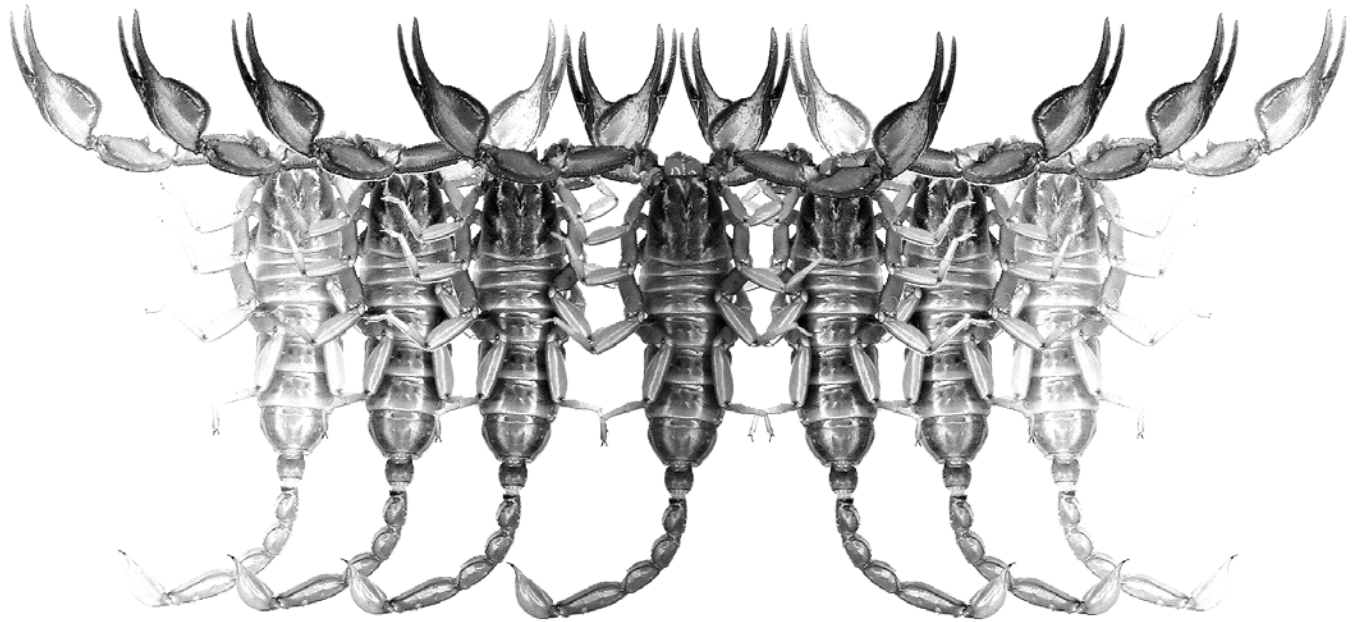


Euscorpium

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**Rare or Poorly Known Scorpions from Colombia. II.
Redescription of *Tityus columbianus* (Thorell, 1876)
(Scorpiones: Buthidae)**

Rolando Teruel & Luis Fernando García H.

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Euscorpius

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Rare or poorly known scorpions from Colombia. II. Redescription of *Tityus columbianus* (Thorell, 1876) (Scorpiones: Buthidae)

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Summary

A fully illustrated redescription is herein presented of *Tityus columbianus* (Thorell, 1876). It includes a description of the adult male, an update of its geographical distribution, and detailed information about age-related individual variation, with comments on the taxonomy of the “*Tityus clathratus*” group.

Introduction

Amongst other nomenclatural acts contained in a well known paper, Thorell (1876) described both the new genus and species *Phassus columbianus* on the basis of a single female specimen from Bogotá, Colombia. Later, Pocock (1897) listed this species under the genus *Tityus*. C. L. Koch, 1836 in a key, and the species has since remained valid as *Tityus columbianus*. It was treated in detail by Mello-Leitão (1945) in his monumental monograph on South-American scorpions, but was unfortunately mistaken for more than one species (see below). Last, Lourenço (1984) confirmed the validity of *T. columbianus*, rediagnosed and briefly illustrated it on the basis of the holotype and additional female specimens, but did not redescribe the species.

After this, *T. columbianus* became widely mentioned in the literature published about Colombian scorpions (Lourenço, 1991a, 1991b, 1992, 1997, 1998, 1999a, 1999b, 2000, 2002; Lourenço & Flórez, 1990; Lourenço & Cuéllar, 1994; Lourenço et al., 1996, 2000; Lourenço & Otero Patiño, 1998; Fet & Lowe, 2000; Flórez, 2001; Bohórquez et al., 2005; Kovařík, 2007), but only additional capture records or information about its reproduction was recorded. Nothing else was added about taxonomic implications, and the adult male remained undescribed in spite of being repeatedly mentioned in the literature for more than 15 years (Lourenço, 1991b, 1997; Lourenço & Cuéllar, 1994; Lourenço et al., 1996, 2000; Kovařík, 2007). Due to this dichotomy, *T. columbianus* has become a very peculiar case, with a well known reproductive biology but taxonomically obscure.

As a part of a joint research project on the systematics of Colombian scorpions, one of the authors (LFGH) and some of his collaborators undertook extensive field work in several areas of Colombia; an effort that has already yielded several important discoveries of both undescribed and poorly known species (Teruel & García, 2007a, 2007b; Teruel & Roncallo, 2007; R. Teruel, L. F. García & C. A. Roncallo, unpublished data). Among them, 22 specimens of *T. columbianus* were collected in a locality from Boyacá Department, which represents a new record for this species. We immediately noticed for this sample that among adult males there were several different size classes, which also differ in some morphological features that are widely used to diagnose species in this subgenus, and decided to study carefully this situation in order to elucidate whether this was an unsuspected case of age-related individual variation, or there were two different species in the sample. As the first case proved to be true, then we prepared the present contribution, which includes a detailed and fully illustrated redescription of *T. columbianus*, and some comments about the taxonomy of the subgenus.

Methods & Material

This redescription is entirely based upon the samples herein examined, but all previously published data of the holotype and other credible conspecific specimens have also been included. All specimens were studied, measured and photographed under a Zeiss Stemi 2000-C stereomicroscope, equipped with line scale and grid

Dimensions		♂	♂	♂	♂	♀	♀
Carapace	L/Wp	3.30/3.60	3.75/3.85	4.25/4.50	4.95/4.70	3.80/4.25	4.00/4.55
Mesosoma	L	7.15	7.65	8.60	9.00	9.00	9.60
Tergite VII	L	2.10/3.25	2.25/3.50	2.50/3.75	2.75/4.00	2.30/4.15	2.35/4.35
Metasoma	L	19.30	20.85	24.90	25.95	20.10	21.00
Segment I	L/W	2.15/1.90	2.35/2.10	2.75/2.50	2.85/2.60	2.05/2.20	2.25/2.40
Segment II	L/W	2.70/1.85	2.80/2.00	3.50/2.35	3.60/2.45	2.60/2.10	2.85/2.25
Segment III	L/W	3.00/1.95	3.25/2.05	3.90/2.40	4.05/2.60	3.05/2.10	3.10/2.25
Segment IV	L/W	3.60/2.15	4.00/2.20	4.75/2.45	4.90/2.65	3.75/2.10	3.85/2.25
Segment V	L/W	4.10/2.20	4.40/2.40	5.15/2.85	5.35/3.05	4.30/2.15	4.40/2.30
Telson	L	3.75	4.15	4.85	5.20	4.35	4.55
Vesicle	L/W/H	2.10/1.20/1.15	2.30/1.30/1.25	2.75/1.60/1.55	2.85/1.70/1.60	2.30/1.35/1.25	2.40/1.50/1.30
Aculeus	L	1.65	1.85	2.10	2.35	2.05	2.15
Pedipalp	L	12.60	13.85	16.55	17.30	14.50	14.90
Femur	L/W	3.10/1.00	3.35/1.05	4.15/1.15	4.15/1.25	3.90/1.15	4.00/1.20
Patella	L/W	3.35/1.35	3.70/1.55	4.40/1.75	4.65/1.85	3.90/1.55	4.00/1.60
Chela	L	6.15	6.80	8.00	8.50	6.70	6.90
Hand	L/W/H	2.25/1.50/1.55	2.75/1.85/1.95	3.25/2.45/2.50	3.50/2.65/2.75	2.20/1.30/1.10	2.30/1.40/1.30
Movable finger	L	3.90	4.05	4.75	5.00	4.50	4.60
Total	L	29.75	32.25	37.75	39.90	32.9	34.60

Table 1: Measurements of six adults of *Tityus columbianus* from Chiquinquirá. Abbreviations: length (L), width (W), posterior width (Wp), depth (H).

ocular micrometers, and a Canon PowerShot A620 digital camera, all calibrated to 20x. Digital images were slightly processed with Adobe Photoshop® 8.0, only to optimize brightness and contrast. Nomenclature and measurements follow Stahnke (1970), except for trichobothriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977) and sternum (Soleglad & Fet, 2003). In Table 1, all measurements are given in millimeters as length/width/depth except for the carapace, where these correspond to length/posterior width. To avoid an unnecessarily extended synonymy, only those papers which include information relevant to the purposes of this article have been included, such as the original description, redescriptions, nomenclatural changes, and records of males and new localities. All specimens are deposited in the authors' personal collections (RTO and LFGH, respectively), with both collecting and identification labels originally written in Spanish (transcribed here into English).

Systematics

Tityus columbianus (Thorell, 1876)

(Figures 1–7, Tables 1–4)

Phassus columbianus Thorell, 1876: 8.

Tityus columbianus: Pocock, 1897: 520; Mello-Leitão, 1945: 299, 305, 322–325, figs. 131–132; Lourenço,

1984: 352, 355–358, figs. 16, 18, tabs. I–II; Lourenço & Flórez, 1990: 72; Lourenço, 1991b: 275, fig. 1 (in part, except record from Angelópolis); Lourenço, 1992: 476–480, fig. 5, tab. I (in part, except record from Angelópolis); Lourenço, 1997: 62, 71 (in part, except record from Angelópolis); Lourenço, 1998: 492–494, fig. 4; Lourenço & Otero Patiño, 1998: 301, 303; Lourenço, 1999a: 4–5, fig. 7; Lourenço, 1999b: 124; Fet & Lowe, 2000: 239; Lourenço, 2000: 456–458, fig. 13; Flórez, 2001: 28; Bohórquez et al., 2005: 122.

Diagnosis: Species of small size (males 30–40 mm, females 33–35 mm) for the genus. Body light yellowish-brown, very densely spotted with dark to blackish brown, tergites with three moderately well defined dark stripes; metasomal segment V and telson reddish black, pedipalp fingers infusate to sparsely spotted. Pedipalp chela and metasomal segment V inflated and globular in larger males, but only slightly incrassate in smaller males. Sternite V with a smooth and whitish triangular patch on posterior fourth in both sexes, noticeably larger in males. Dorsolateral carinae of metasomal segments II–IV with distal tooth enlarged, more so in smaller males and females. Telson vesicle coarsely granulose; subaculear tubercle large and conical with two large dorsal granules. Pedipalp fixed finger with 12–13 principal rows of granules, movable finger with 12–14; basal lobe/notch combination weak to vestigial in

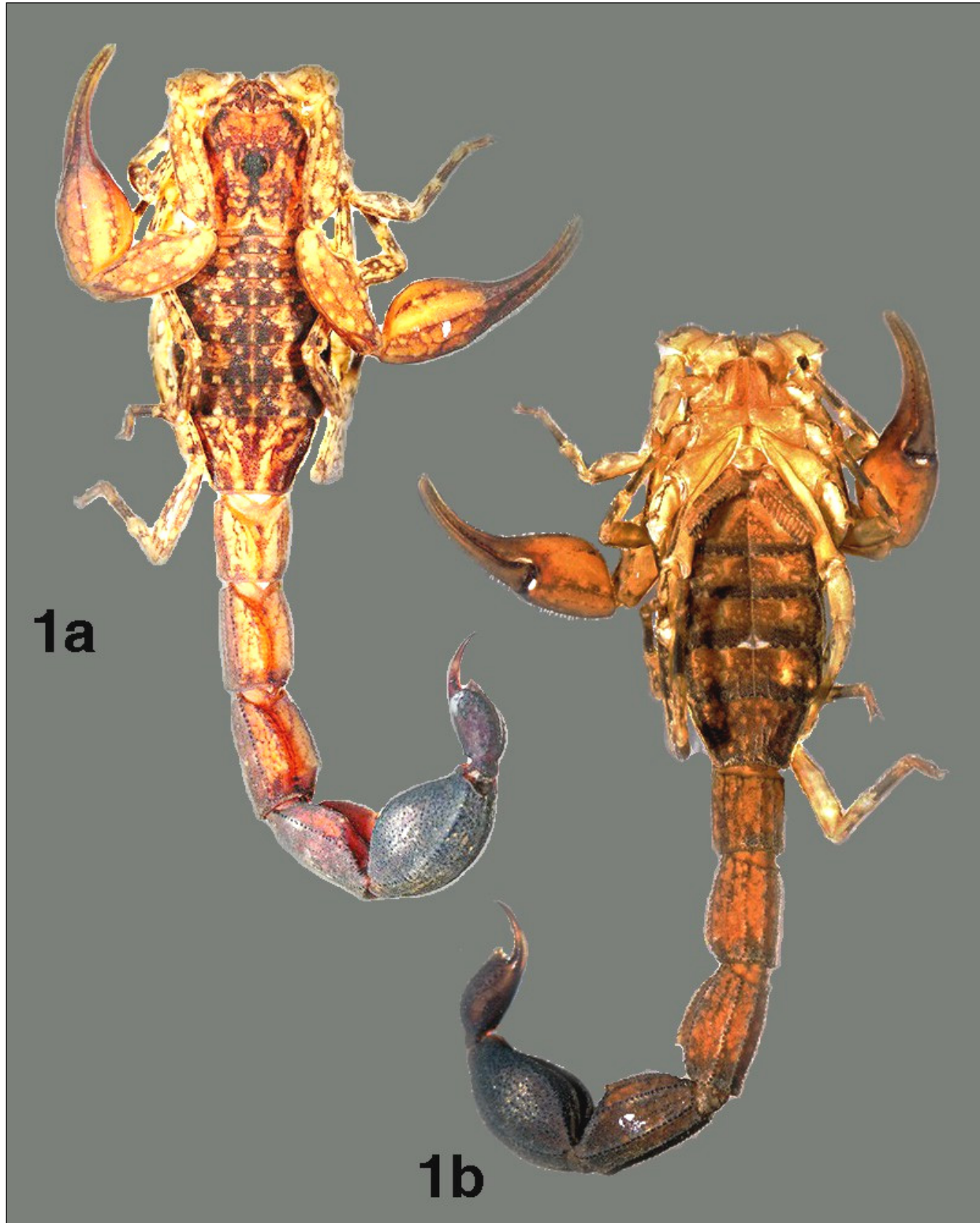


Figure 1: Large adult male of *Tityus columbianus* from Chiquinquirá: **a)** entire dorsal view; **b)** entire ventral view.



Figure 2: Large adult male of *Tityus columbianus* from Chiquinquirá: **a)** prosoma, dorsal view; **b)** pedipalp, dorsal view; **c)** sternopectinal region, ventral view; **d)** pecten, ventral view; **e)** sternites V–VI, ventral view; **f)** metasomal segments II–IV, lateral view; **g)** metasomal segments IV–V and telson, lateral view.

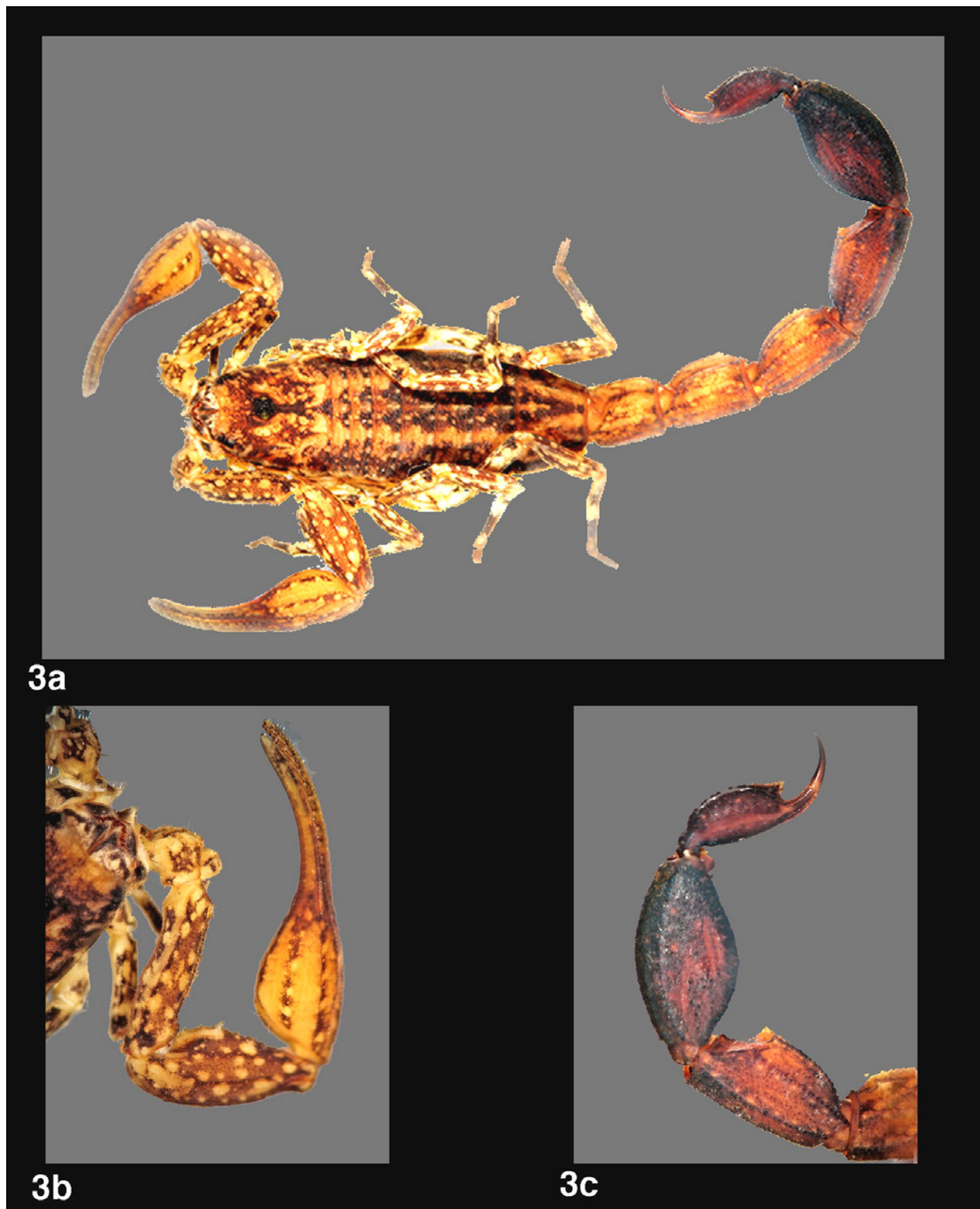


Figure 3: Small adult male of *Tityus columbianus* from Chiquinquirá: **a)** entire dorsal view; **b)** pedipalp, dorsal view; **c)** metasomal segments IV–V and telson, lateral view.

males, obsolete in females. Pectines with 12–15 teeth in males, and 12–13 in females; basal middle lamella not dilated.

Type data: Adult ♀ holotype (NMG-Scorp.42): “America merid., Columbia, Bogota?”. Not examined.

Ratio		♂	♂	♂	♂	♀	♀
1.	Chela (L/W)	4.10	3.68	3.27	3.21	5.15	4.93
2.	Chela (W) / Patella (W)	1.11	1.19	1.40	1.43	0.84	0.87
3.	Mov. Finger (L) / Hand (W)	2.60	2.19	1.94	1.89	3.46	3.29
4.	Metasomal Segm. I (L/W)	1.13	1.12	1.10	1.09	0.93	0.94
5.	Metasomal Segm. V (L/W)	1.86	1.83	1.81	1.75	2.00	1.91
Total (L)		29.75	32.25	37.75	39.90	32.90	34.00

Table 2: Age- and sex-related variation of some morphometric ratios in six adults of *Tityus columbianus* from Chiquinquirá. Abbreviations: length (L), width (W).

Sex	N	Pectinal teeth				Media	SD
		12	13	14	15		
♂♂	22	1	8	9	4	13.73	±0.83
♀♀	20	7	13			12.65	±0.49

Table 3: Variation of pectinal tooth counts in *Tityus columbianus* from Chiquinquirá, including type data given by Thorell (1876) and Lourenço (1984). Abbreviations: number of pectines (N), standard deviation (SD).

Sex	Finger	N	Principal Rows of Granules			Media	SD
			12	13	14		
♂♂	Fixed	20	2	18		12.90	±0.31
	Movable	20		12	8	13.40	±0.50
♀♀	Fixed	20	7	13		12.65	±0.49
	Movable	18	1	17		12.94	±0.24

Table 4: Variation of the number of principal rows of granules of pedipalp fingers in *Tityus columbianus* from Chiquinquirá. Abbreviations: number of fingers (N), standard deviation (SD).

Distribution (Fig. 6): Widespread over arid areas of the high plateau (2200–3100 m a.s.l.) of mid Cordillera Central (Colombian Andes); even though only eight published records can be regarded as confirmed (see "Remarks" below).

Redescription (based upon a large adult male, see "Variation"): **Coloration** (Fig. 1) basically light yellowish brown, with a dense pattern of dark to blackish brown spots all over the body and appendages; metasomal segment V and telson reddish black; chelicerae densely reticulated with blackish brown; pectines pale yellowish, densely spotted with blackish brown. Pedipalps densely spotted with dark brown on femur and patella; chela with carinae and fingers deeply infusate. **Carapace** (Fig. 2a) trapezoidal; carinae indistinct due to densely granulose tegument, with many coarser granules scattered; median eyes separate by more than one ocular diameter; three pairs of lateral eyes. **Tergites** with similar

granulation as on carapace, longitudinal carina strongly granulose; VII with two pairs of serrate lateral carinae. **Chelicerae** (Fig. 2a) with typical dentition for the genus; tegument smooth and shiny. **Pedipalps** (Fig. 2b) orthobothriotaxic A- α . Femur with all carinae serrate, intercarinal tegument densely granulose, with coarser granules scattered. Patella with all carinae moderately costate to granulose, intercarinal tegument with the same granulation as on femur, internal surface with some large and spiniform granules. Chela inflate, much wider than patella; hand with all carinae moderate to weak, costate to subgranulose, intercarinal tegument with the same granulation as on patella but finer; fingers with basal lobe/notch combination weakly developed, fixed finger with 12/12 principal rows of granules, movable finger with 13/14, apical subrow composed by four granules aligned similar to principal rows. **Legs** (Figs. 1a–1b) with all carinae subserrate, intercarinal tegument finely and densely granulose. **Sternum** (Fig. 2c) type 1, sub-



Figure 4: Adult female of *Tityus columbianus* from Chiquinquirá: **a)** entire dorsal view; **b)** entire ventral view.

pentagonal, typical for the group. **Pectines** (Figs. 2c–2d) somewhat small, with large fulcra; pectinal tooth count 14/14; basal middle lamella angulose, but not dilated. **Sternites** (Figs. 2c, 2e) with the same granulation as on tergites, spiracles oval; posterior margin of sternite V with a large and smooth patch, which is bright white, subtriangular and wider than long; sternites VI–VII with two pairs of granulate lateral carinae. **Metasoma** (Figs. 1a–1b, 2f–2g) slightly elongate but conspicuously bulky

distally, with each segment wider and deeper than the preceding, especially on V which is inflate and globular; intercarinal tegument densely granulate and with coarse granules scattered over all segments, but much coarser and denser on V; segments I–II with ten complete carinae, III–IV with eight (even though vestiges of lateral inframedian carinae are present on III as irregularly aligned granules), V with five, all strongly developed and coarsely granulate to crenulate; dorsolateral carinae on

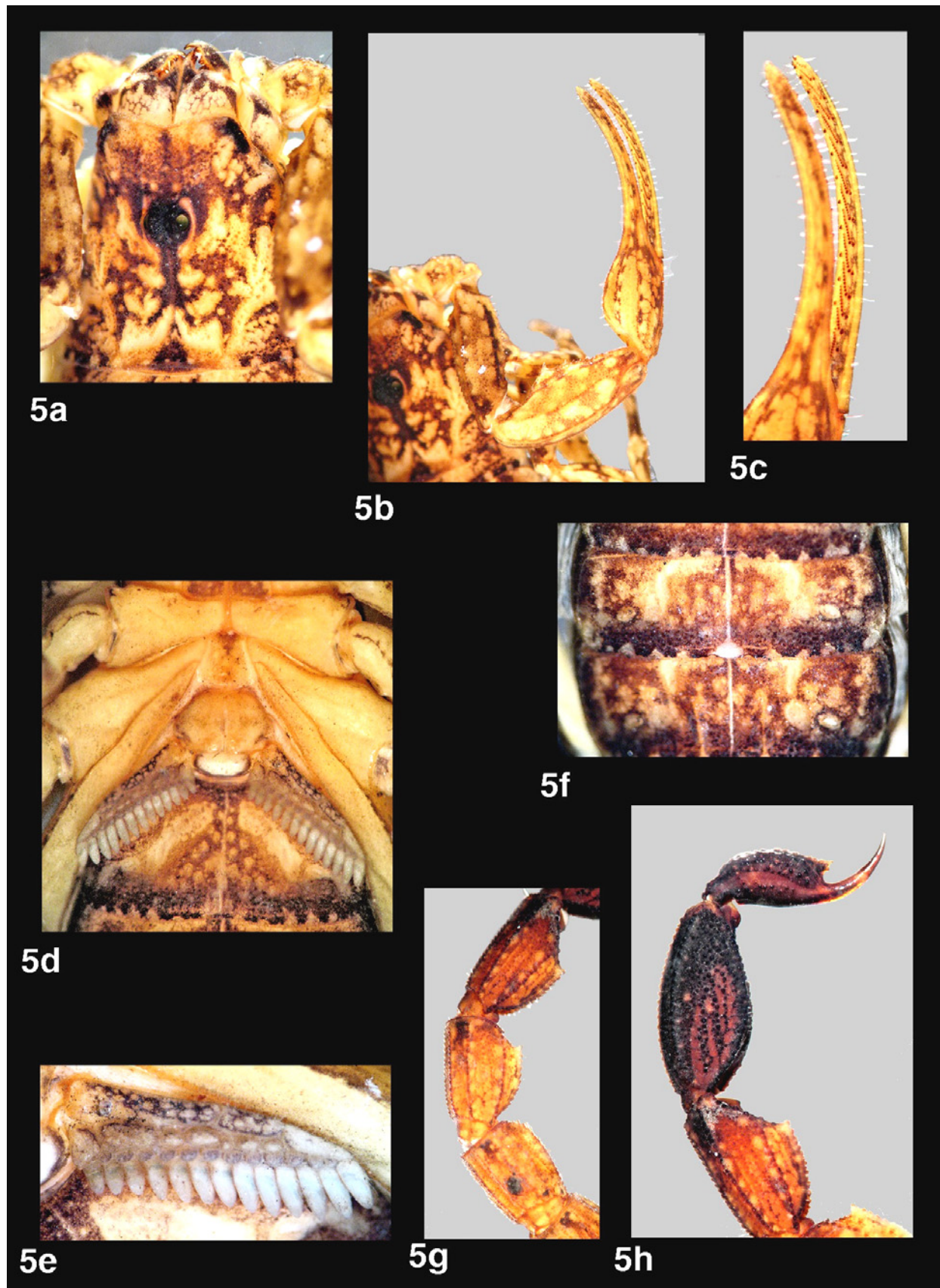


Figure 5: Adult female of *Tityus columbianus* from Chiquinquirá: **a)** prosoma, dorsal view; **b)** pedipalp, dorsal view; **c)** movable finger, dorsal view; **d)** sternopectinal region, ventral view; **e)** pecten, ventral view; **f)** sternites V–VI, ventral view; **g)** metasomal segments II–IV, lateral view; **h)** metasomal segments IV–V and telson, lateral view.

II–IV with the distal tooth conspicuously enlarged; telson not elongate, vesicle oval and coarsely granulose, with a granulose ventromedian carina progressively elevated towards the subaculear tubercle, which is large, conical and equipped with two large dorsal granules; aculeus long and evenly curved.

Female (Figs. 4–5; Tabs. 1–4): Similar to the male but sexually dimorphic in the following characters: (1) mesosoma relatively wider, but metasoma and appendages noticeably more slender; (2) pedipalp chela oval and slender; (3) pedipalp fingers much lighter (sparsely spotted with grayish brown), with basal lobe/notch combination obsolete; (4) genital papillae absent; (5) pectines with basalmost teeth proportionally shorter; (6) sternite V with whitish patch much smaller; (7) metasomal carinae stronger.

Variation: In the examined sample, adult specimens are represented by several discrete size classes, clearly separated by total length average gaps of 2.9 mm; there are four size classes in males and two in females (Tab. 1). The most interesting finding is that sexual dimorphism is always well-marked in all male size classes, but clearly there is a progressive size-related gradation of the expression of such dimorphic characters (Figs. 1, 3, Tab. 2). Unlike larger specimens, smaller males always have: (1) the most slender body and appendages (2) incrassate (not inflate) pedipalp chela and metasomal segment V (3) pedipalp fingers with basal lobe/notch combination vestigial (4) metasomal segment V with ventrolateral and dorsolateral carinae weaker (5) much sparser and weaker intercarinal granulation of metasoma and telson (6) dorsolateral carinae on metasomal segments II–IV with the largest and sharpest terminal granule.

Similar variations have already been detected in other species of this group which also share the conspicuously inflate pedipalp chela and metasomal segment V (Lourenço, 1983; Montoya & Armas, 2002; Rojas-Runjaic & Armas, 2007), and in all cases the variations affect characters which have been traditionally used to diagnose species [i.e., degree of dilatation of pedipalp chela and metasomal segment V, development of intercarinal granulation, and structure of the metasomal carinae, see as example the available keys published by Lourenço (1983, 1998, 1999a, 1999b, 2000) and Lourenço & Otero Patiño (1998)]. Thus, it is necessary to be especially prudent when dealing with this particular species when few adult males are available per sample, because different size classes could easily lead to wrong identifications.

Pectinal tooth counts varied from 12–15 (mode 14, with high incidence also of 13) in males, and 12–13 (mode 13) in females (Tab. 3). The number of primary rows of granules varied from 12–13 (mode 13) on fixed finger and 12–14 (mode 13) on movable finger; males

showed a clear tendency to present higher counts than females for both fingers (Tab. 4).

No other significant variations were detected in the examined sample, except for coloration of pedipalp fingers, which are always sparsely spotted in females and juveniles, but in males may be either infuscate (the most commonly found pattern) or also sparsely spotted. Juveniles exhibit the same basic pattern of adults, but are lighter overall and lack the conspicuous darkening of the metasomal segment V and telson, which is typical of adults.

Ecological notes: The specimens recorded herein were found during the day under stones, in an arid area of sandy soil at an elevation of 2550 m a.s.l. (Fig. 7), living syntopically with *Chactas keyserlingi* Pocock, 1893; the scorpions were aggregated in small groups of up to 13 individuals under the same stone. These data match those recorded for *T. columbianus* in the previous literature (Lourenço, 1991b, 1992; Lourenço et al., 1996; Bohórquez et al., 2005). The adult male/female sex ratio in our sample was 1.11/1, a value which is inverse to those previously recorded for other sexual populations of this species: 1/2 to 1/6 for Iza, and 1/2 to 1/40 for Villa de Leiva (Lourenço, 1991b, 1997; Lourenço et al., 1996).

Material examined: Colombia, Boyacá, Chiquinquirá (new record), 2550 m a.s.l., March 3, 2007, L. F. García; 9♂♂, 8♀♀, 2 juvenile ♂♂, 1 juvenile ♀ (RTO: Sco.0372), 1♂, 1♀ (LFGH).

Remarks: Since its original description, *T. columbianus* has been recorded in the literature for many South-American localities, but all records outside Colombia have already been demonstrated to be based on misidentifications (Lourenço, 1991a, 1999b), as was the case for some of those inside this country (Lourenço, 1984, 1992). Regarding the remaining Colombian records, Mello-Leitão (1945) listed merely “La Pedrera, Sarrina, San Mateo and Bogotá”, without further details. Excluding the type locality, the other records cannot be confirmed after thorough searches in modern maps. We could not find any site named Sarrina, but found two sites named La Pedrera, which are located in Magdalena and Amazonas departments. Both are completely outside the distribution of *T. columbianus*, and if the former was the actual record by Mello-Leitão (1945), then it should belong to *Tityus tayrona* Lourenço, 1991; if it was the latter, then it should belong to *Tityus bastosi* Lourenço, 1984 (however, as neither of these two species had been described in Mello-Leitão times, it is highly possible that this record was based upon a misidentification). Further, we located nine sites named San Mateo: two of them in Sucre, one each in Arauca, Bolívar, Boyacá, Córdoba, Cundinamarca, and Nariño, and one district inside Bo-

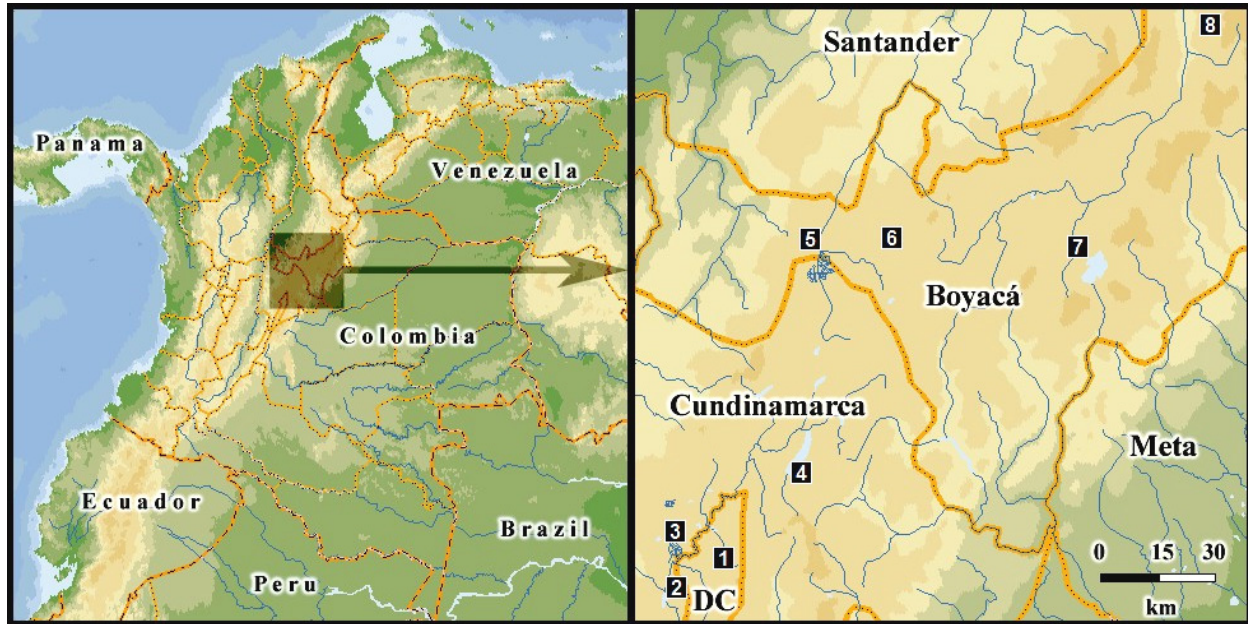


Figure 6: Known geographical distribution of *Tityus columbianus*: 1) Bogotá; 2) Soacha; 3) Mosquera; 4) Guatavita; 5) Chiquinquirá; 6) Villa de Leiva; 7) Iza; 8) La Uvita.

gotá city. Thus, it is impossible to warrant which of them was the actual record by Mello-Leitão (1945), and depending upon the location it would equally refer to several different species. Moreover, Flórez (2001) recorded this species for Santander Department on the basis of specimens deposited in the Instituto de Ciencias Naturales de la Universidad Nacional de Colombia. We consider this record as accurate, but unfortunately it does not mention any precise locality data. In conclusion, only eight records of this species can be regarded today as confirmed, and all of them are located in the mid-portion of the high plateau of the Cordillera Central (Fig. 6): Bogotá (Distrito Capital: type locality), Guatavita, Mosquera and Soacha (Cundinamarca Department: Lourenço, 1984, 1991b; Bohórquez *et al.*, 2005), Villa de Leiva, Iza, and La Uvita (Boyacá Department: Lourenço, 1991b, 1997, 2000; Lourenço *et al.*, 1996), plus the new record herein given (Chiquinquirá, also in Boyacá).

On the other hand, the inflated pedipalp chela and metasomal segment V in adult males is a remarkable character which is controversial with respect to published literature, because the only two taxonomic papers which have listed males (Mello-Leitão, 1945: 323–325; Francke & Stockwell, 1987: 24), either explicitly or implicitly stated that this character was absent in *T. columbianus*. We choose to dismiss this statement as incorrect, as it was possibly based upon either misidentified specimens (more than 50% of the species of the “*Tityus clathratus*” group have been described after 1987), or maybe subadult males of *T. columbianus* (see “Variation” above).

Also, the conspicuous whitish patch present in sternite V of *T. columbianus* is a surprising finding, be-

cause in all previous literature this structure was either not mentioned or explicitly stated to be absent as in most keys published by Lourenço (1999a: 5; 1999b: 124; 2000: 458). As this patch is much smaller in females than in males, and the latter sex had remained undescribed until now, we infer that it has simply been overlooked by all previous authors except Mello-Leitão (1945: 323). Also, the irregularly trifasciate dorsal pattern is another conspicuous feature that has neither been accredited in the literature, except again for Mello-Leitão (1945: 323). Unfortunately, this author appears to have confused more than one species under *T. columbianus* (see “Distribution” above).

General Comments

In general, the present study revealed that *T. columbianus* was a peculiar case of a scorpion that over the years became very well known from a biological perspective, but remained poorly known from a taxonomic view. This problem is not at all unique to *T. columbianus*, but more or less parallels the remaining Colombian species of the “*Tityus clathratus*” group. This handicap coupled with the size-related variations herein recorded and the fact that some taxa are still known from a single sex, brings about the possibility that several published records may be erroneous or even that some species may eventually prove to be synonyms of others. The first case can be applied to the following examples:

1. Botero-Trujillo & Fagua (2007: 131–132) recorded the southern endemic *Tityus betschi* Lourenço, 1992



Figure 7: Two views of the habitat of *Tityus columbianus* at Chiquinquirá.

for Antioquia, but their specimens clearly belong to *Tityus parvulus* Kraepelin, 1914 (compare the adult female illustrated in figs. 9–10 of this paper, to figs. 4–5 of Lourenço's 1984 redescription). Moreover, these authors seem to have overlooked that Lourenço (1999b) had already recorded *T. parvulus* from the same site near Angelópolis, and even that this is roughly the type locality of this species. It should also be noted that the single record of *T. parvulus* from Panama (Arraiján, originally given by Lourenço [1984], but echoed in subsequent papers by different authors) is obviously erroneous and based upon a misidentified specimen of *Tityus ocelote* Francke et Stockwell, 1987.

2. Lourenço (2000: 456–457, fig. 13) gave a number of controversial records for some species of this group, which overlap each other without a definite geographical pattern. For example, he recorded the lowland Amazonian *T. bastosi* for the arid mountains of Boyacá, and the northern Magdalena basin endemic *Tityus erikae* Lourenço, 1999 for the southern foothills of the Cordillera Central, across the Andes. The first record is nested inside the general distribution of *T. columbianus* and almost undoubtedly should be referred to that species, and the second should belong to *T. bastosi*, which was recorded in the same paper from several localities surrounding this site (Lourenço, 2000: fig. 13).

The second case (potential synonymies) is more problematic and inevitably will demand detailed studies of large and representative samples, but it is obvious that actually most of the remaining species of the “*Tityus clathratus*” group are inadequately defined and need to be either redescribed or rediagnosed, as Kovařík (2007) already noticed. Some taxa have been described exclusively on the basis of a single character which was actually not unique to these species (i.e., the shape of subaculear tubercle for *T. betschi*, also shared by *T. columbianus*, and the presence of a smooth patch on sternite V for *T. erikae*, which is widespread in this group), and other taxa have been defined by characters which now have proven to be either intraspecifically variable (i.e., those herein discussed under “Variation”) or even misinterpreted. For example, Botero-Trujillo & Fagua (2007: 133) asserted that one character diagnostic for *T. tayrona* is the lack of a smooth patch on sternite V (incorrectly referred to as “sternite III”), but in the detailed ventral photographs (figs. 13 and 15 of their paper) this patch is clearly visible on an adult male and female. For all of the abovementioned reasons, we refrained from including a “Comparisons” section here until a clearer knowledge of these other species has been achieved.

As a final comment, Kovařík (2007: 3) suggested that *T. betschi* may be a junior synonym of *T. columbianus*, but this possibility should be rejected because

these two species are clearly different not only in morphology, but also in ecological requirements and geographical distribution. The former occurs only in the rainforests of the Cordillera Occidental, while the latter is restricted to the arid high plateau of the Cordillera Oriental. These two ranges are not only very high and separated by deep river valleys, which act as real barriers for tropical scorpions, but also have another entire range between them (Cordillera Central), which doubles those barriers. Based upon the senior author's experience with tropical scorpions, vegetation types and altitudes over 1200 m a.s.l. constitute critical barriers for dispersal.

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