

FURTHER CONSIDERATIONS ON *TITYUS (ARCHAEOTITYUS) CLATHRATUS* C. L. KOCH, 1844 AND DESCRIPTION OF TWO ASSOCIATED NEW SPECIES (SCORPIONES, BUTHIDAE)

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Abstract: The type material of *Tityus (Archaeotityus) clathratus* C. L. Koch, originally described from “Cabo da Boa Esperança” (Cape of Good Hope) in South Africa is reanalyzed. Since no *Tityus* species exist in Africa, this locality is obviously fallacious. Descriptions of historical expeditions to South America may suggest that the possible American type locality should be in Venezuela rather than in Guyana as often indicated by several authors. Two new species, close to *T. (A.) clathratus*, are respectively described from French Guiana and from the region of the Upper Rio Negro in Brazilian Amazon.

Key words: Scorpiones, Buthidae, *Tityus (Archaeotityus) clathratus*, new species, Brazil, Rio Negro, French Guiana.

Nuevas consideraciones sobre *Tityus (Archaeotityus) clathratus* C. L. Koch, 1844 y descripción de dos especies nuevas relacionadas (Scorpiones, Buthidae)

Resumen: Se analiza de nuevo el material tipo de *Tityus (Archaeotityus) clathratus* C. L. Koch, descrito originalmente de “Cabo da Boa Esperança” (Cape de Buena Esperanza), en Sudáfrica. Puesto que no hay especies de *Tityus* en África, la localidad es evidentemente errónea. Las descripciones de expediciones históricas a Sudamérica pueden sugerir que la posible localidad típica estaría situada en Venezuela en lugar de las Guayanas como han indicado a menudo diversos autores. Se describen dos especies nuevas relacionadas con *T. (A.) clathratus*, respectivamente de la Guayana Francesa y de la zona del valle alto del río Negro, en el Amazonas brasileño.

Palabras clave: Scorpiones, Buthidae, *Tityus (Archaeotityus) clathratus*, especies nuevas, Brasil, río Negro, Guayana Francesa.

Taxonomy / Taxonomía: *Tityus (Archaeotityus) mana* sp. n.
Tityus (Archaeotityus) grahami sp. n.

Introduction

The precise identity of several ‘old species’ of the genus *Tityus* C. L. Koch, 1836 remain enigmatic and confuse. One of these, *Tityus (Archaeotityus) clathratus*, the type species of the subgenus *Archaeotityus* Lourenço, 2006 (Lourenço, 2006) was the subject of controversial discussion in several papers (Kraepelin, 1899; Mello-Leitão, 1945; Lourenço, 1983, 1984; Rojas-Runjaic & Armas, 2007). The problem with the precise identification and definition of this species holds on its original type locality. In fact, the type material of *Tityus (A.) clathratus* C. L. Koch, was originally described from “Cabo da Boa Esperança” (Cape of Good Hope) in South Africa, a locality which cannot be considered as correct since no *Tityus* species exist in Africa. Both the type locality and the collector indicated by C. L. Koch (1844) in the description of *T. (A.) clathratus* are certainly due to mislabelling, situation that was already assumed by early authors (Kraepelin, 1899; Mello-Leitão, 1945).

Subsequently to the original description, most authors suggested that the correct origin of *Tityus (A.) clathratus* should be considered Guyana, former British Guiana. In fact, this current opinion simply followed Kraepelin’s (1899) decision of placing *Tityus quelchii* Pocock, 1893 in the synonymy of *T. (A.) clathratus*, and to the fact that *T. quelchii* was described from British Guiana (now Guyana). Records following Kraepelin (1899) also proved to be biased by both misinterpretations and/or misidentifications. Mello-Leitão (1931, 1932) referred to ‘Guyana Hollandesa’ and ‘Guiana Ho-

landêsa’, now Suriname, without any justification. This same author (Mello-Leitão, 1945) cited specimens from Caracas in Venezuela and Pará in Brazil. This last locality is incorrect and probably due to misidentification. The idea of Guyana as the possible original locality for *T. (A.) clathratus* was maintained by Lourenço (1983, 1984), Rojas-Runjaic and Armas (2007) but also in the ‘Catalog of the Scorpions of the World’ (Fet & Lowe, 2000).

At present, a question can be asked; what are the chances that specimens of *Tityus* were collected in British Guiana in the early 19th century and sent to the Zoologisches Museum in Berlin to be subsequently described by C. L. Koch? In fact, according to several reports of early zoological expeditions to northern South America, these chances appear to be weak.

Very few field expeditions were conducted in former British Guiana on the early years of 19th century. One particular case was the trip of Robert Hermann Schomburgk, a native of Freiburg in Prussia. Schomburgk explored British Guiana from 1834 to 1839 and from 1840 to 1844. Although being a German citizen, Schomburgk worked mainly for the Geographical Society of London, and the important collections of plants and animals he assembled were essentially brought to England and not to Berlin. (Papavero, 1973).

A second example is that of Johann Wilhelm Karl Moritz from Sachsen in Prussia. This German collector also conducted field trips in Venezuela and nearby regions such as

Colombia and probably British Guiana. The trips by Moritz took place from 1835 to 1837 and again starting on 1840 (Papavero, 1973); these dates were, however, rather late to match with that of the description done by C. L. Koch (1844). Never less (nevertheless?) he remains a potential collector for the material studied by C. L. Koch.

A more plausible possibility comes from the field trips by Friedrich Heinrich Alexander, Baron von Humboldt and Aimé Jacques Goujaud Bonpland in South America and in particular in Venezuela, on the very end of the 18th century - 1799 (Papavero, 1971). Humboldt was from Berlin whereas Bonpland was from La Rochelle but moved to Paris where he later met Humboldt. Their initial project was to travel to Havana in Cuba, but when their ship was approaching the West Indies an epidemic occurred on board. The captain fearing for the safety of the crew changed route and headed to Cumaná on the coast of Venezuela. Humboldt and Bonpland first explored the city's surroundings and later the Peninsula de Araya and several localities in the present state of Sucre. Humboldt also proceeded by sea to La Guaira and Caracas. During several months (1800), they collected plants and animals along the coasts of Venezuela (in locations where *T. (A.) clathratus* is still present today). The collections made in Venezuela (and subsequently in Cuba) were divided in three portions - one to go to Germany, a second to go to France and the third to remain in Havana. Father Juan González, who had accompanied the two naturalists in their trip through the Lower Orinoco, was to transport the collections destined to Paris, but his ship was attacked by pirates in the coast of Africa and the collections were lost (Papavero, 1971). The portion sent to Germany arrived in Berlin and could be a possible source of the material used in the description of *T. (A.) clathratus*. This strongly suggests that Venezuela may be the true type locality for this species.

Methods

Illustrations and measurements were made with the aid of a Wild M5 stereo-microscope with an attached drawing tube (camera lucida) and an ocular micrometer. Measurements follow Stahnke (1970) and are given in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows Hjelle (1990).

Taxonomic remarks

A revised diagnosis is proposed for *T. (A.) clathratus*, based on the type material and on specimens collected in Venezuela. Specimens from Venezuela are those which better correspond to the type material.

Lourenço (1983) referred to a single male specimen from French Guiana as *T. clathratus*. This specimen presents, however, many differences compared to *T. clathratus*, in particular in its much paler pigmentation pattern. A second specimen, a female, also from French Guiana, confirms this pattern of pigmentation and brings further evidence to support that this local population is a different new species.

A second new species is described here based on specimens from the upper Rio Negro in Brazilian Amazon. This region has a totally distinct habitat compared to the coastal zones of Venezuela and Guyana, where *T. (A.) clathratus* is distributed (see ecological section).

Taxonomic treatment

Family Buthidae C. L. Koch, 1837

Genus *Tityus* C. L. Koch, 1836

Revised diagnosis for *Tityus (Archaeotityus) clathratus* C. L. Koch, 1845 (Fig. 1).

MATERIAL: *Tityus clathratus* - für Koch-type - holotypus, female, ZMB - Kat - Nr. 121 (Bergius), Africa, 'Cabo da Boa Esperança' (Cape of Good Hope). Typen Koch, 1 male, 1 male juvenile, ZMB - Kat - Nr. 121a (Bergius), Africa, 'Cabo da Boa Esperança' (Cape of Good Hope). Venezuela, Caracas, 3 females, Tovar, no date; La Guaira, 1 male, (F. Geay), no date, MNHN.

DIAGNOSIS: scorpions of moderate size with a total length of 37 to 42 mm in males and 35 to 40 mm in females. Coloration yellowish to reddish-yellow with variegated brown to dark brown spots over the body and appendages; metasomal segment V and telson generally very dark. Moderate strongly marked granulations over the entire body and pedipalps, better marked in females. Fixed and movable fingers of pedipalps with 13-14 rows of granules. All carinae complete or almost complete. Pectines small, with moderate fulcra. Pectinal tooth count 17 to 18 in males, 14 to 16 in females. Basal middle lamella not dilated in female. Dorsal carinae of metasomal segments II to IV with a moderately marked distal spinoid granule; metasomal segment V and chela hand strongly globular in males. Telson smooth in males, and with two to four vestigial lateral carinae in the female; subaculear tubercle strongly rhomboid.

DISTRIBUTION: Coastal regions of Venezuela and Guyana. The population found in the 'Ilha do Maracá' in the state of Roraima in Brazil, may correspond to *T. (A.) clathratus*, but a final decision requires yet further investigation.

Tityus (Archaeotityus) mana sp. n.

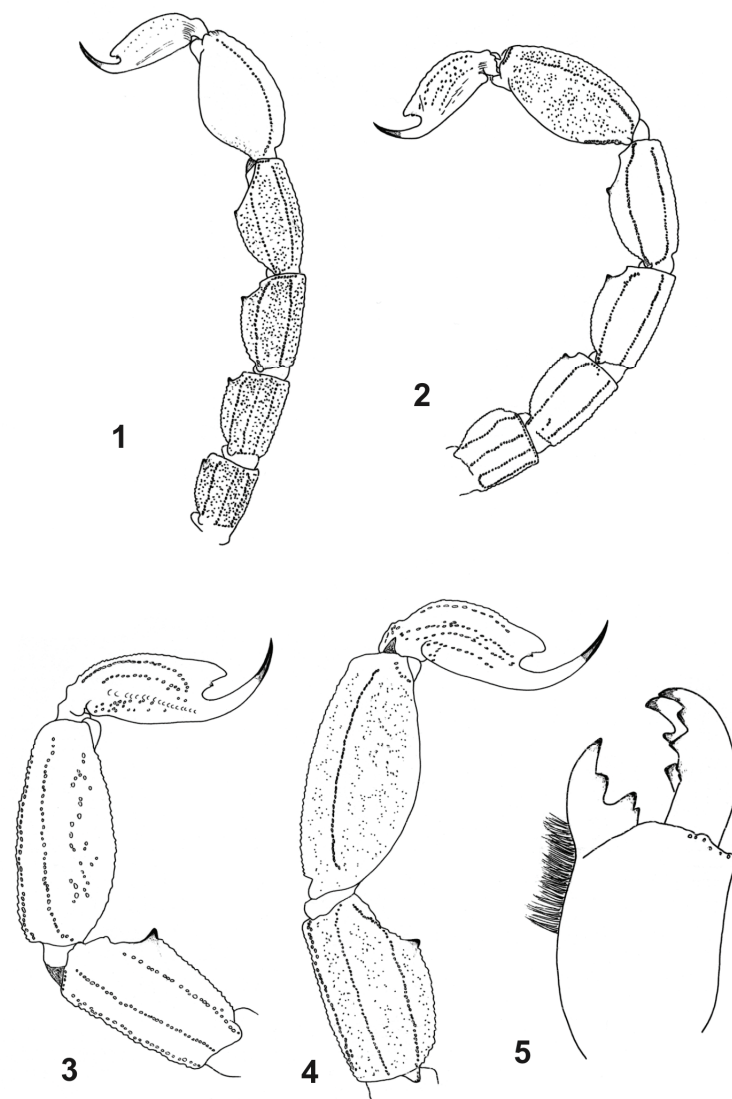
Fig. 2, 11-15.

TYPE MATERIAL: Holotype male: French Guiana, Pisti Mana-Les Hattes (terre très sableuse [very sandy soil]), 8/VIII/1975 (M. Boulard & P. Pompanou). Paratype female: E Couachi, route Organabo, forêt sèche [dry forest], 22/VI/1987 (W. Lourenço). Deposited in the Muséum national d'Histoire naturelle, Paris.

ETYMOLOGY: The specific epithet is placed in apposition to the generic name and refers to Mana, the type locality of the holotype.

DIAGNOSIS: Small to moderate scorpions, with a total length of 31.4 mm in male and 35.8 mm in female. Coloration yellowish with only residual variegated pale brown spots over the body and appendages. Moderate to weak granulation over the entire body and pedipalps, in special on carapace and tergites. Fixed and movable fingers of pedipalps with 13-14 rows of granules. All carinae complete or almost complete; internal carina of patella and ventral carinae of chela with strongly marked granules. Pectines small, with moderate fulcra. Pectinal tooth count 16-17 in male, 14-14 in female. Basal middle lamella not dilated in female. Telson smooth in male, with two to four weakly marked lateral carinae in the female; subaculear tubercle short and strongly rhomboid.

Fig. 1. *Tityus (A.) clathratus*, male 'co-type'. Metasomal segments I-V and telson, lateral aspect. **Fig. 2.** *Tityus (A.) mana*, sp. n., male holotype, idem figure 1. **Fig. 3-5.** *Tityus (A.) grahami*, sp. n. **3-4.** Metasomal segments IV-V and telson, lateral aspect, male holotype and female paratype. **5.** Chelicera, male holotype.



The new species *T. (A.) mana* sp. n. can be distinguished from *T. (A.) clathratus*, by the following characters: (i) a distinct pattern of pigmentation, globally pale yellow with only residual variegated spots on body and appendages (ii) different morphometric values; see Table I, (iii) granulations on carapace and tergites weakly marked, (iv) ventral carinae on pedipalp chela strongly marked, (v) subaculear tubercle on telson short and strongly rhomboid in male.

DESCRIPTION BASED ON MALE HOLOTYPE AND FEMALE PARATYPE

Measurements in Table I.

Coloration. Basically yellowish to pale yellow with only residual variegated pale brown spots over the body and appendages. Prosoma: carapace yellowish with residual spots on the posterior and central zones; eyes surrounded with black pigment. Mesosoma yellowish with pale brown variegated spots on the posterior margins of tergites. Metasomal segments I to IV yellowish, V reddish-yellow, with dark spots laterally and ventrally. Vesicle reddish; aculeus reddish. Venter yellowish without spots; sternites with pale brown variegated spots on the posterior margins; sternum, genital operculum and pectines pale yellow. Chelicerae yellowish without spots; fingers yellowish; teeth reddish. Pedipalps yellowish with only some vestigial spots on the femur and patella of male. Legs yellowish with residual variegated spots on all segments.

Morphology. Prosoma: Anterior margin of carapace only moderately emarginate. Carapace carinae weakly developed; anterior median carinae weak; central median and posterior median carinae moderate to weak; central lateral carinae vestigial. All furrows weak. Intercarinal spaces weakly granular. Median ocular tubercle anterior to the centre of the carapace; median eyes separated by a little more than one ocular diameter. Three pairs of lateral eyes. Mesosoma: Tergites I-VI with one moderately marked median carina. Tergite VII pentacarinata, lateral pairs of carinae moderately marked; median carinae marked only on proximal third. Intercarinal spaces weakly granular. Sternites: carinae absent on III-VI; four weak to moderate carinae on VII; sternites surface with a residual granulation, almost smooth; spiracles slit-like but

short. Pectines small with moderate fulcra; basal middle lamella not dilated in female; pectinal tooth count 16-17 in male holotype; 14-14 in female paratype. Metasomal segments I and II with 10 carinae; III and IV with 8 carinae; segment V with 5 carinae; dorsal carinae of segments I to IV with one strong distal spinoid granule, better marked in female. Dorsal furrow of all segments weakly developed; intercarinal spaces weakly granular. Telson smooth in males; with one ventral and four vestigial lateral carinae in the female. Aculeus shorter than vesicle, moderately curved; subaculear tubercle short and strongly rhomboid, with two dorsal teeth. Chelicerae with two reduced denticles at the base of the movable finger, as typical in buthids (Vachon, 1963). Pedipalps: femur pentacarinata; all carinae moderately to strongly crenulate. Patella with seven carinae; internal carina with strong spinoid granules; chelae with 8-9 strongly marked carinae; all faces weakly granular; carinae and granules better marked in female. Dentate margins of fixed and movable fingers composed of 13-14 oblique rows of granules. Trichobothrial pattern orthobothriotaxic, type A (Vachon, 1974); dorsal trichobothria of femur in α (alpha) configuration (Vachon, 1975). Legs: Ventral aspect of tarsi with numerous thin setae. Tibial spurs absent. Pedal spurs present but vestigial in all legs.

Table I. Morphometric values (in mm) of *Tityus clathratus*, male co-type (M-CT), female holotype (F-T) and a male from Venezuela (M-V); *Tityus mana* sp. n. F. Guiana and *Tityus grahami* sp. n. Rio Negro, male holotype and female paratype.

	<i>Tityus clathratus</i>			<i>Tityus mana</i> sp. n.		<i>Tityus grahami</i> sp. n.	
	(M-CT)	(F-T)	(M-V)	(M)	(F)	(M)	(F)
Total length	36.7	34.7	42.5	31.4	35.8	25.2	36.3
Carapace:							
- length	4.5	4.8	4.8	3.6	4.4	3.2	4.3
- anterior width	3.0	3.1	3.2	2.4	2.8	2.2	2.8
- posterior width	4.7	5.5	5.2	3.8	4.6	3.4	4.6
Metasomal segment I:							
- length	2.8	2.5	2.9	2.2	2.2	1.8	2.3
- width	2.5	2.5	2.6	1.9	2.4	1.7	2.4
Metasomal segment V:							
- length	5.0	4.9	5.5	4.5	4.7	3.6	5.2
- width	3.1	2.5	3.2	2.0	2.3	1.4	2.3
- depth	3.4	2.3	3.5	2.3	2.1	1.5	2.3
Telson length	4.4	4.1	4.6	3.5	3.8	3.2	4.2
Vesicle:							
- width	1.6	1.5	1.7	1.3	1.4	1.0	1.3
- depth	1.6	1.5	1.6	1.3	1.3	1.1	1.4
Pedipalp:							
- Femur length	4.2	4.2	4.5	3.4	3.9	3.2	4.1
- Femur width	1.4	1.4	1.6	1.1	1.3	1.0	1.4
- Patella length	4.7	4.8	5.0	3.7	4.3	3.6	4.7
- Patella width	2.0	1.9	2.2	1.5	1.9	1.3	2.0
- Chela length	8.2	7.7	8.8	6.5	7.0	5.8	7.7
- Chela width	2.7	1.7	2.8	1.5	1.7	1.1	1.6
- Chela depth	2.5	1.5	2.7	1.4	1.4	1.0	1.4
Movable finger:							
- length	4.9	5.2	5.2	4.1	4.9	4.1	5.3

***Tityus (Archaeotityus) grahami* sp. n.** (Fig. 3-10).

TYPE MATERIAL: Holotype male: Brazil, State of Amazonas, Upper Rio Negro, Barcelos, Acampamento Madrugada, Igarapé da Coruja, Piaçaval margem direita do Rio Erere (00°05'58.2"N, 63°53'02.9"W)13-16/VIII/2009 (G. Leandro & R. Baiatune). 3 female paratypes, Upper Rio Negro, São Tomé, Mun. Santa Izabel (0°28'S, 65°2'W) 22/VIII/1995 (N. Fé): Holotype and one paratype, deposited in the INPA, Manaus, Brazil; two paratypes deposited in the Muséum national d'Histoire naturelle, Paris.

ETYMOLOGY: Patronym in honour of Matthew R. Graham, University of Nevada, Las Vegas, USA, for his enthusiastic interest in the study of scorpions.

DIAGNOSIS: Moderate to small scorpions, with a total length of 25.2 mm in male and 35 to 37 mm in females. Coloration yellowish to reddish-yellow with variegated brown to dark brown spots over the body and appendages; better marked in male. Moderate to weak granulations over the entire body and pedipalps. Pedipalp chela with un conspicuous ventral carinae. Fixed and movable fingers of pedipalps with 13-14 rows of granules. All carinae complete or almost complete. Pectines small, with moderate fulcra. Pectinal tooth count 15-15 in male, 15 to 16 in females. Basal middle lamella not dilated in female. Telson with ventral and lateral carinae in male and female; subaculear tubercle strongly rhomboid.

The new species *T. (A.) grahami* sp. n. can be distinguished from *T. (A.) clathratus* by the following characters: (i) a distinct pattern of pigmentation, yellowish with less conspicuous spots on carapace tergites and pedipalps; sternites, however, are heavily pigmented (ii) quite distinct morphometric values, see Table I, (iii) granulations on carapace and tergites weakly marked, but dorsal carinae of metasomal segments I to IV with conspicuous spinoid granules, (iv)

ventral carinae of pedipalp chela inconspicuous, (v) metasomal segment V granulated; vesicle with ventral and lateral carinae.

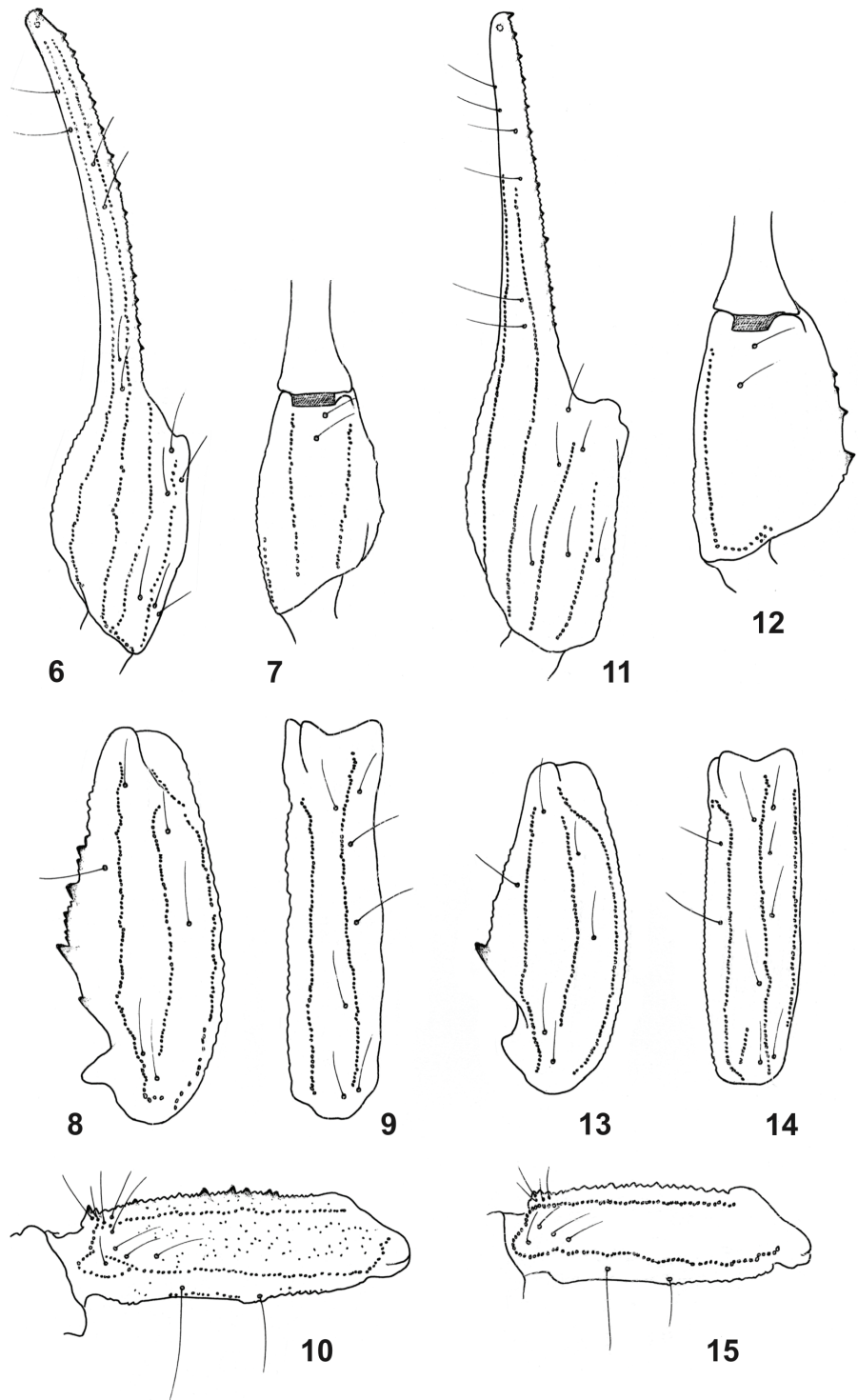
DESCRIPTION BASED ON MALE HOLOTYPE AND FEMALE PARATYPES

Measurements in Table I.

Coloration. Basically yellowish to reddish-yellow, symmetrically marbled with brown to dark brown variegated pigmentation producing an overall spotted appearance; spots better marked on male. Prosoma: carapace yellowish and heavily spotted except on the anterior margins; eyes surrounded with black pigment. Mesosoma: yellowish with variegated brown to dark brown spots over all tergites. Metasomal segments I to IV yellowish, V reddish-yellow, with dark brown spots laterally and ventrally. Vesicle dark reddish to blackish-brown; aculeus reddish. Venter yellowish with two dark spots on the coxapophysis; sternites with intensely marked variegated dark spots; sternum, genital operculum and pectines pale yellow. Chelicerae yellowish with minute blackish spots at the base of fingers; fingers yellowish with some black spots; teeth reddish. Pedipalps: yellowish with several spots on the femur, patella, chela hand and chela fingers; better marked on male. Legs yellowish with dark brown variegated spots on all segments.

Morphology. Prosoma: Anterior margin of carapace only moderately emarginate. Carapace carinae weakly developed; anterior median carinae weak; central median and posterior median carinae moderate to weak; central lateral carinae vestigial. All furrows weak. Intercarinal spaces moderately to weakly granular, with the granules distributed over the entire surface. Median ocular tubercle anterior to the centre of the carapace; median eyes separated by a little more than one

Fig. 6-15. Trichobothrial pattern. **6-10.** *Tityus (A.) grahamsi* sp. n., male holotype. **6-7.** Chela dorso-external and ventral aspects. **8-9.** Patella, dorsal and external aspects. **10.** Femur, dorsal aspect. **Fig. 11-15.** *Tityus (A.) mana* sp. n., male holotype. Idem figures 6-10.



ocular diameter. Three pairs of lateral eyes. Mesosoma: Tergites I-VI with one moderately to strongly marked median carina. Tergite VII pentacarinata, lateral pairs of carinae moderately marked; median carinae marked only on proximal third. Intercarinal spaces moderately granular, with the granules distributed over the entire surface. Sternites: carinae absent on III-V; weak on VI; four moderate to strong carinae on VII; sternites surface with a thin granulation; spiracles slit-like but short. Pectines small with moderate fulcra; basal middle lamella not dilated in female; pectinal tooth count 15-15 in male holotype; 15 to 16 in female paratypes. Metasomal segments I and II with 10 carinae; III and IV with 8 carinae; segment V with 5 carinae; dorsal carinae of segments I to IV

with one distal spinoid granule, better marked in male. Dorsal furrow of all segments weakly developed; intercarinal spaces weakly granular. Telson with one ventral and four weak lateral carinae in male and female. Aculeus shorter than vesicle, moderately curved; subaculear tubercle very strong and rhomboid, with two dorsal teeth. Chelicerae with two reduced and almost fused denticles at the base of the movable finger (Vachon, 1963). Pedipalps: Femur pentacarinata; all carinae moderately to strongly crenulate. Patella with seven carinae; internal carina with 3-4 strong spinoid granules; chelae with 8-9 moderate carinae; ventral carina inconspicuous; all faces weakly granular; carinae and granules better marked in male. Dentate margins of fixed and movable fingers composed

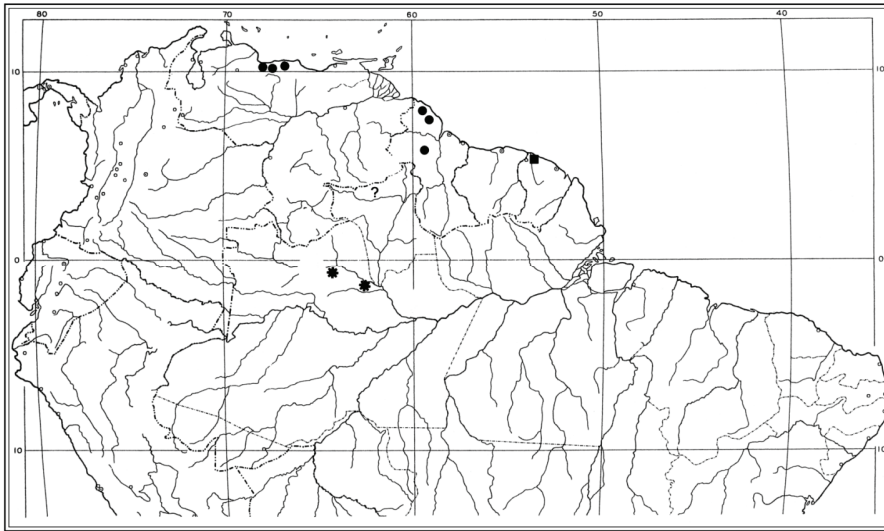


Fig. 16. Map of North South America, showing the suggested region of distribution of *T. (A.) clathratus* in Guyana and Venezuela (black circles) and the type localities of *Tityus (A.) mana* sp. n. (black square), and *Tityus (A.) grahami* sp. n. (black asterisks). The population of 'Ilha Maracá' in Brazil is indicated with an interrogation mark.

of 13-14 oblique rows of granules. Trichobothrial pattern orthobothriotaxic, type A (Vachon, 1974); dorsal trichobothria of femur in α (alpha) configuration (Vachon, 1975). Legs: Ventral aspect of tarsi with numerous thin setae. Tibial spurs absent. Pedal spurs present but vestigial in all legs.

Biogeographic and ecological comments

Tityus (A.) mana sp. n. was collected in what can be defined as the Coastal savannahs of the Guayanas (Sarmiento, 1984), more precisely in the region of Mana in French Guyana. To a certain extent it would be possible to define this form as a 'subspecies' or as a possible sibling of *T. (A.) clathratus*. The savannah areas of the Guayana region, including those of French Guiana Coastal range most certainly coalesced with those of Rio Branco-Rupununi area in Guyana in past dry epochs. However, the definition of subspecies normally requires the demonstration of contact zones between the more or less isolated subpopulations. This could be the case here, however, at the present stage of our knowledge we do not have significant information about the scorpion population of the savannah of Suriname. More complete studies about the fauna of Suriname may bring more clear answers to these questions.

The Rio Negro region includes a large area of north-western Brazilian Amazonia, as well as parts of Venezuelan and Colombian Amazonia (Prance, 1973, 1982; Lourenço, 1986). The extreme complexity of diversity and endemism in the middle and upper Rio Negro area has already been discussed for several groups of plants and animals (Steyermark, 1979; Prance, 1982; Lourenço, 1986, 1994, 2005).

Barcelos and Santa Isabel are located near the margins of Rio Negro, about half-way between Manaus and São Gabriel da Cachoeira. This region is located not far from the 'Sierra Imeri' which belongs to the Roraima formation and corresponds to an important centre of endemism in Amazon. Moreover, since the Rio Negro region is quite vast, many new taxonomic elements, mainly at the level of species, may be expected to be discovered and described.

Acknowledgments

I am most grateful to Drs Jason Dunlop and Anja Friederichs, Museum für Naturkunde, Humboldt-Universität zu Berlin for the loan of the type material of *T. clathratus*; to Victor Fet, Marshall University, for his comments to the manuscript; and to Elise-Anne Leguin, MNHN, Paris for her assistance in the preparation of the plates.

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