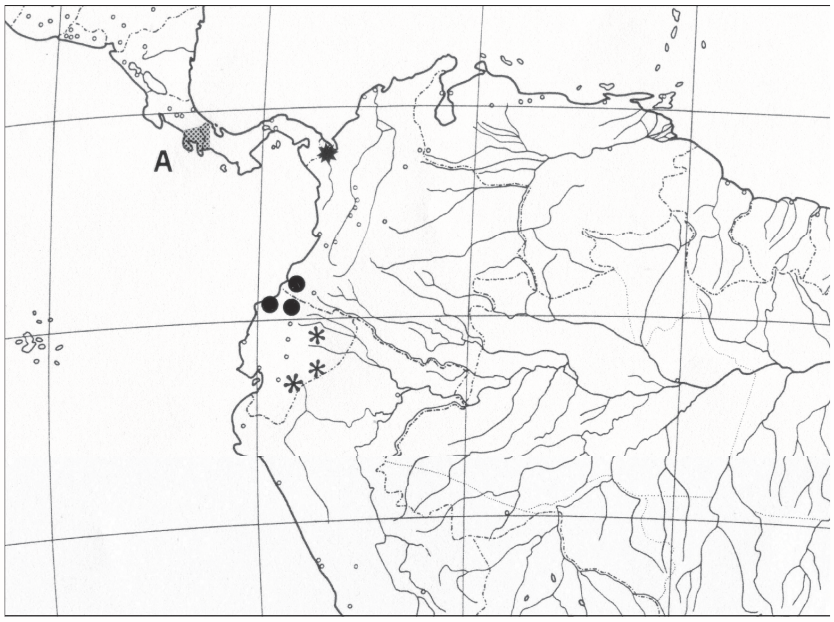
VACHON, M. 1952. *Etude sur les Scorpions*. Institut Pasteur d'Algérie, Alger: 482 pp.

VACHON, M. 1963. De l'utilité, en systématique, d'une nomenclature des dents des chélicères chez les Scorpions. *Bulletin du Muséum national d'Histoire naturelle*, 2e sér., **35**(2): 161-166.

VACHON, M. 1974. Etude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bulletin du Muséum national d'Histoire naturelle*, 3è sér., n° **140**, Zool. 104: 857-958.

VACHON, M. 1975. Sur l'utilisation de la trichobothriotaxie du bras des pédipalpes des Scorpions (Arachnides) dans le classement des genres de la famille des Buthidae Simon. *Comptes Rendus des Séances de l'Académie des Sciences*, **281**(D): 1597-1599.

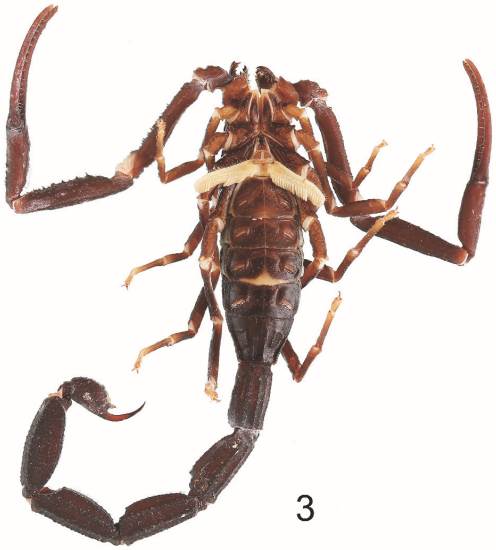
(*) References available at www.sea-entomologia.org



1



2



3

1 cm



4



5

Fig. 1. Map of Western South America, including Panama and Costa Rica showing the known distributions of *Tityus cisandinus* (black flower), *Tityus rosenbergi* (black circles), *Tityus championi* (dashed area indicated A) and *Tityus choco* sp. n. (black star).**Fig. 2-5.** *Tityus rosenbergi*, habitus of male and female from Tumaco, Colombia, showing dorsal and ventral aspects. **2-3**. Male. **4-5**. Female.

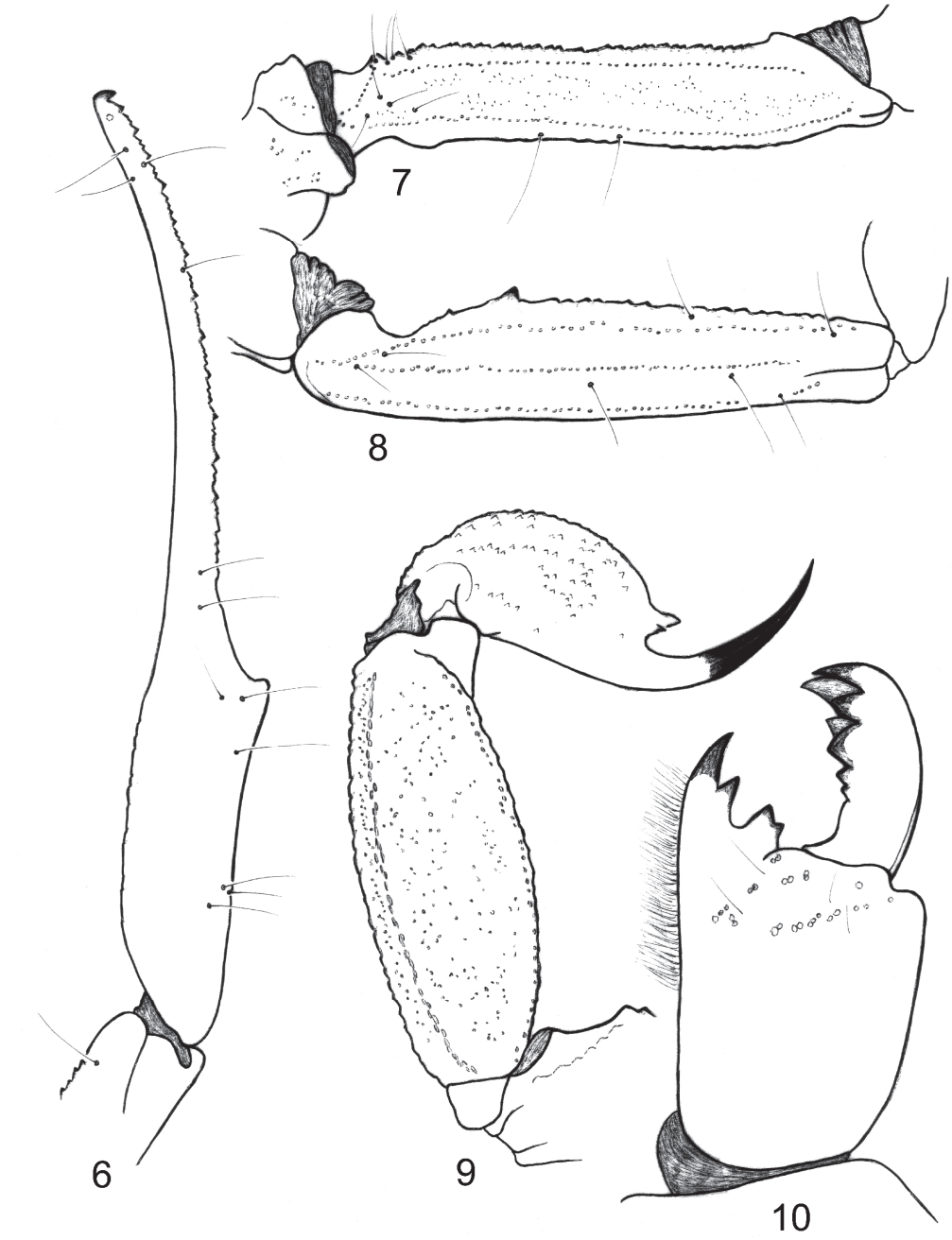


Fig. 6-10. *Tityus rosenbergi,* male from Tumaco. **6-8**. Trichobothrial pattern. **6**. Chela, dorso-external aspect. **7**. Femur, dorsal aspect. **8**. Patella, dorsal aspect. **9**. Metasomal segment V and telson, lateral aspect. **10**. Chelicera, dorsal aspect.

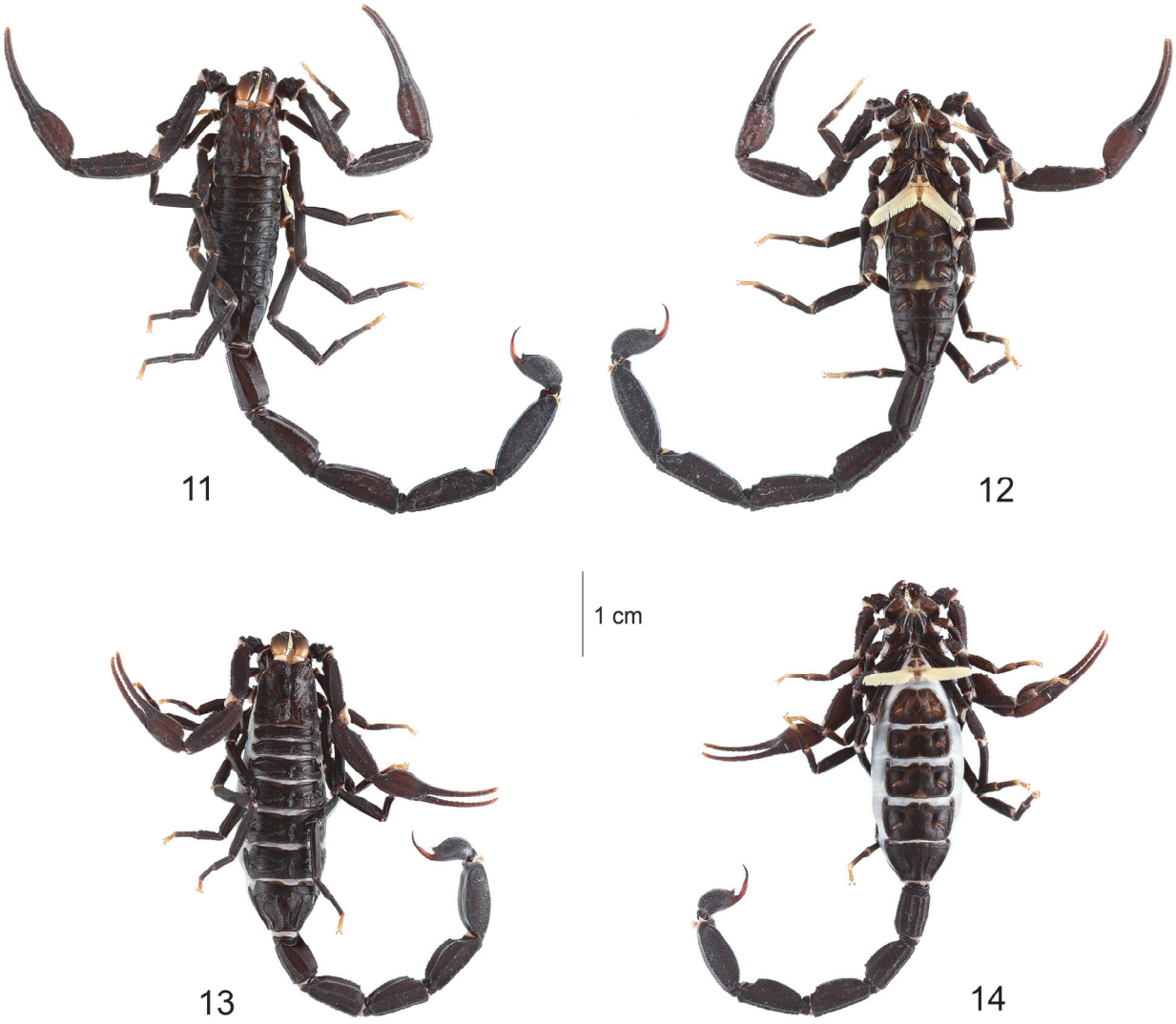


Fig. 11-14. *Tityus choco* sp. n., habitus of male holotype and female paratype from Choco, Colombia, showing dorsal and ventral aspects. **11-12**. Male. **13-14**. Female.

►

Fig. 15-18. *Tityus choco* sp. n. Male holotype (**15**, **17-18**) and female partaype (**16**). **15-16**. Metasomal segment V and telson, lateral aspect. **17** Cutting edge of movable finger. **18**. Chelicera, dorsal aspect with fixed finger on detail. **Fig. 19-23.** *Tityus choco* sp. n. Male holotype. Trichobothrial pattern. **19-20**. Chela, dorso-external and ventral aspects. **21-22**. Patella, dorsal and external aspects. **23**. Femur, dorsal aspect.

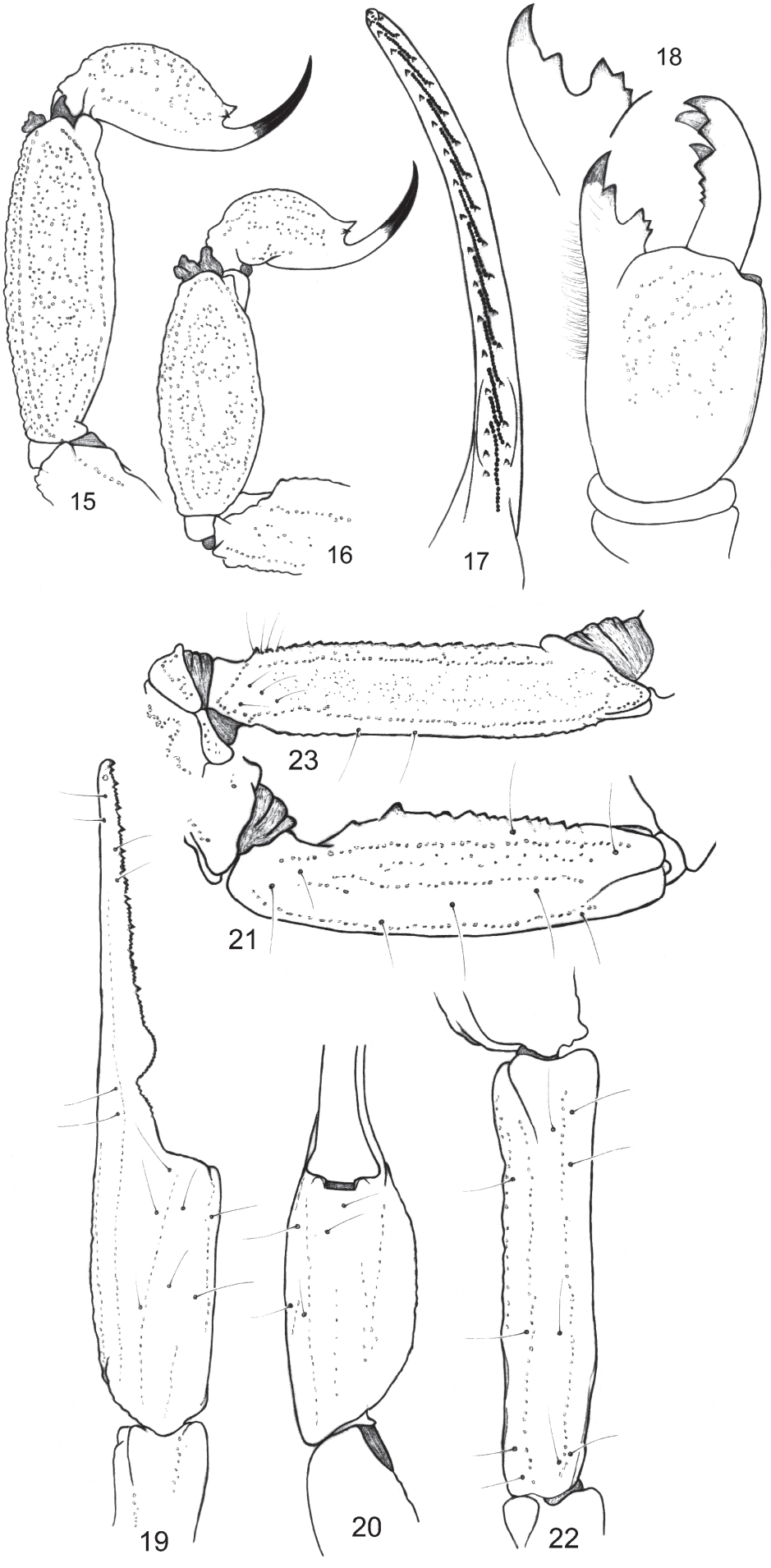

15
16
17
18
19
20
21
22
23



Fig. 24- 29. 24. Natural habitat (rainforest) of *Tityus rosenbergi* in Tumaco. **25**. *Tityus rosenbergi*, female alive in natural habitat. **26**. Natural habitat (rainforest) of *Tityus choco* sp. n. in Acandi. **27**. Idem, showing micro-habitat. **28**-**29**. Male and female alive of *Tityus choco* sp. n. in natural habitat.