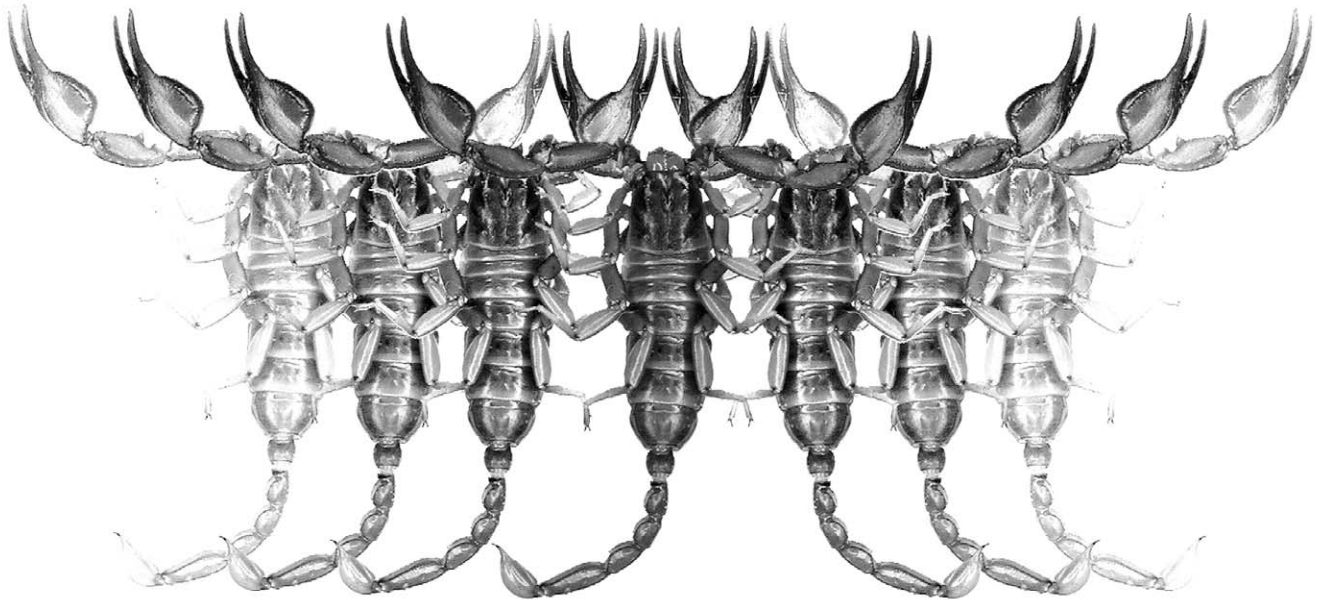


# *Euscorpium*

Occasional Publications in Scorpiology



**Some Taxonomic Corrections to the Genus *Tityus* C. L. Koch,  
1836 (Scorpiones: Buthidae) in Hispaniola, Greater Antilles**

**Rolando Teruel**

**March 2017 — No. 242**

# *Euscorpius*

## Occasional Publications in Scorpiology

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Publication date: 15 March 2017

## Some taxonomic corrections to the genus *Tityus* C. L. Koch, 1836 (Scorpiones: Buthidae) in Hispaniola, Greater Antilles

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### Summary

In the present paper, the taxonomic status of several Hispaniolan members of the genus *Tityus* C. L. Koch, 1836 is revised after examination of almost all primary types and abundant supplementary material. This resulted in six new synonymies, which involve both extant and fossil species. The extant taxa herein synonymized are *Tityus anasilviae* Armas et Abud, 2004 under *Tityus ottenwalderi* Armas, 1999, *Tityus bahoruco* Teruel et Armas, 2006 under *Tityus crassimanus* (Thorell, 1876), *Tityus ebanoverde* Armas, 1999 under *Tityus elii* Armas et Marciano, 1992, and *Tityus septentrionalis* Armas et Abud, 2004 under *Tityus portoplatensis* Armas et Marciano, 1992. The fossil taxa herein synonymized are *Tityus azari* Lourenço, 2013† and *Tityus (Brazilotityus) hartkorni* Lourenço, 2009†, both under *Tityus geratus* Santiago-Blay et Poinar, 1988†. Updated distribution maps are given for all extant senior synonymy.

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The buthid scorpion genus *Tityus* C. L. Koch, 1836, is very diverse in the Greater Antillean island of Hispaniola: the most recent catalog by Santos et al. (2016) listed 14 nominal species, all endemic and unevenly divided into the "crassimanus" and "quisqueyanus" species-groups (4 and 10 species, respectively). As expected from such diversity, it also widespread in the island and has colonized almost all available ecosystems. Its members occur from the seashore to the highest peaks above 3,000 m a.s.l., and in all vegetation types from desert to rainforest, including montane savannas and pine forests (Armas, 1987, 1999; Teruel, 2005; Teruel & Armas, 2006; Kovařík & Teruel, 2014). Apart from these extant taxa, three fossil species have been described from Dominican amber (Santiago-Blay & Poinar, 1988; Lourenço, 2009, 2013), but their correct infra-generic assignation to subgenera or species-groups is still pending for two of them and unsatisfactory for the other.

Very recently, Santos et al. (2016: 16) declared that the correct taxonomic status of three extant species was under investigation. The present author was finally able to study the type-series of all *Tityus* described from Hispaniola and deposited in IES collection, together with abundant supplementary material captured by himself and collaborators during three intensive field trips to Dominican Republic (2005, 2014 and 2016), plus the collections of IES, MHNHSD and MSU, plus additional specimens kindly donated by friends and colleagues. The detailed comparison of all this material (more than 200 specimens in total) allowed clarifying the precise status of four extant and the three fossil taxa: six cases of synonymy were discovered. All pertinent nomenclatural

changes are introduced and discussed in detail in the present paper.

Abbreviations used in the text for specimen repositories are as follows: Instituto de Ecología y Sistemática, Havana, Cuba (IES), Museo Nacional de Historia Natural, Santo Domingo, Dominican Republic (MNHNSD), Montana State University, Bozeman, Montana, USA (MSU), and personal collection of the author (RTO).

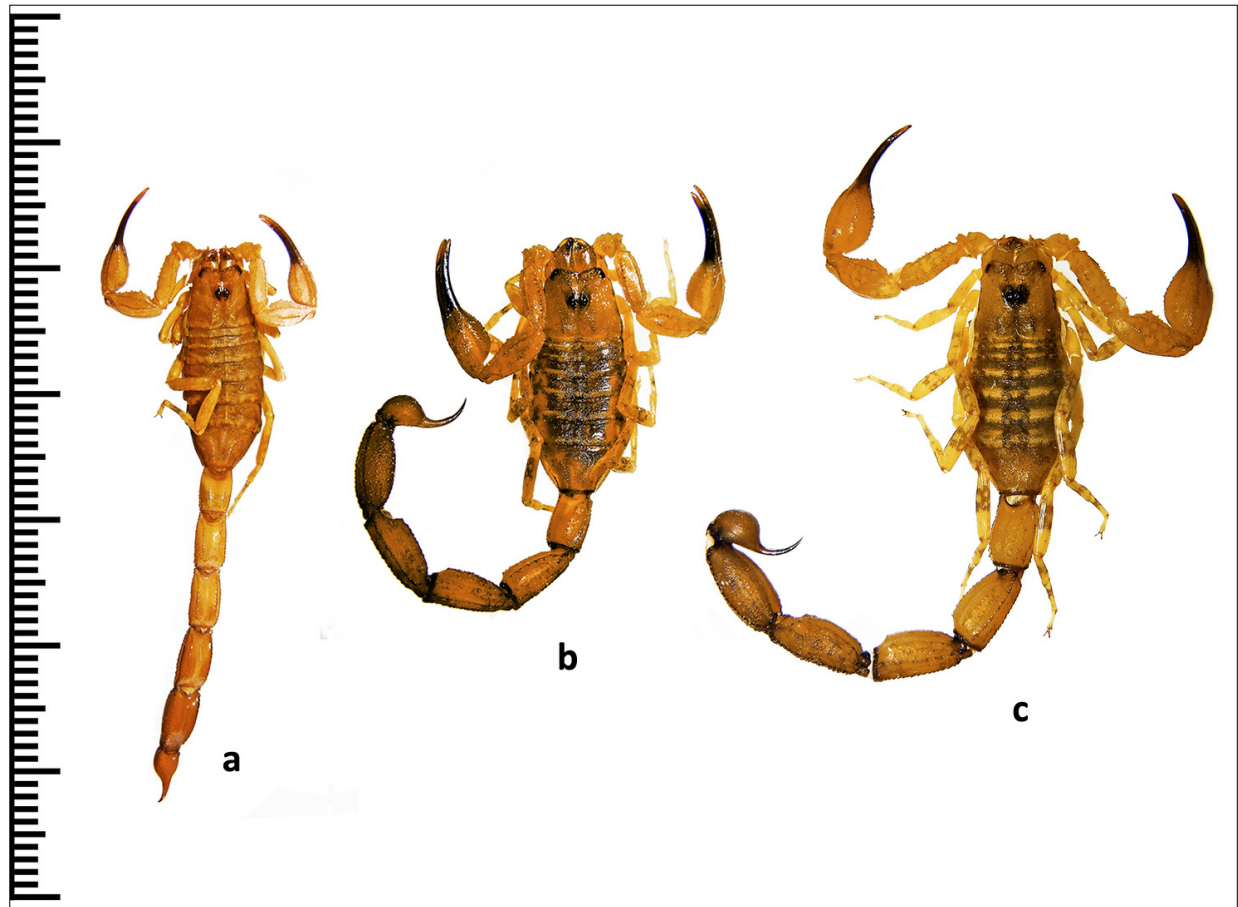
### *Tityus anasilviae* Armas et Abud Antun, 2004

Figures 1, 6

**Type Data.** DOMINICAN REPUBLIC, Cordillera Central [Central Range], Monseñor Nouel Province, Bonaio Municipality, Blanco, Arroyón [= Los Guázaros], 700 m a.s.l., inside pillowcase in house, 8/September/2002, A. Abud, A. S. Reynoso, ♂ holotype (IES: CZACC-3.3145, examined).

**Remarks.** This species was described upon a single adult male by Armas & Abud Antun (2004) and accepted as valid by Teruel & Armas (2006). An adult female was described later by Armas & Abud Antun (2015), who stated that one of the main characters alleged as diagnostic for this taxon (dorsolateral carinae with terminal granule much stronger on metasomal segments II–IV), was absent in the new specimen and more samples were needed to define if this implied sexual dimorphism or just individual variation.

The direct comparison of the holotype of *T. anasilviae* to the types of *Tityus ottenwalderi* Armas,



**Figure 1:** Size-related morphological variability of adult *Tityus ottenwalderi*, exemplified by females: **a)** small specimen from El Río, La Vega Province (typical *T. ottenwalderi*); **b)** standard specimen from Pinar Quemado, La Vega Province (intermediate); **c)** large specimen from El Majagual, San Cristóbal Province (typical *T. anasilviae* **n. syn.**). Scale bar in millimeters.

1999 (the only other member of the "crassimanus" species-group known to occur in this mountain range) and abundant additional specimens revealed that both taxa are conspecific. Thus, the following synonymy is herein established: *Tityus ottenwalderi* Armas, 1999 = *Tityus anasilviae* Armas et Abud Antun, 2004, **new synonym**.

The present study proved that all Hispaniolan members of the "crassimanus" species-group are so highly variable morphologically, that adults belonging to different size-classes can be easily mistaken as distinct species. The expression of sexual dimorphism follows the same rule as in other studied species of the genus, i.e., larger adults are the most strongly dimorphic and smaller ones are the least (Fig. 1).

Moreover, the degree of attenuation of pedipalps and metasoma shows a clinal variation positively correlated to altitude: the most slender specimens (i.e., typical *T. ottenwalderi*), come from mountains above 1,400 m, the most robust ones (i.e., typical *T. anasilviae* **n. syn.**) come from the slopes below 800 m, and inter-

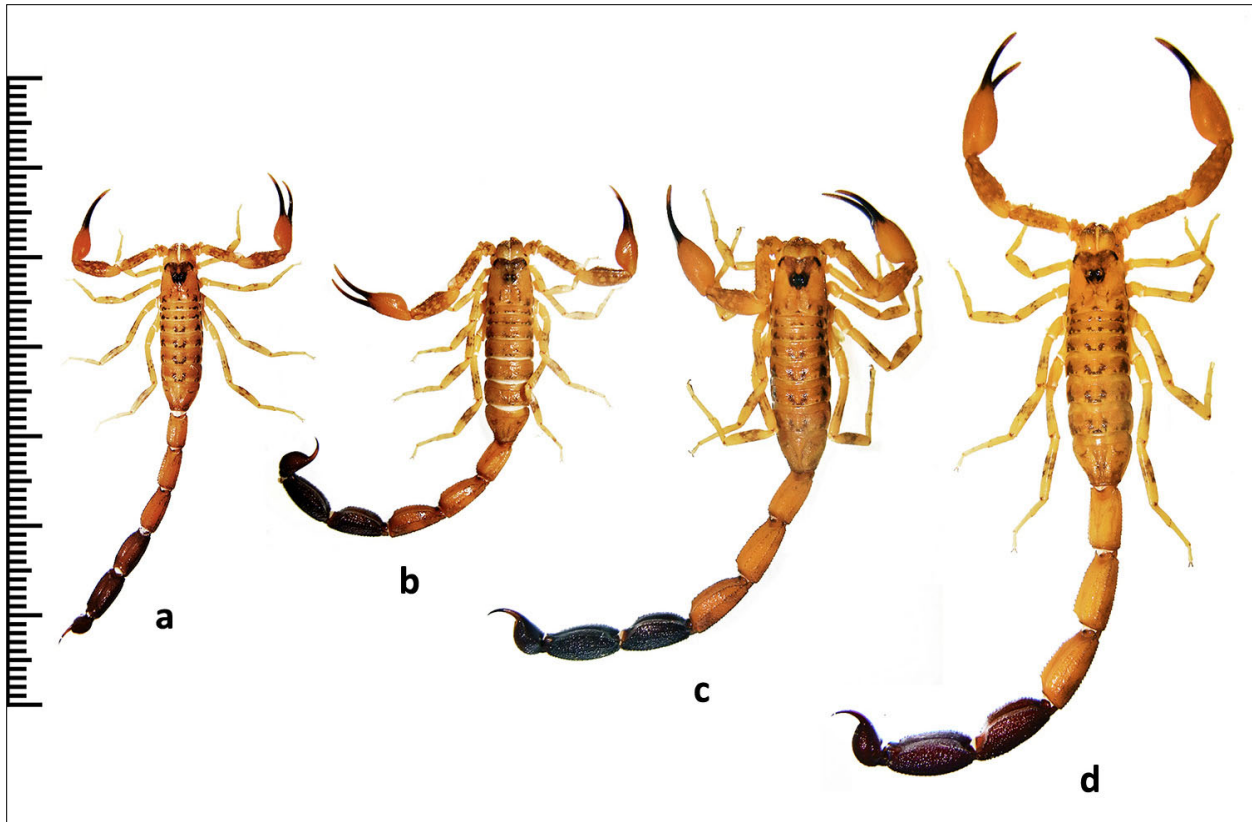
mediate individuals occur all across the intervening altitude zone (Fig. 1).

#### ***Tityus bahoruco* Teruel et Armas, 2006**

Figures 2, 6

**Type Data.** DOMINICAN REPUBLIC, Sierra de Bahoruco [Bahoruco Range], Pedernales Province, Pedernales Municipality, Mencía, Río Mulito [= El Mulito, Las Agüitas], 500 m a.s.l., under tree bark, 22/August/1987, A. Abud, L. F. de Armas, ♂ holotype (IES, examined). Sierra de Bahoruco [Bahoruco Range], Pedernales Province, Pedernales Municipality, Las Abejas, 1,290 m a.s.l., inside rotten log, 22/July/1999, M. A. Ivie, ♀ paratype (MSU, examined).

**Remarks.** The direct comparison of the types of *T. bahoruco* to abundant additional specimens of *T. crassimanus* (the only other member of the "crassimanus" species-group known to occur in this mountain range), revealed that both taxa are conspecific. Both



**Figure 2:** Size-related morphological variability of adult *Tityus crassimanus*, exemplified by males: **a**) small specimen from road Cabo Rojo-El Aceitillar, Pedernales Province (typical *T. bahoruco* n. syn.); **b**) standard specimen from road Cabo Rojo-El Aceitillar, Pedernales Province (intermediate); **c**) large specimen from road Cabo Rojo-El Aceitillar, Pedernales Province (intermediate); **d**) very large specimen from Río Mulito, Pedernales Province (typical *T. crassimanus*). Scale bar in millimeters.

types of the former are just the smallest adults of the latter and the comparison made in the original description was misleading: a reexamination of the two supposedly adult males of *T. crassimanus* from Fondo Paradi used for comparison by Teruel & Armas (2006), revealed that both are actually very large females. Thus, the following synonymy is herein established: *Isometrus crassimanus* Thorell, 1876 [currently *Tityus crassimanus* (Thorell, 1876)] = *Tityus bahoruco* Teruel et Armas, 2006, **new synonym**.

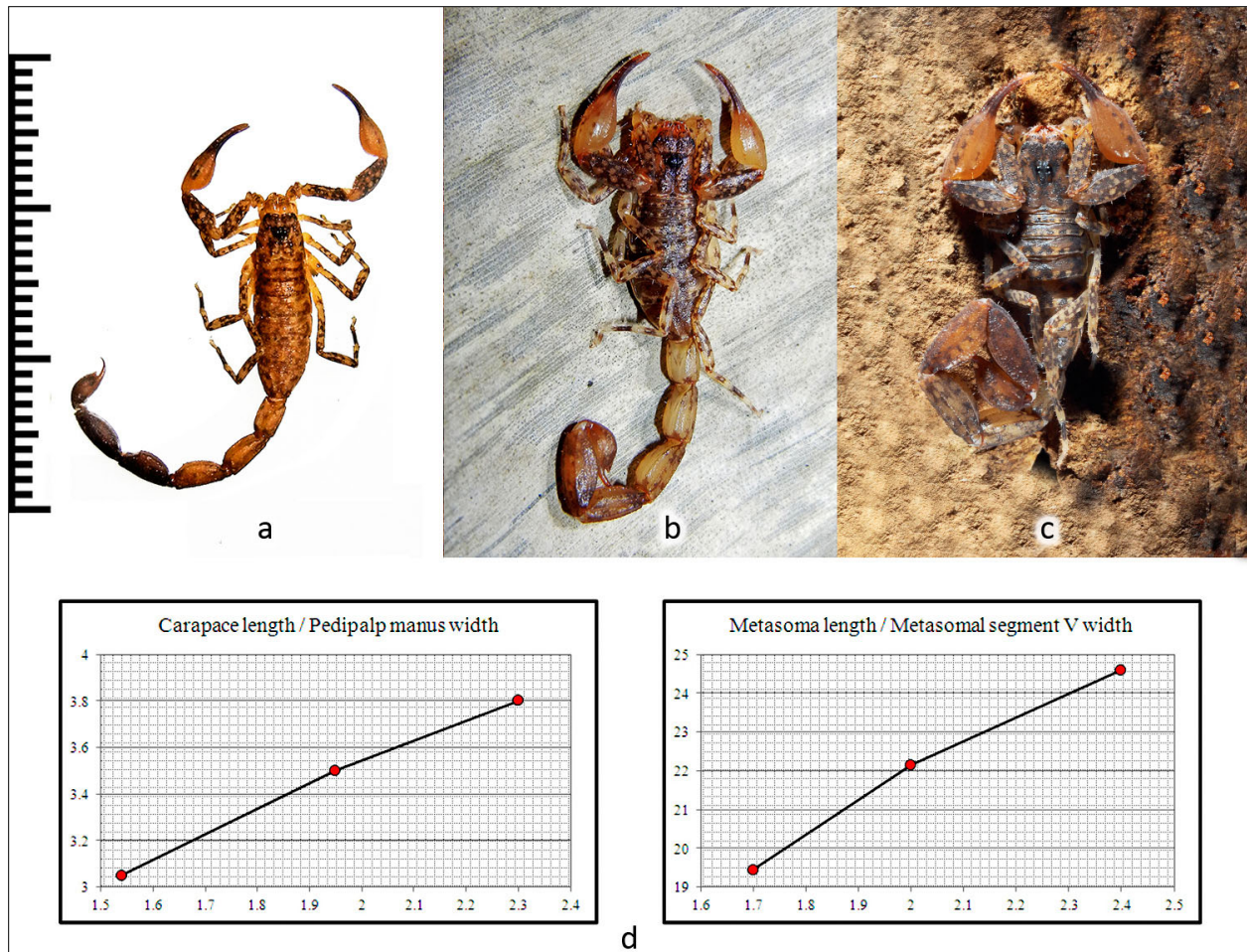
The present study (which included successful captive breeding for several consecutive generations) allowed to define that *T. crassimanus* is morphologically highly variable, that sexual maturity is attained at very different instars (from nymphs III–VI), and that morphological variation is directly correlated to size, to the point that adults belonging to different size-class can be easily mistaken as distinct species. The expression of sexual dimorphism follows the same rule as in other studied species of the genus, i.e., larger adults are the most strongly dimorphic and smaller ones are the least (Fig. 2).

### *Tityus ebanoverde* Armas, 1999

Figures 3, 7

**Type Data.** DOMINICAN REPUBLIC, Cordillera Central [Central Range], La Vega Province, Constanza Municipality, El Arroyazo, Reserva Científica "Ébano Verde", 1,100 m a.s.l., under box in house, 27/March/1999, R. Escalante, L. F. de Armas, ♂ holotype (IES: CZACC-3.2869, examined).

**Remarks.** Without having studied the holotype, Teruel (2005) concluded that this species was most likely not valid because all of the characters utilized as diagnostic by Armas (1999) matched exactly those which hypothetically must possess the yet unknown small adult male of *Tityus elii* Armas et Marcato Fondour, 1992. Moreover, Teruel (2005) argued that he visited the type locality of *T. ebanoverde* and noticed that its ecological conditions were so homogeneous that it could hardly support the existence of three syntopic species of *Tityus*, as *T. elii* and *T. ottenwalderi* were confirmed to occur there as well.



**Figure 3:** Size-related morphological variability of adult *Tityus elii*, exemplified by males: **a**) small preserved specimen from Ébano Verde, La Vega Province (holotype of *T. ebanoverde* n. syn.); **b**) standard live specimen from road Bonao-Casabito, La Vega Province (intermediate); **c**) large live specimen from Villa Las Neblinas, La Vega Province (typical *T. elii*; photo courtesy František Kovařík); **d**) two selected morphometric ratios of the same three specimens, showing that robustness of pedipalp manus and metasomal segment V increases with size (expressed as length of carapace and metasoma). Scale bar and graph axes in millimeters.

The direct comparison of the holotype of *T. ebanoverde* to the types and abundant additional material of *T. elii* (representing adults of three different size-classes), confirmed that the holotype of *T. ebanoverde* is indeed a small adult male of the latter. Thus, the following synonymy is herein established: *Tityus elii* Armas et Marcano Fondeur, 1992 = *Tityus ebanoverde* Armas, 1999, **new synonym**.

The expression of sexual secondary dimorphism in *T. elii* follows exactly the same rule as in other studied species of the genus, i.e., larger adults are the most strongly dimorphic and smaller ones are the least, while standard males are intermediate between both extremes. Small males of *T. elii* possess the pedipalp chela and metasomal segment V only slightly swollen and more strongly carinate, as well as pedipalp fingers with basal

lobe/notch combination weak to moderate. The expression of all these dimorphic characters increases positively correlated to size: pedipalp chelae and metasomal segment V become progressively wider and deeper with their carination weaker, and lobe/notch combination of fingers becomes stronger (Fig. 3).

***Tityus septentrionalis* Armas et Abud Antun,  
2004**

Figures 4, 7

**Type Data.** DOMINICAN REPUBLIC, Cordillera Septentrional [Northern Range], Duarte Province, Loma Quita Espuela, 700 m a.s.l., feeding on centipede in forest litter at night, 11/February/2002, E. Gutiérrez, ♀ holotype (IES: CZACC-3.3144, examined). Cordillera



**Figure 4:** Photographical comparison amongst the holotypes of *Tityus portoplatensis* (a) and *Tityus septentrionalis* n. syn. (c), and a live adult topotype pair of the former (b: male left, female right; photo courtesy Fr. Alejandro Sánchez). Note the strong sexual dimorphism that demonstrates the former is actually a male and not a female, as wrongly determined by Armas & Marcato Fondeur (1992).

Septentrional [Northern Range], Espailat Province, Moca, Los 21, under rock, 31/January/1989, D. Lantigua, ♀ paratype (IES, not examined).

**Remarks.** The direct comparison of the holotypes and additional specimens (topotypes included) of *T. septentrionalis* and *T. portoplatensis* (the only other member of the "quisqueyanus" species-group known to occur in this mountain range), revealed that both taxa are conspecific. Thus, the following synonymy is herein established: *Tityus portoplatensis* Armas et Marcato Fondeur, 1992 = *Tityus septentrionalis* Armas et Abud Antun, 2004, **new synonym**.

The present study disclosed that Armas & Marcato Fondeur (1992) wrongly sexed the holotype of *T. portoplatensis* as a female. It is actually a large adult male, thus, all characters alleged by Armas & Marcato Fondeur (1992) and Armas & Abud (2004) as diagnostic merely reflect sexual dimorphism (Fig. 4).

The specimen from Los Haitises in Hato Mayor Province, described by Armas (2005) as the adult male of *T. septentrionalis*, is either incorrectly sexed or misidentified (the photographs included in the paper could also refer to a small adult female). Unfortunately, the present author has repeatedly requested it on loan from IES collection, without success.

***Tityus (Brazilotityus) hartkorni* Lourenço, 2009  
and *Tityus azari* Lourenço, 2013**

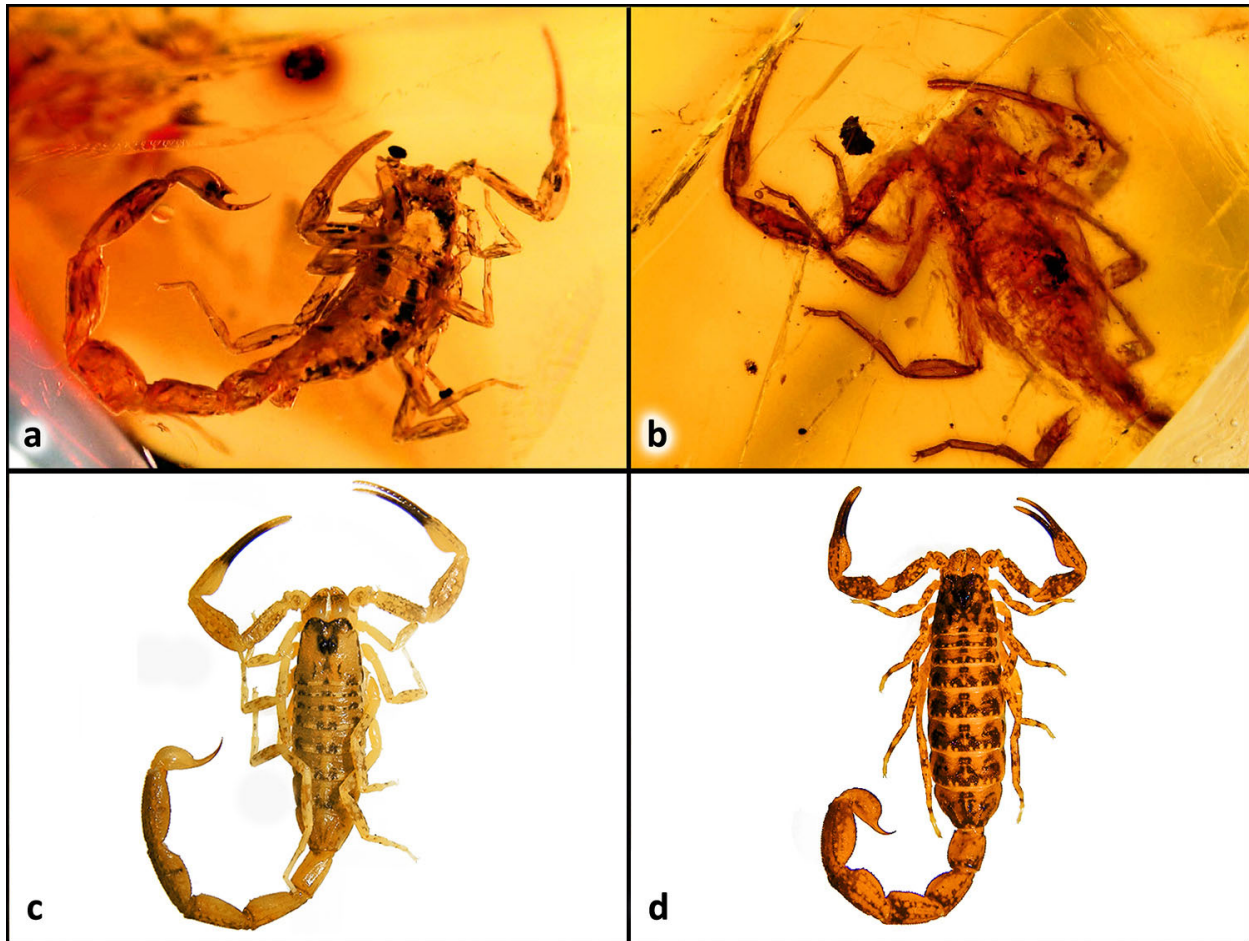
Figure 5

**Type Data.** "Dominican Republic. Precise amber mine not confirmed. Lower Oligocene to Upper Eocene" [*sic*], juvenile ♂ holotype of *T. hartkorni* (private collection of Joachim Hartkorn, not examined), juvenile ♂ holotype of *T. azari* (private collection of Jörg Wun-

derlich, not examined). **Note:** Lourenço (2009: 4; 2013: 4) identically declared imprecise geographic and stratigraphic origins for both holotypes, as literally quoted above.

**Remarks.** The holotypes of both species were not available for study, but fortunately, their original descriptions include good-quality color photographs that allow a satisfactory interpretation of the main diagnostic characters. First, two of them warrant their membership in the "crassimanus" species-group: pedipalp fingers with 14–15 principal rows of denticles and pectines with 19–20 teeth. These counts are within the diagnostic ranges given for this group by Teruel & Armas (2006) and exclude them from the "quisqueyanus" species-group as diagnosed by Armas & Abud Antun (2004): 11–15 principal rows of denticles and 19–20 pectinal teeth, vs. 10–12 principal rows of denticles and 8–15 pectinal teeth, respectively. Moreover, the elongate-slender habitus (especially pedipalps, legs and metasoma) of both *T. hartkorni* and *T. azari* holotypes is also unambiguously diagnostic for the "crassimanus" species-group, as opposite to the short-stocky habitus of the "quisqueyanus" species-group (Fig 5).

As pointed out elsewhere (Kovářik et al., 2016a–c; Lowe & Kovářik, 2016; Prendini, 2016) for other papers authored by Wilson R. Lourenço, both original descriptions are flawed by false and/or incorrectly described characters, plus drawings of an inadmissible, poor quality and thus, must be discarded as unreliable except for the photographs (when included). A perfect example is found here: the main character used by Lourenço (2009, 2013) to support these allegedly new taxa and their infra-generic relationships resides in the pectinal fulcra, being described as vestigial to obsolete in *T. hartkorni* and absent in *T. azari*. Even on this basis



**Figure 5:** Photographical comparison amongst the holotypes of *Tityus hartkorni* n. syn. (a) and *Tityus azari* n. syn. (b), and the typical representatives of the "crassimanus" and "quisqueyanus" species-groups: *Tityus crassimanus* (c) and *Tityus quisqueyanus* (d). All four specimens are juvenile males of similar size: 16–19 mm total length including telson. Images a–b taken from Lourenço (2009: fig. 7) and Lourenço (2013: fig. 1), respectively.

alone, Lourenço (2009) placed *T. hartkorni* in the strictly Amazonian, controversial subgenus *Tityus* (*Brazilotityus*), without giving any biogeographical argument to support such an odd assignment. Nevertheless, when the photographs published by Lourenço (2009: fig. 8; 2013: fig. 2) are zoomed-in, the pectinal fulcra become clearly visible as normally developed at least in the right-side pecten of both *T. hartkorni* and *T. azari* holotypes.

The third fossil member of the genus known from Hispaniola is *Tityus geratus* Santiago-Blay et Poinar, 1988, but it presents a very different situation. It was described also from a juvenile male holotype of similar size (apparently second-instars in all three cases), but as opposite to both previous cases, it has precise geographic and stratigraphic origins (La Toca amber mine, in Puerto Plata Province), and its description is correctly written, accurately discussed and satisfactorily illustrated. Thus, the only issue that remains to be addressed is its infra-generic assignment. Based upon the same characters discussed in the previous paragraph (see

above), it is clearly another member of the "crassimanus" species-group: pedipalp fingers with 12–14 principal rows of denticles, pectines with 18–19 teeth, and elongate-slender habitus (Santiago-Blay & Poinar, 1988).

Once the infra-generic position of these three taxa is established, it becomes clear that they closely match each other in all diagnostic characters such as size, degree of attenuation, carination and intercarinal sculpture of body and appendages, counts of principal denticle rows on pedipalp fingers and pectinal teeth. Therefore, the conclusion is obvious: all three holotypes are conspecific and the valid name corresponds to the oldest available synonym. Thus, the following synonymies are herein established: *Tityus geratus* Santiago-Blay et Poinar, 1988 = *Tityus* (*Brazilotityus*) *hartkorni* Lourenço, 2009, **new synonym** = *Tityus azari* Lourenço, 2013, **new synonym**.

It is worth to mention here that this discovery does not represent an isolate case. Recently, the amber-fossil





**Figure 6:** Map of Hispaniola, showing the updated geographical distribution of all valid extant members of the "crassimanus" species-group: *Tityus crassimanus* (circles), *Tityus ottenwalderi* (squares) and *Tityus* sp. (triangles). New records depicted in white symbols, previous records in black.

arachnid fauna of Hispaniola has been shown to be actually overestimated and abundant synonymies have been demonstrated after detailed studies, see for example Penney (2001).

### General Remarks

After these changes, the diversity and distribution patterns of the genus *Tityus* in Hispaniola are set as follow. First, the "quisqueyanus" species-group is typical from and well diversified in the Central Range with six species (*T. abudi*, *T. altithronus*, *T. bellulus*, *T. elii*, *T. kindli*, and *T. quisqueyanus*), but also has single-species' peripheral occurrences in the Neiba (*T. neibae*) and Northern Ranges (*T. portoplatensis*). On the other hand, the "crassimanus" species-group has a single allopatric species in every major mountain range: *T. crassimanus* in Bahoruco Range, *T. ottenwalderi* in the Central Range, and one still-undetermined species in the Northern Range (Armas & Teruel, 2006; R. Teruel, unpublished data).

In addition, the data personally gathered in the field by the present author revealed that their ecological preferences also differ markedly. All members of the "crassimanus" species-group are microhabitat-specific, but habitat-generalist: they are always strictly arboreal, but widespread across all altitude ranges and vegetation types. As opposite, the members of the "quisqueyanus" species-group are microhabitat-generalist, but habitat-specific: they occur indistinctly in the ground and trees,

but only in particular vegetation types and altitude zones, i.e., *T. abudi*, *T. elii*, *T. neibae*, and *T. portoplatensis* live in lower, humid broadleaf forests (350–2,400 m a.s.l.), while *T. altithronus*, *T. bellulus*, *T. kindli*, and *T. quisqueyanus* occupy mostly higher, drier pine forests (1,800–3,185 m a.s.l.).

The Hispaniolan amber-fossil members of the genus have now decreased to a single species, which also belongs in the "crassimanus" species-group. This is also consistent with its chorology, i.e., this group is widespread in most main mountain ranges of the island, but composed of highly microhabitat-specialized taxa; such combination suggests a very ancient origin.

The present corrections set the list of extant and fossil *Tityus* species from this Greater Antillean insular territory to 10 and 1, respectively, plus another extant taxon that remains undetermined due to unavailability of adequate samples. It follows below, with the updated distribution of every species in each country (HA = Haiti, DR = Dominican Republic) and their upper-level political divisions (Départements in Haiti, Provinces in Dominican Republic); new records were marked in boldface and tentative records in question mark:

- "crassimanus" species-group
  1. *Tityus crassimanus* Armas, 1999: HA (Sud Est), RD (Pedernales, **Independencia**, Barahona).
  2. *Tityus ottenwalderi* Armas, 1999: RD (**Eliás Piña**, Santiago, La Vega, **Monseñor Nouel**, **San Cristóbal**).



**Figure 7:** Map of Hispaniola, showing the updated geographical distribution of two valid extant members of the "quisqueyanus" species-group: *Tityus elii* (squares) and *Tityus portoplatensis* (triangles). New records depicted in white symbols, previous records in black.

3. *Tityus geratus* Santiago-Blay et Poinar, 1988†: RD (fossil in amber, confirmed only from Puerto Plata).

4. *Tityus* sp.: RD (**Puerto Plata, Espailat, Hato Mayor**).

• "quisqueyanus" species-group

5. *Tityus abudi* Armas, 1999: RD (Santiago).

6. *Tityus altiethronus* Armas, 1999: RD (San Juan, Santiago).

7. *Tityus bellulus* Armas, 1999: RD (Santiago).

8. *Tityus elii* Armas et Marcano Fondeur, 1992: RD (Santiago, La Vega, **San Cristóbal**).

9. *Tityus kindli* Kovařík et Teruel, 2014: RD (**Azua, La Vega**).

10. *Tityus neibae* Armas, 1999: RD (Independencia, **Bahoruco, Elías Piña**).

11. *Tityus portoplatensis* Armas et Abud Antun, 1992: RD (Puerto Plata, **Duarte, Espailat, Hato Mayor?**).

12. *Tityus quisqueyanus* Armas, 1982: RD (Santiago, La Vega).

Last, it is worth noting here that this list is not yet definitive. A forthcoming paper by the present author and his collaborators (R. Teruel, F. Kovařík, M. Seiter, and G. de los Santos, in preparation), will revise the genus in detail for Hispaniola, and bring more changes: it will include the description of at least one new species from Haiti, the update of geographical distribution and

ecological information of most taxa, and the correction of more errors discovered in the published literature.

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