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NEW INSIGHTS ON THE SCORPION SPECIES OF THE '*TITYUS TRIVITTATUS* GROUP' OF SUBGENUS *TITYUS* C. L. KOCH, 1836 (SCORPIONES: BUTHIDAE)

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Abstract: The species of *Tityus*, subgenus *Tityus*, associated to the *Tityus trivittatus* group have been the subject of several studies during the last four decades. Nevertheless, the status of some of these species still needs to be clarified. This task is now further complicated by the recent destruction of several type specimens in the fire which took place in the Museu Nacional in Rio de Janeiro, Brazil. The collection of new specimens associated to this group allows a redefinition of some of the species. A new species, collected by Jean Vellard, and entrusted to the author, is also described from northern Goiás.
Key words: Scorpiones, Buthidae, *Tityus trivittatus* group, new species, Goiás, Brazil.

Nuevas consideraciones sobre las especies de escorpiones del grupo '*Tityus trivittatus* group' del subgénero *Tityus* C. L. Koch, 1836 (Scorpiones: Buthidae)
Resumen: Las especies de *Tityus*, subgénero *Tityus*, asociadas al grupo *Tityus trivittatus* han sido objeto de varios estudios durante las últimas cuatro décadas. Sin embargo, el estatus de algunas de las especies sigue sin aclararse totalmente. La tarea se ha complicado aún más con la reciente destrucción de varios ejemplares tipo en el incendio que tuvo lugar en el Museu Nacional de Río de Janeiro, Brasil. La recogida de ejemplares nuevos asociados a este grupo permite redefinir algunas de las especies. Se describe una especie nueva, recogida por Jean Vellard y confiada al autor, del norte del estado de Goiás.
Palabras clave: Scorpiones, Buthidae, grupo *Tityus trivittatus*, especie nueva, Goiás, Brasil.

Taxonomy / Taxonomía: *Tityus rupestre* **sp. n.**

Introduction

As already outlined in previous publications (Lourenço, 2001, 2002, 2003) *Tityus* species inhabitant the Core Cerrado formation of Central Brazil, and belonging to the subgenus *Tityus*, as defined by Lourenço (2006), have been the subject of numerous taxonomic studies since the late 1970s. Historically however, this region of Brazil knew some early contributions since the 1930s which in some cases remained obscure or poorly known. Among these we have the publications by Mello-Leitão (1931, 1933), Vellard (1932) and Pessôa (1935). In these contributions several species or subspecies have been described, namely, *Tityus blaseri* Mello-Leitão, 1931, *Tityus bahiensis uniformes* Mello-Leitao, 1931, *Tityus trivittatus charreyroni* Vellard, 1932, *Tityus thelyacanthus* Mello-Leitao, 1933, *Tityus acutidens* Mello-Leitao, 1933 and *Tityus trivittatus fasciolatus* Pessôa, 1935. The subsequent contributions by Mello-Leitão (1939, 1945) can be considered as generally confuse and brought little clarification to the identity of these species. In some cases original type localities have been misinterpreted leading to an even more obscure situation.

Among the contributions which started on the 1970s some were noticeable, in particular those concerning *Tityus fasciolatus* Pessôa, and *Tityus charreyroni* Vellard, (Lourenço, 1980), *Tityus serrulatus* Lutz & Mello, 1922 and associated forms (Lourenço, 1981a); *Tityus bahiensis* (Perty, 1833) and associated species (Lourenço, 1982a). In subsequent contributions, precise patterns of distribution and differentiation have been synthesised (Lourenço, 1986, 1994, 1996, 2002), and it was suggested that the fauna of *Tityus* distributed in the Cerrados was largely known. Evidently, several regions within the Core Cerrado formations of Central Brazil have been intensively prospected, mainly in connection with scorpionism problems (Lourenço & Cloudsley-Thompson, 1996; Lourenço *et al.*, 1996), and this is particularly true for the States of São Paulo, Minas Gerais and Goiás (see Lourenço, 2015 for references).

Nevertheless in more recent years we assisted to the discovery and description of several new species of *Tityus* for the Core Cerrado formations of Central Brazil, namely *Tityus jeanvellardi* Lourenço, 2001, *Tityus adrianoi* Lourenço, 2003 and *Tityus karaja* Lourenço, 2016 (Lourenço, 2001, 2003, 2016) attesting therefore that the inventory work of this region is not yet complete.

In the present paper a new species *Tityus rupestre* sp. n., which can also be included in the '*Tityus trivittatus* group of species' is described based on one female specimen collected in the region of the Chapada dos Veadeiros, state of Goiás by Jean Vellard. The field explorations of this French scientist have already been largely commented in previous papers (see Lourenço, 2001, 2016). The Chapada dos Veadeiros region can be included in the core region of the Brazilian Cerrados (sensu lato - Eiten, 1978, 1982) but constitutes a particular formation represented by the Campos Rupestres. A check-list of several species belonging or associated to the '*Tityus trivittatus*' group, which are distributed in the Cerrados (sensu lato) is proposed and followed by some new comments on their taxonomic status and possible range of geographical distribution. Having in account that the recent tragic fire-incident that took place in the Museu Nacional in Rio de Janeiro in 2018 lead to the destruction of numerous types specimens treated in this article, an up to date discussion appears as useful.

Methods

Illustrations and measurements were obtained using a Wild M5 stereo-microscope with a drawing tube and ocular micrometer. Measurements follow Stahnke (1970) and are given

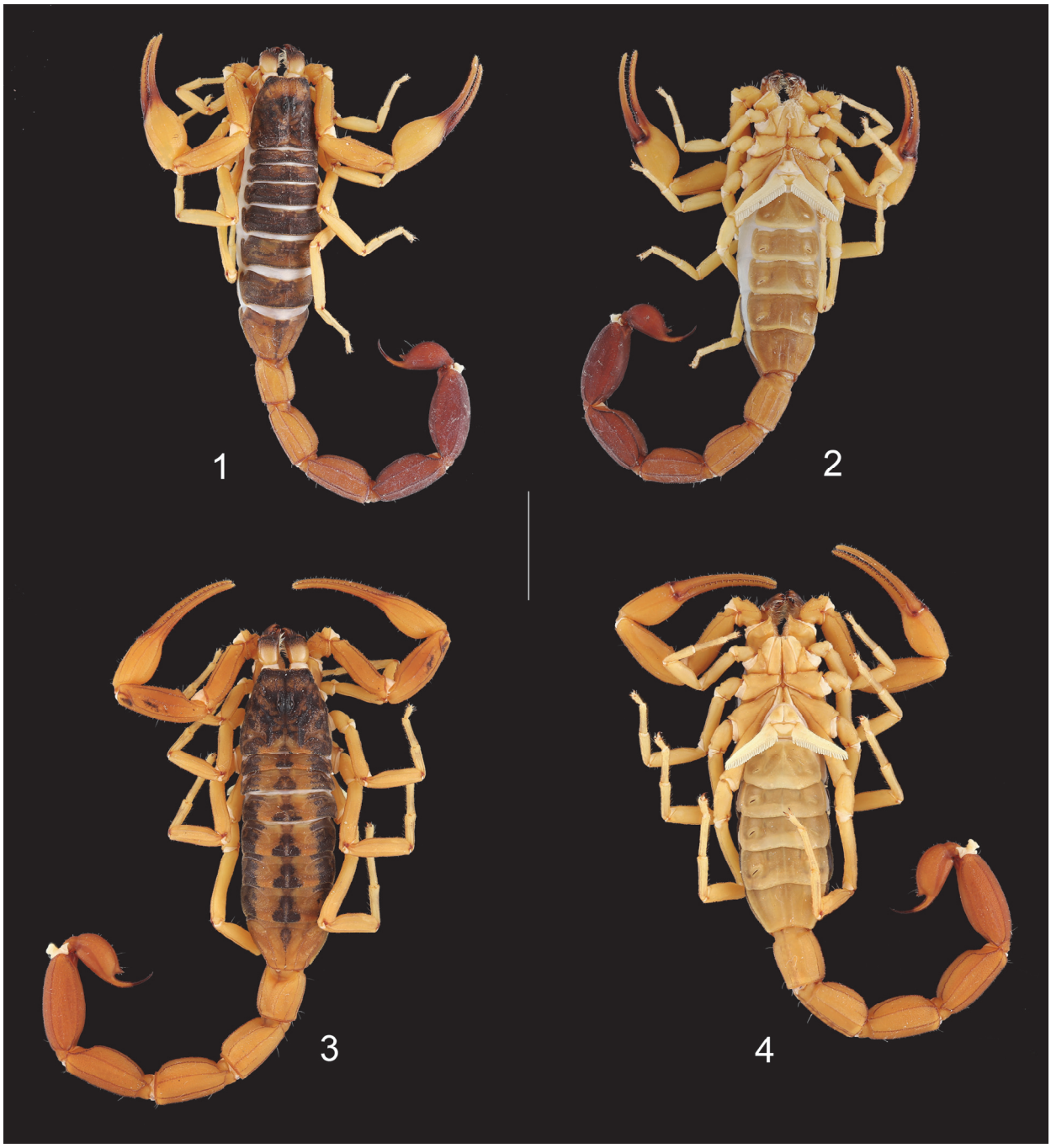


Fig. 1-2 and 3-4. *Tityus blaseri*, male topotype from Chapada dos Veadeiros and *Tityus charreyroni* female from Goiás-Velho. Habitus, dorsal and ventral aspects.

in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows Hjelle (1990).

Comments on some of the species of subgenus *Tityus* distributed in the Cerrados Formations of Central Brazil.

***Tityus blaseri* Mello-Leitão 1931** (Fig. 1-2)

In a paper concerning the classification and distribution of the genus *Tityus*, Mello-Leitão (1931) described *T. blaseri*, based on one immature female from Rio São Miguel, Veadeiros in the State of Goiás, Brazil (data from the labels). The description was short and illustrations were limited to a single poor quality photo. Consequently, the status of this species remained enigmatic. Lourenço (1980), in his study of species of *Tityus* from Central Brazil, was unable to find the type material and disregarded the species as uncertain. A few years later a new study was possible based on some fresh material collected in the area of Niquelândia, Goiás, which is very close to the type locality; besides the type specimen was finally located in the Museu Nacional, Rio de Janeiro (Lourenço *et al*., 1997; Lourenço, 2002). This study leads to the final clarification of the taxonomic status of *T. blaseri* which can be associated to the '*Tityus trivittatus* groupe'. The type material was destroyed in the 2018 fire.

The records of *Tityus confluens* Borelli, 1899 for Central Brazil, Goiás/Tocantins states (Bertani et al., 2005), most certainly correspond to *Tityus blaseri*, a very similar species to *T. confluens*, and are most certainly due to misidentifications (see also Maury, 1974; Lourenço, 1980). Further studies of this material will be necessary to clarify this point.

***Tityus uniformis* Mello-Leitão 1931**
This species was originally described as a sub-species of *Tityus bahiensis* and only the State of Goiás was indicated as type locality. The subsequent indication by Mello-Leitão (1945) of Veadeiros as type locality is certainly erroneous. These subsequent changes were a common trait in the work of this author. This species remained enigmatic until it was revalidated by Lourenço (1982a) and rose to the species level; it can be considered as distinct from *Tityus bahiensis*. This species remains poorly known. The type material was not found during previous studies and the specimens used to confirm its status (Lourenço, 1982a) were collected in the region of Aruanã in the state of Goiás, near to the Rio Araguaia, by me in 1976. The type material was definitely destroyed in the 2018 fire.

***Tityus charreyroni* Vellard, 1932** (Fig. 3-4)
This species was described based on a single female specimen collected in Aruanã in the State of Goiás. Vellard (1932) originally proposed it as a sub-species of *Tityus trivittatus*, but it was subsequently raised to the rank of species (Lourenço, 1980, 1982b). The type specimen was originally lost and never reached the Muséum in Paris. The validation of the species was based on topotype specimens collected in Aruanã by the author in 1976.

***Tityus thelyacanthus* Mello-Leitao, 1933**
This species was described based on a single dry male specimen collected, accordingly to Mello-Leitão (1933) in the Island of Bananal in the state of Goiás. Subsequently, Mello-Leitão (1945) placed this species in the synonymy of *Tityus charreyroni*. Lourenço (1980) suggested that this species was most certainly related to both *Tityus charreyroni* and *Tityus fasciolatus*. Nevertheless, insisted about the fact that the Island of Bananal was geographically closer to Aruanã, type locality of *T. charreyroni* than to Vianópolis, type locality of *T. fasciolatus*. The type specimen of *T. thelyacanthus* was finally located in the Museu Nacional, Rio de Janeiro, but very poorly preserved. During 1979 I spend about two months doing field work in the Island of Bananal, and this species proved to be absent from this particular region. After reanalysis of all available data, and in account of the geographic distribution of *T. charreyroni*, I confirm the previous opinion of Mello-Leitão (1945) and definitely place *T. thelyacanthus* as a synonym of *T. charreyroni*. The type material was destroyed in the 2018 fire.

***Tityus acutidens* Mello-Leitao, 1933**
Species described together with *T. thelyacanthus*, with also Island of Bananal as type locality, but obviously was never collected again. The single dry specimen used for the description was not located in the collections of the Museu Nacional during previous studies, but was finally found by the new curator (Kury & Nogueira, 1999). The type material was definitely destroyed in the 2018 fire. Curiously, Mello-Leitão (1933) associated this species with other *Tityus* such as *Tityus rufofuscus* Pocock, 1897 which don't even belong to the same subgenus and have a total distinct distribution. Lourenço (1981a) redefined this species based on one specimen collected at Mutunópolis in the state of Goiás, which was rather associated to *Tityus serrulatus* (see Lourenço, 1981a – figs. 11-12). In account of the confuse taxonomic situation which still prevails around *Tityus serrulatus* and associated species (Lourenço & Cloudsley-Thompson, 1999), the collection of new material should bring more light to the true status of this species.

***Tityus fasciolatus* Pessôa 1935** (Fig. 5-6)
The description of this species was based on five specimens collected in Vianópolis the state of Goiás, but originally considered as only a variety of *Tityus trivittatus* by Pessôa (1935). Lourenço (1980, 1982b) considered it as a valid subspecies and after raised it to the species rank. *Tityus fasciolatus* is one of the best studied species in the world, in what concerns its biology, ecology and biogeography (Lourenço, 1980, 1981b, 1995, 2002). The species is distributed in savanna formations, and shelters exclusively under termite mounds of the genus *Armitermes*.

***Tityus jeanvellardi* Lourenço, 2001**
This species collected by me on the NW region of the Federal District, in a zone of woodland savannas (Cerradão), could be associated to the '*Tityus trivittatus* group' and showed affinities with both *T. blaseri* and *T. fasciolatus*. Major differences were based on distinct patterns of pigmentation, as often observed for the *Tityus* species of this group. No new material was ever collected and unfortunately the single holotype specimen, deposited in the Museu Nacional, Rio de Janeiro, was destroyed in the 2018 fire.

***Tityus karaja* Lourenço, 2016**
Species also collected by Jean Vellard in the late 1920s in the state of Goiás and only recently described, based on a single male specimen. This species shows some affinities with both *Tityus trivittatus* and *Tityus charreyroni*. Major differences between these species are equally based on distinct patterns of pigmentation.

Results

Taxonomy

Family Buthidae C. L. Koch 1837

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

Subgenus ***Tityus*** C. L. Koch, 1836

***Tityus rupestre* sp. n.**

Fig. 7-16. Table I.

TYPE MATERIAL: Brazil, State of Goiás, Chapada dos Veadeiros, N of Forte, road to Cavalcante. Campo rupestre formation XII/1930 (leg. J. Vellard). Holotype, a pre-adult male. 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 type of formation – the campos rupestres – where the new species was collected.

DISTRIBUTION: Only known from the type locality (Fig. 17).

DIAGNOSIS: Medium size scorpions, measuring probably 50 to 60 mm in total length for adults; the type, a pre-adult male measures 52.1 mm in total length and corresponds to the 4th instar. The species probably reach adulthood on instars 5 or 6 (Lourenço, 1979). Coloration yellowish to pale yellow, with several well marked spots over the carapace, tergites, legs and pedipalps. Spots on tergites having a confluent disposition. Granulations moderate to strong all over the body and pedi-



Fig. 5-6 and 7-8. *Tityus fasciolatus* male pre-adult from the Federal District and *Tityus rupestre* sp. n. pre-adult male holotype. Habitus, dorsal and ventral aspects.

palps. Pedipalps not particularly elongated. Fixed and movable fingers of pedipalps with 15-17 rows of almost oblique granules. All carinae on body and appendages complete or almost complete. Pectinal tooth count 23-22 in male.

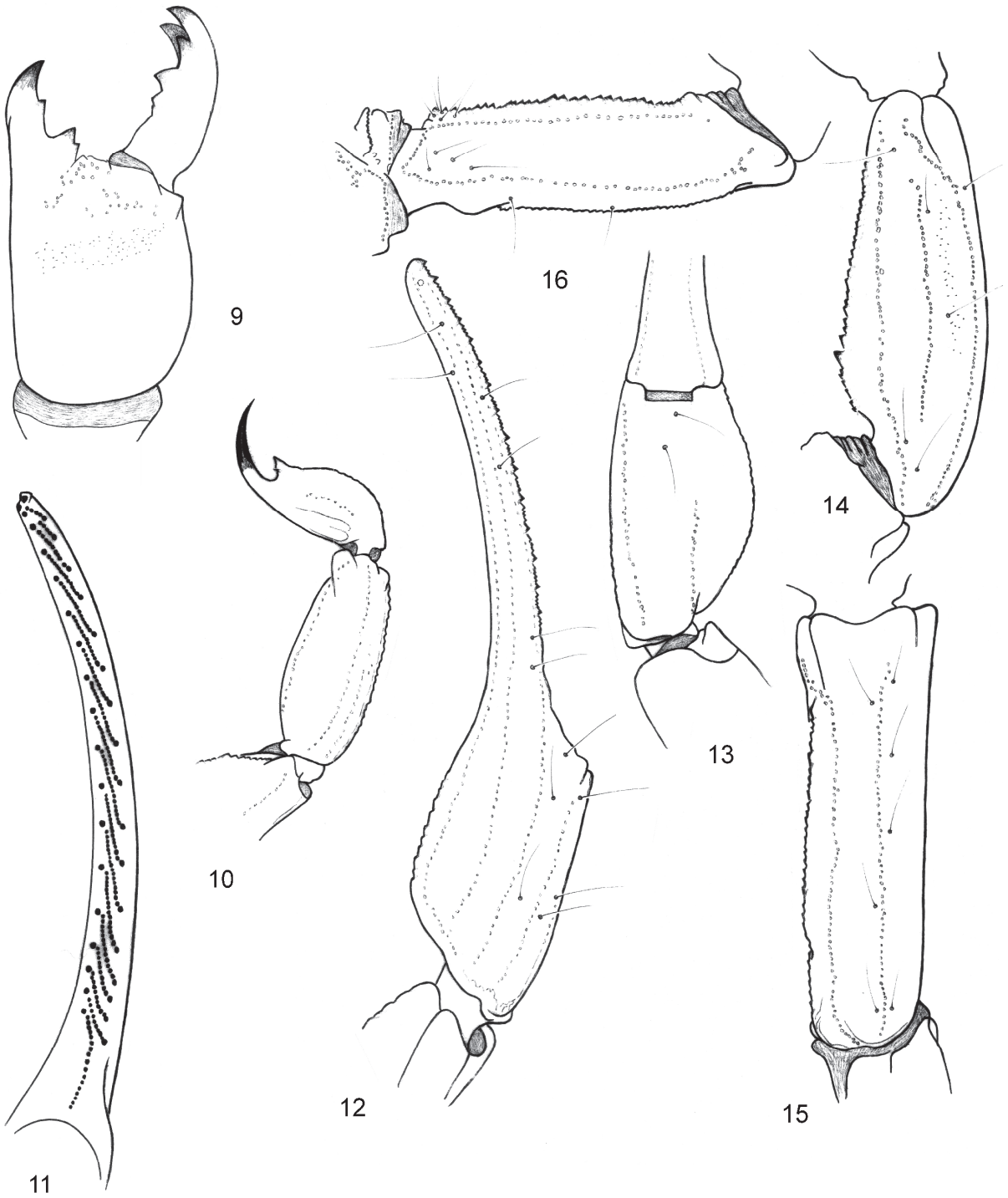


Fig. 9-16. *Tityus rupestre* sp. n. male holotype. **9**. Chelicera, dorsal aspect. **10**. Metasomal segment V and telson, lateral aspect. **11**. Cutting edge of movable finger. **Fig. 12-16.** Trichobothrial pattern. **12-13**. Chela, dorso-external and ventral aspects. **14-15**. Patella, dorsal and external aspects. **16**. Femur, dorsal aspect.

DESCRIPTION: BASED ON MALE HOLOTYPE

Coloration. Basically yellowish to pale yellow. Prosoma globally dark; posterior region of the carapace yellow; the anterior region more intensely dark; lateral regions to the ocular tubercle and lateral eyes yellow; eyes strongly marked with black pigment. Mesosomal tergites I-VII yellow with diffused longitudinal strips which become confluent and strongly marked. Metasomal segments I to V dark-yellow with blackish zones ventrally and very diffused brownish spots on the dorsal surface of segments I-III. Vesicle yellow; extremity of aculeus darker than vesicle, reddish. Venter yellow; pectines pale yellow. Chelicerae yellowish with variegated dark pigmentation on the anterior two/thirds; fingers blackish with reddish teeth. Pedipalps and legs yellow, marked with conspicuous.

Morphology. Carapace strongly granular; anterior margin moderately emarginated. Anterior median superciliary and posterior median carinae moderately developted. All furrows moderately deep. Median ocular tubercle anterior to the centre of the carapace. Three pairs of lateral eyes. Sternum triangular.

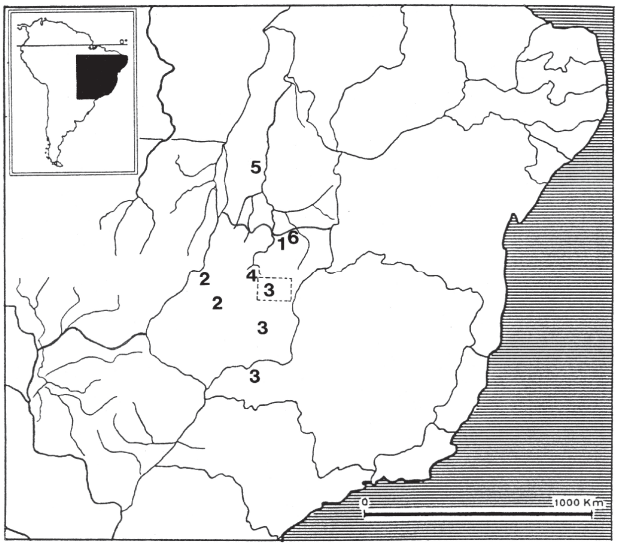


Fig. 17. Map of Central Brazil region, showing the known distributions of *Tityus rupestre* sp. n. and related species: *Tityus blaseri* (1). *Tityus charreyroni* (2). *Tityus fasciolatus* (3). *Tityus jeanvellardi* (4). *Tityus karaja* (5). *Tityus rupestre* sp. n. (6).

Mesosomal tergites moderately to strongly granular. Median carina moderate on all tergites; tergite VII pentacarinate. Venter: genital operculum wider than long. Pectines: pectinal teeth count 23-22; basal middle lamellae of the pectines not dilated. Sternites with thin granulation and with elongate stigmata; VI with vestigial carinae; VII with four moderately developed carinae. Metasomal segment I and II with 10 carinae; segments III and IV with 8 carinae; segment V with 5 carinae; intermediate carinae not complete on segment II. Intercarinal spaces moderately to strongly granular. Telson with weak granulations on ventral and lateral surfaces and with a long and strongly curved aculeus; subaculear tooth strong and spinoid, with two dorsal teeth. Chelicerae granulated; cheliceral dentition characteristic of the family Buthidae; ventral teeth on movable finger strongly reduced (Vachon, 1963); ventral aspect of both fingers and of manus densely covered with long setae. Pedipalps: femur pentacarinate; patella with 7 carinae; all carinae moderately to strongly developed; chela with 9 moderately marked carinae; femur and patella moderately granular; chela weakly granular, almost smooth. Fixed finger with 15 and movable finger with 17 oblique rows of granules. Trichobothriotaxy; orthobothriotaxy A-α-alpha (Vachon, 1974, 1975). Legs: tarsus with numerous short fine setae ventrally.

RELATIONSHIPS: The new species *Tityus rupestre* sp. n. belongs to the *Tityus trivittatus* species group. By its general morphology and pattern of coloration, the new species shows affinities with *Tityus fasciolatus* Pessôa and *Tityus blaseri* Mello-Leitão, both distributed in the State of Goias and Federal District (Lourenço, 1980; Lourenço et al., 1997). The new species can, however, be distinguished by a number of feature: (i) different morphometric values when compared to the same instar of a pre-adult *T. fasciolatus* – see table I, (ii) a distinct pigmentation pattern with confluent spots on tergites and heavily spotted pedipalps, (iii) granulations on carapace and tergites better marked in the new species.

Table I. Morphometric values (in mm) of pre-adult male holotype of *Tityus rupestre* sp. n. and of one fourth instar male of *Tityus fasciolatus*

	T. rupestre sp. n.	*T. fasciolatus*
Total length	52.1	44.2
Carapace:		
Length	5.9	6.1
Anterior width	3.8	3.4
Posterior width	5.8	5.6
Mesosoma length	14.4	11.3
Metasomal segment I		
Length	3.8	3.2
Width	3.2	2.8
Metasomal segment II:		
Length	4.5	3.7
Width	3.0	2.6
Metasomal segment III:		
Length	5.2	4.3
Width	3.0	2.6
Metasomal segment IV		
Length	6.0	4.9
Width	2.9	2.6
Metasomal segment V:		
Length	6.7	5.9
Width	2.8	2.5
Depth	2.7	2.6
Telson length	5.6	4.8
Vesicle:		
Width	2.0	1.8
Depth	2.1	1.7
Pedipalp:		
Femur length	5.4	4.8
Femur width	1.6	1.4
Patella length	6.1	5.2
Patella width	2.1	1.8
Chela length	10.7	8.9
Chela width	2.1	1.7
Chela depth	1.9	1.8
Movable finger:		
Length	6.9	6.0

Environmental characteristics of a Campo-Rupestre formation

The Chapada dos Veadeiros region can be included in the core region of the Brazilian Cerrados. According to Eiten (1978, 1982), the cerrado gradient found in the Chapada dos Veadeiros is of the type defined as Campo Rupestre (or rocky field in English). The Campo Rupestre normally occurs in certain high-lands and on mountain tops and ridges at moderate altitudes, usually between 1000 and 1800 m. These particular formations have very high species endemicity. The soils are derived from special rock types, usually meta-quartzite (such as itacolomite), but sometimes from fine grain orthoquartzite, iron ore, etc. When from the quartzites, the soil is white or light gray fine sand, usually 10-30 cm thick, sometimes with humus. The bedrock usually outcrops in blocks so that the soil may vary in depth, humus and drainage over distances of a few centimetres. The physiognomy of the vegetation may be low-tree and scrub woodland, open scrub, closed scrub, savanna or grassfield. According to Eiten (1978, 1982), the flora of the "Campos rupestres" can be divided into at least four categories. The Chapada dos Veadeiros formation is characterised by species with a growth form typical of white sand campos in central Brazil and eastern Amazonia. The branches or their ends have closely-set, short, four-ranked leaves perpendicular to the stem, that is, they are squarrose or short-cruciate. Herbs, semi-shrubs and shrubs have this growth form; the larger woody plants of this form have a candelabra branching. Altogether, the plants can be somewhat distinct from most frequent Cerrado plants.

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