

Addition to the scorpion fauna of the Manaus region (Brazil), with a description of two new species of *Tityus* from the canopy

by

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Abstract

Two new species belonging to the genus *Tityus* C.L. KOCH are described from the region of Manaus, Amazonas State, Brazil. Until now a total of 9 scorpion species have been listed from this region, which is the best known region of Brazilian Amazonia. Both new species were collected from the forest canopy by means of insecticidal fogging. Even though other scorpion species have previously been collected in the canopy, we suggest that the new species represent the first known examples of species living exclusively in this environment.

Keywords: **Scorpiones, Buthidae, *Tityus*, canopy, Manaus, Amazonia, Neotropics.**

Resumo

Duas novas espécies pertencentes ao gênero *Tityus* C.L. KOCH são descritas para a região de Manaus, Estado do Amazonas, Brasil. Até agora um total de 9 espécies de escorpião eram conhecidas para esta região, a qual é sem dúvida alguma a melhor inventoriada dentro da Amazonia brasileira. Ambas espécies novas foram coletadas na canopéia da floresta pelo método de 'insecticidal fogging'. Mesmo se outras espécies de escorpião foram coletadas na canopéia, é sugerido aqui que as novas espécies representam os primeiros casos conhecidos de espécies habitando a canopéia de maneira exclusiva.

Introduction

The inventory of known Brazilian Amazonia scorpion species has greatly increased in recent years. The first synthesis was proposed by LOURENÇO (1986). Particular regions such as the State of Pará (LOURENÇO 1988a) have been the subject of more or less intensive study. The region of Manaus, in the State of Amazonas is, however, without question, the best inventoried within the Amazonian region (LOURENÇO 1982, 1988b; MONOD & LOURENÇO 2001). This is due both to intensive collecting by the senior author during several field trips in the 1980s, and also to important contributions from several colleagues working in the area (cf. ADIS 1981).

All the species of scorpions discovered and described, have been found on or near *terra firme* (non-flooded formations), *igapó* (flooded formations) or both. Some species, all buthids, have been collected from forest trees or palms, a few from the forest canopy. In all cases, however, these species have also been found at ground level, in

both *terra firme* and *igapó* formations.

In a project of sampling by insecticidal fogging carried out by ERWIN, MONTGOMERY, ADIS et al. (cf. ERWIN 1983), in the region of Manaus during July and August, 1979, three juvenile scorpions belonging to the genus *Tityus* were collected. Although immature, it was possible to compare them with related juveniles in the same instar, of species living on the ground (LOURENÇO 1988b).

The genus *Tityus* has recently been divided again into three groups of species (LOURENÇO 2000). Following this, one of the new species can be placed in the "*Tityus bahiensis*" group. The second new species is more or less close to the "*Tityus clathratus*" group, but diverges from it in some characters. For this reason, we propose a specific group for this new species.

Moreover, we suggest that the two new species, almost certainly live exclusively in the forest canopy because they have never been found on the ground. They therefore correspond with the category defined by ADIS (1997) as 'non-migrant arboreal animals'.

Check-list of the species known to the Manaus region

Family Buthidae C.L. KOCH, 1837

Genus *Ananteris* THORELL 1891

Ananteris dekeyseri LOURENÇO, 1982

Ananteris pydanieli LOURENÇO, 1982

Genus *Tityus* C.L. KOCH, 1836

Tityus adisi n.sp.

Tityus canopensis n.sp.

Tityus metuendus POCOCK, 1897

Tityus raquelae LOURENÇO, 1988

Tityus silvestris POCOCK, 1897

Tityus strandi WERNER, 1939

Family Chaetidae POCOCK, 1893

Genus *Broteochactas* POCOCK, 1893

Broteochactas polisi MONOD & LOURENÇO, 2001

Genus *Brotheas* C.L. KOCH, 1837

Brotheas amazonicus LOURENÇO, 1988

Genus *Chactopsis* KRAEPELIN, 1912

Chactopsis amazonica LOURENÇO & FRANCKE, 1986

Tityus canopensis n.sp. (Figs. 1-3)

Brazil, Amazonas State, Rio Tarumã-Mirim (*igapó*), site 03, 30/VII/1979 (T.L. ERWIN & G.G. MONTGOMERY, J. ADIS et al.), 1 male (juvenile) holotype. Deposited in the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Brazil.

Etymology: the specific name makes reference to the ecological niche in which the species lives.

Diagnosis: Among the *Tityus* species found in the Manaus region, the new species is assumed to be allied to *Tityus raquelae* LOURENÇO, mainly on account of its pale-yellow coloration. It can, however, be distinguished from this species by the following

characters:

- The morphometric values of the new species are much lower than those of a juvenile of *T. raquelae* in the same instar. This is based on the assumption that adults of the new species are much smaller than those of *T. raquelae* (see Table 1).

- Pectinal tooth counts in the new species shows a smaller number of teeth than are found in *T. raquelae*: 14/15 against 18/19 in males.

- Dentate margins of pedipalp-tibia fingers are composed of 11/12 oblique rows of granules, whereas in *T. raquelae* there are 15 rows.

- The subaculear tooth is strong and spinoid in shape, whereas in *T. raquelae* it is moderate and between spinoid and rhomboidal.

Description based on male holotype. Morphometric values in Table 1.

Coloration. Generally pale yellow without spots or pigmented regions on the body and its appendages. Prosoma: carapace yellowish; only the eyes surrounded by black pigment. Mesosoma: yellowish; tergites I-VII with two lateral depigmented zones. Metasoma: all segments yellowish. Vesicle yellowish; aculeus yellowish at its base and slightly reddish at its extremity. Venter pale yellow. Chelicerae yellowish; teeth pale reddish. Pedipalps: yellowish overall; rows of granules on the dentate margins of the fingers pale reddish. Legs yellowish.

Morphology. Prosoma: Anterior margin of carapace only slightly emarginate, almost straight. Carapace carinae weakly developed; central median and posterior median carinae weak; anterior median carinae vestigial; central lateral and central median carinae weak. All furrows weak. Intercarinal spaces faintly granular, almost smooth. Median ocular tubercle anterior to the center of the carapace; median eyes separated by one ocular diameter. Three pairs of lateral eyes. Mesosoma: Tergites I-VI with one median carina. Tergite VII pentacarinata, with lateral pairs of carinae moderate to weak; median carinae present on proximal third, moderate to weak. Intercarinal spaces faintly granular, almost smooth. Sternites: all carinae absent. Pectines moderate; pectinal tooth count 14-15. Metasoma: Segment I with 10 keels; II-IV with 8 keels. Segment V with 5 keels. Dorsal furrows of all segments poorly developed, smooth; intercarinal spaces faintly granular, almost smooth. Telson smooth. Aculeus long; subaculear tubercle strong and spinoid. Chelicerae, with two reduced but not fused denticles at the base of the ventral aspect of the movable finger (VACHON 1963). Pedipalps: Trichobothrial pattern orthobothriotaxic, type A (VACHON 1974); dorsal trichobothria of femur in alpha configuration (VACHON 1975). Femur pentacarinata; all carinae moderately crenulate. Patella with 7 carinae; internal carina with spinoid granules; tibia with 7/8 vestigial carinae. Dentate margins on fixed and movable fingers composed of 11/12 oblique rows of granules. Legs: Ventral aspect of tarsi with numerous thin setae. Patellar spurs absent. Pedal spurs present on legs III-IV, moderate to weak.

Tityus adisi n.sp. (Figs 5-16)

Brazil, Amazonas State, Lago Janauari, *igapó* & *várzea* (água mista), 03°20'S, 60°17'W, site 06, 07/VIII/1979 (J. ADIS, T.L. ERWIN & MONTGOMERY et al.), 1 male (juvenile) holotype. Rio Tarumã-Mirim (*igapó*), site 03, 30/VII/1979 (J. ADIS, T.L. ERWIN & MONTGOMERY et al.), 1 male (juvenile) paratype. Deposited in the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Brazil.

Etymology: Patronym in honor of Dr. Joachim ADIS, of the Tropical Ecology Working Group at the Max-Planck-Institute for Limnology in Plön, Germany.

Diagnosis: Among the *Tityus* species found in the Manaus region, the new species is allied to *Tityus silvestris* POCOCK, mainly by its yellow-variegated pigmentation. It can, however, be distinguished from this species by the following characters:

- The morphometric values of the new species are much lower than those of a juvenile of *T. silvestris* in the same instar. This again is based on the assumption that adults of the new species are much smaller than those of *T. silvestris* (see Table 1).
- The variegated pattern of pigmentation is different between the two species.
- The dentate margins of the pedipalp-tibia fingers are composed of 12/13 oblique rows of granules, whereas in *T. silvestris* there are 15/16 rows.
- Subaculear tooth very strong and spinoid in the new species, whereas in *T. silvestris* the subaculear tooth is strong but rhomboidal.

Description based on male holotype. Morphometric values in Table 1.

Coloration. Generally yellowish, symmetrically marbled with dark reddish brown producing an overall variegated appearance. Prosoma: carapace yellowish and heavily spotted except on the lateral margins; eyes surrounded by black pigment. Mesosoma: yellowish with variegated brown spots over the tergites, clustered into three longitudinal stripes. Metasoma: segments I-IV yellowish with variegated brown spots anteriorly and posteriorly forming rings. Segment V slightly darker; dorsal aspect yellowish. Vesicle light brown; aculeus yellowish at the base and pale reddish at the extremity. Venter yellowish without spots. Chelicerae yellowish with variegated brown spots; base of fingers yellowish; fingers yellowish with some brown spots; teeth pale reddish. Pedipalps: yellowish with several pale brown spots on the femur and patella; tibia less densely spotted; fingers yellowish; rows of granules on the dentate margins of the fingers, pale reddish. Legs yellowish with brown variegated spots on all segments.

Morphology. Prosoma: Anterior margin of carapace only weakly emarginate. Carapace carinae weakly developed; central median and posterior median carinae weak; anterior median carinae vestigial; central lateral and central median weak. All furrows weak. Intercarinal spaces faintly granular. Median ocular tubercle anterior to the center of the carapace; median eyes separated by one ocular diameter. Three pairs of lateral eyes. Mesosoma: Tergites I-VI with one median carina. Tergite VII pentacarinata, lateral pairs of carinae moderate to weak; median carinae present on proximal one-third, moderate to weak. Intercarinal spaces moderately granular. Sternites: all carinae absent on III-VI; VII with vestigial carinae. Pectines moderate; pectinal tooth count 15-15 (15-15 on paratype). Metasoma: Segment I with 10 keels; II-IV with 8 keels. Segment V with 5 keels. Dorsal furrows of all segments weakly developed; intercarinal spaces weakly granular. Telson with three vestigial carinae. Aculeus long and moderately curved; subaculear tubercle very strong and spinoid. Chelicerae, with two well distinct and not fused denticles at the base of the ventral aspect of the movable finger (VACHON 1963). Pedipalps: Trichobothrial pattern orthobothriotaxic, type A (VACHON 1974); dorsal trichobothria of femur in alpha configuration (VACHON 1975). Femur pentacarinata; all carinae moderately crenulate. Patella with 7 carinae; internal carina with spinoid granules; tibia with 7/8 vestigial carinae; all faces weakly granular. Dentate margins on fixed and movable fingers composed of 12/13 oblique rows of granules. Legs: Ventral aspect of tarsi with numerous thin setae. Patellar spurs absent. Pedal spurs present on legs III-IV, moderate to weak.

Key to the groups of *Tityus* proposed in this paper

1. Small species ranging from 18 to 40 mm in total length with variegated pigmentation 2
 - (1) Medium or large species, ranging from 50 to 100 mm in total length; pigmentation varying from yellowish to brown and black 3
2. With a very rhomboidal subaculear tooth *Tityus clathratus* group
 - (2). With a spinoid subaculear tooth *Tityus adisi* group
3. Species of medium size, ranging from 50 to 70 mm in total length; coloration rather pale varying from yellowish to reddish-brown or brownish, never black; often with conspicuous dark spots; basal middle lamellae of female pectines not dilated in most species *Tityus bahiensis* group
 - (3). Large species, ranging from 65 to 100 mm in total length; pigmentation blackish in the adult and yellowish/variegated in immature individuals; subaculear tooth always spinoid; basal middle lamellae of female pectines dilated in most species *Tityus asthenes* group

Acknowledgments

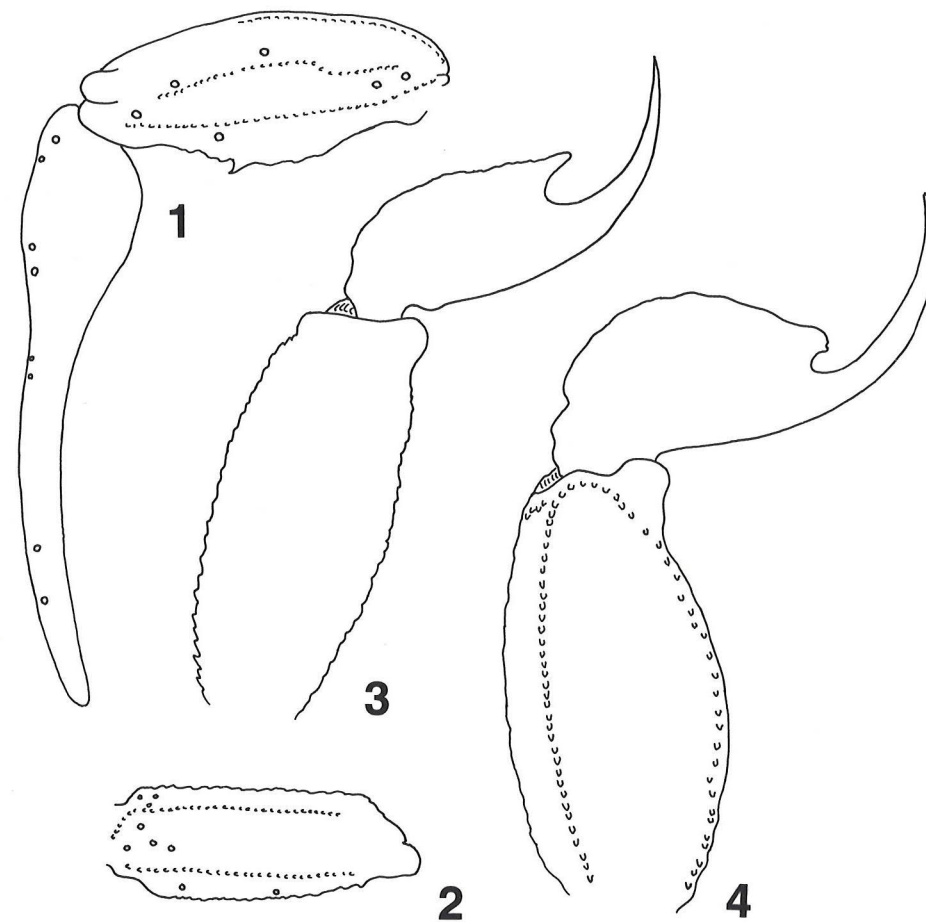
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Table 1: Morphometric values (in mm) of the holotypes of *Tityus canopensis*, *Tityus adisi* and juveniles of instar I of *Tityus raquelae*, *Tityus silvestris* and *Tityus metuendus*.

	<i>T. canopensis</i>	<i>T. adisi</i>	<i>T. raquelae</i>	<i>T. silvestris</i>	<i>T. metuendus</i>
Total length	10.2	9.8	15.7	12.9	19.2
Carapace:					
- length	1.6	1.4	2.2	1.7	2.3
- anterior width	1.2	1.0	1.8	1.3	1.9
- posterior width	1.6	1.4	2.5	2.0	2.7
Metasomal segment I:					
- length	1.0	0.8	1.1	0.9	1.5
- width	0.8	0.8	1.2	0.8	1.1
Metasomal segment V:					
- length	1.8	1.4	2.4	1.8	2.5
- width	0.6	0.6	0.9	0.7	1.0
- depth	0.6	0.7	1.0	0.8	1.0
Vesicle:					
- width	0.5	0.5	0.7	0.5	0.7
- depth	0.5	0.4	0.9	0.6	0.9
Pedipalp:					
- Femur length	1.2	1.0	2.4	1.5	2.5
- Femur width	0.4	0.3	0.7	0.5	0.7
- Patella length	1.6	1.4	2.7	2.0	2.1
- Patella width	0.6	0.5	0.9	0.7	1.0
- Tibia length	2.2	2.0	4.5	3.1	4.7
- Tibia width	0.3	0.2	0.8	0.5	0.7
- Tibia depth	0.3	0.2	0.7	0.5	0.5
Movable finger:					
- length	1.8	1.4	3.1	2.1	3.5



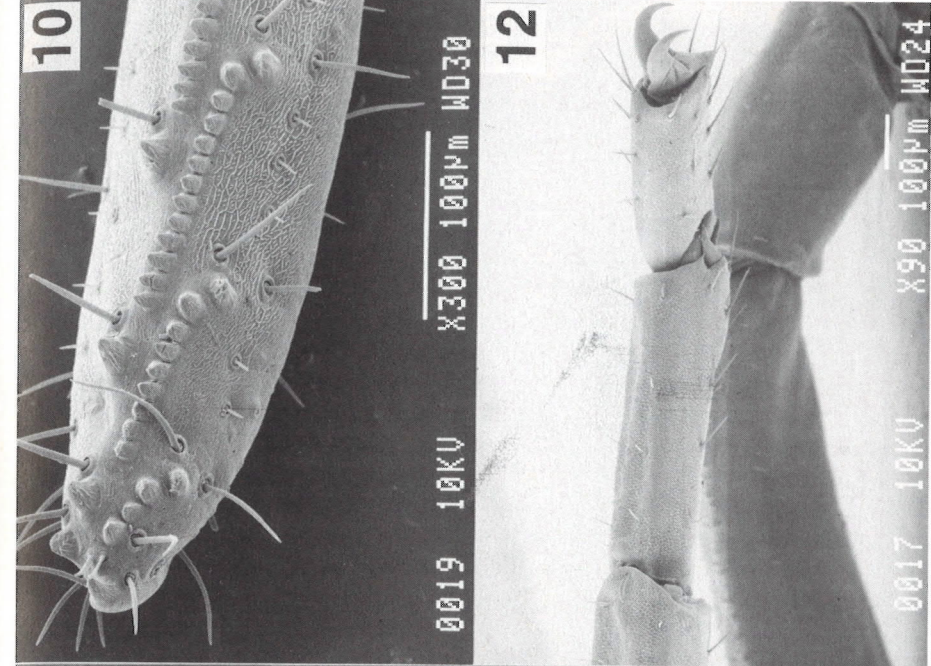
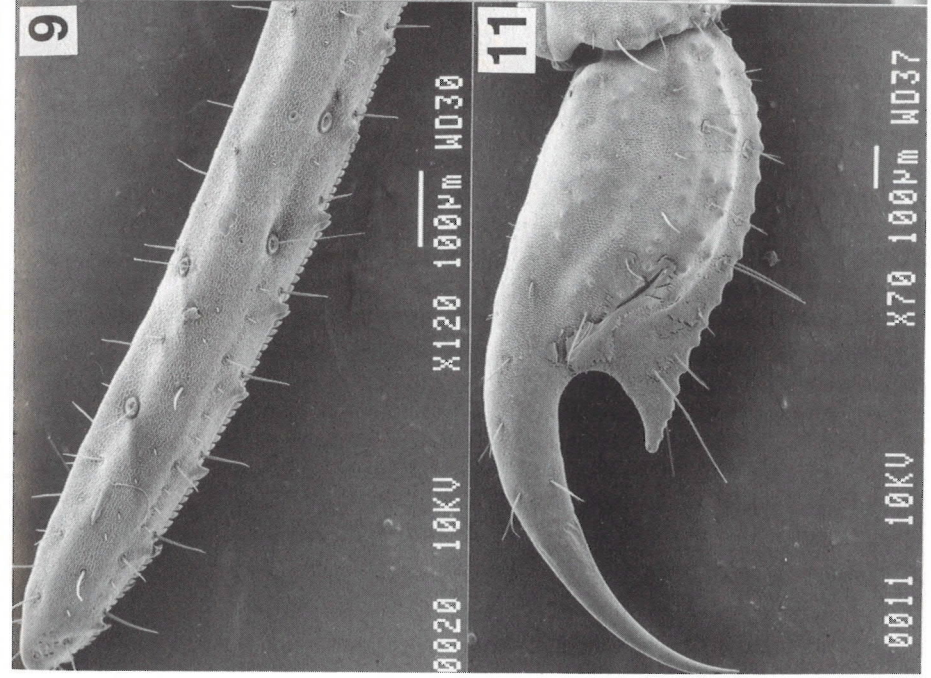
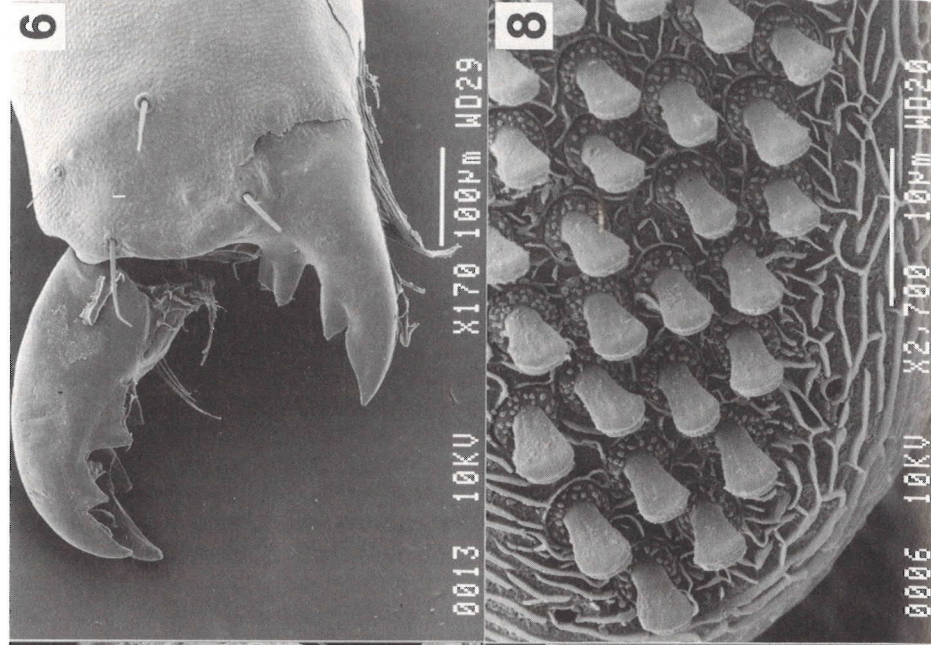
Figs. 1-4:

Tityus canopensis sp.n. (holotype). (Figs. 1-3).

1-2: Trichobothrial pattern. 1: Patella and tibia, dorsal aspect. 2: Femur, dorsal aspect. 3: Metasomal segment V and telson, lateral aspect. 4: Idem for a juvenile of *Tityus raquelae*.

Figs. 5-8: *Tityus adisi* sp.n. male juvenile, paratype.

5: Carapace, lateral aspect, showing eyes. 6: Chelicera. 7: Pecten. 8: Third tooth of pecten, counting from external one, showing pegs.



Figs. 9-12: *Tityus adisi* sp.n. male juvenile, paratype.

9: Dorsal aspect of pedipalp fixed finger, showing trichobothria *dt. db, et. est.* 10: Extremity of pedipalp movable finger, showing rows and granulations. 11: Telson, lateral aspect. 12: Tarsi and Patella of leg IV, showing absence of patellar spur.

Figs. 13-16: *Tityus adisi* sp.n. male juvenile, paratype. Trichobothrial pattern.

13: Base of tibia, external aspect. 14: Patella, dorsal aspect. 15: Femur, dorsal aspect, showing dorsal trichobothria.

16: Femur, internal aspect, showing trichobothria.

