

The distribution of noxious species of
scorpions in Brazilian Amazonia: the genus
Tityus C. L. Koch, 1836, subgenus *Atreus*
Gervais, 1843 (Scorpiones, Buthidae)

WILSON R. LOURENÇO

(with 11 figures)

Abstract

A geographical survey is proposed to thirteen species of the genus *Tityus* C. L. Koch, subgenus *Atreus* Gervais, distributed in Brazilian Amazonia. Since several of these species are of medical importance, their diagnoses are proposed and geographical distribution is discussed.

Key words: Scorpiones, *Tityus* (*Atreus*), noxious species, diagnosis, misidentifications, geographical distribution, Amazonia.

Introduction

Amazonia is one of the most biologically diverse regions on earth, where many endemic centres can be found (Prance 1982, Wilson 1988, Gentry 1990). Detailed studies on the scorpion populations of Amazonia and Guayana (a floristic lowland province defined by Mori in 1991), started some three decades ago, and leads to a better understanding their patterns of distribution and differentiation. Many aspects about ecological and/or historical factors associated with biogeography have also been discussed in these contributions (Lourenço 1986a, 1986b, 1996, 2001).

In parallel, the number of known species of scorpions in the Amazon and Guayana regions has increased considerably during the last three to four decades (Lourenço 2002a). Many of these species, in particular several belonging to the genus *Tityus*, should be recognized as those of medical importance (Lourenço & Eickstedt 2003). *Tityus* is the largest genus of extant scorpions and comprises five subgenera and more than 200 known species (Lourenço 2006). Curiously, in most medical literature less than ten species of *Tityus* are frequently cited as being of medical importance. A number even smaller of species represent the classical tools used by venom and toxin experts (Bücherl 1978, Simard & Watt 1990, Chavez-Olórtegui *et al.* 1996, Loret & Hammock 2001, Cupo *et al.* 2003).



Fig. 1. *Tityus obscurus* (Gervais), adult male from French Guiana (photo E. Ythier).



Fig. 2. *Tityus obscurus* (Gervais), adult female from Brazil (photo T. Porto).

The fact that these numbers remained globally conservative during several decades may be imputed to the following reasons: (i) absence of communication between scorpion experts, the medical world and venom/toxin users, (ii) important gaps in the knowledge of scorpion taxonomy by medical groups and venom/toxin experts, leading to frequent misidentifications of species, (iii) insufficient efforts to correlate human incidents and the precise geographical distribution of the species.

In Amazonia, where the species of the subgenus *Atreus* Gervais are well represented, reported accidents have been often attributed to one or two different species (Hommel *et al.* 2000, Marty 2002). At present, it is suggested that the numbers of medically important species belonging to the subgenus *Atreus*, are higher than what was previously suspected. An insufficient knowledge of species taxonomy and of their distribution ranges leads to misidentifications. In the case of human incidents and/or for a correct use of venoms for toxin research, the most reliable manner to refer to a given scorpion species is to define a precise population. In the present paper diagnoses are proposed to the known species of the subgenus *Atreus* distributed in Brazilian Amazonia. Their geographical ranges of distribution are also commented.

Taxonomic account

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

Subgenus *Atreus* Gervais 1843

DIAGNOSIS: Scorpions of large size ranging from 25 to 110 mm in total length. The general coloration can be pale yellow to reddish-yellow or reddish-brown, with dark variegated spots in juveniles. A dark brown to blackish coloration predominates in adults. These spots are not visible in the adults as a result of the very marked sclerification of the cuticle. All segments are in general strongly granulated. Dentate margins of pedipalp-chela fingers composed of 13 to 17 oblique rows of granules, but with supernumerary granules not present. Pectinal tooth counts 14 to 30. Metasomal segments can be parallel in both males and females; elongated or enlarged posteriorly in males. Subaculear tooth always spinoid. Ventral carinae of metasomal segments II to IV parallel or fused, forming a Y-shape configuration. Sexual dimorphism present in almost all species, and presenting several different patterns or configurations. Juveniles of the subgenus *Atreus* are often misidentified with adults of the subgenus *Archaeotityus* Lourenço, 2006. Both have a similar coloration pattern, yellowish with variegated pigmentation. However, in species of the subgenus *Archaeotityus*, the subaculear tooth is always rhomboidal (for illustrations refer to Lourenço 2002a).

Two subgroups are considered here: '*Tityus asthenes*' and '*Tityus androcottoides*'. For comparative purposes, diagnoses are also presented for some species distributed out of Brazilian Amazonia. These show important phylogenetic associations with the Amazonian species of the subgenus *Atreus*. Species are listed in chronological order. Vouchers of most species discussed in this paper have been deposited in the Zoologisches Museum Hamburg (ZMH).



Fig. 3. *Tityus obscurus* (Gervais), male juvenile from French Guiana.



Fig. 4. *Tityus asthenes* Pocock, adult male from Ecuador (photo C. Komposch).

Subgroup I: '*Tityus asthenes*'*Tityus obscurus* (Gervais, 1843)
(Figs 1-3)

Large scorpions, from 75 to 100 mm in total length. General coloration uniformly blackish with only some pale zones on the sternites. Metasomal segments I to V and telson uniformly blackish; with 10-10-8-8-5 carinae. Dentate margins of pedipalp-chela fingers with 17 oblique rows of granules. A strong spinoid subaculear tooth present. This can be moderate in size in very large specimens. Pectines with 18 to 22 teeth and the basal middle lamellae strongly dilated in females. *T. obscurus* shows very strong sexual dimorphism. Male pedipalps are longer and more slender than those of the females (Lourenço 1983a).

This species is most frequently cited as '*Tityus cambridgei*' or '*Tityus paraensis*' in the literature. Only recently these nomenclatural questions were clarified (Lourenço & Leguin 2008).

Geographical distribution: Suriname, French Guiana and the State of Amapá and Pará in Brazil.

Tityus asthenes Pocock, 1893
(Figs 4-5)

Scorpions of medium to large size, ranging from 65 to 85 mm in total length. General coloration uniformly blackish with only some pale zones on the sternites. Metasomal segments I to V and telson uniformly blackish; with 10-10-8-8-5 carinae. Dentate margins of pedipalp-chela fingers with 16 oblique rows of granules. A moderate to strong spinoid subaculear tooth present. Pectines with 17 to 22 teeth and the basal middle lamellae strongly dilated in females. *T. asthenes* shows very strong sexual dimorphism. Male pedipalps are longer and more slender than those of the females (Lourenço 1988a).

This species is similar to *T. obscurus* in many morphological characters, and several cases of misidentification can be recorded in the literature. The two species have, however, a totally allopatric geographical distribution.

Geographical distribution: Rain forests of Ecuador and Colombia.

Tityus metuendus Pocock, 1897
(Fig. 6)

Large scorpions, from 80 to 90 mm in total length. General coloration blackish-brown to blackish. Metasomal segments I to III blackish-brown, IV and V blackish; telson reddish-brown; with 10-10-8-8-5 carinae. Dentate margins of pedipalp-chela fingers with 16 to 17 oblique rows of granules. A strong and spinoid subaculear tooth is present. Pectines with 19 to 22 teeth and the basal middle lamellae dilated in females. This species presents strong sexual dimorphism, the male pedipalps being much larger and more bulky than those of females (Lourenço 1983b).



Fig. 5. *Tityus asthenes* Pocock, male juvenile from Peru (photo E. Ythier).



Fig. 6. *Tityus metuendus* Pocock, adult male from Brazil (photo T. Porto).

Geographical distribution: Central and Western Amazonia, Peru and the States of Pará and Amazonas in Brazil.

Tityus brazilae Lourenço & Eickstedt, 1984
(Figs 7-8)

Scorpions of medium to large size, ranging from 50 to 70 mm in total length. General coloration reddish-yellow with dark spots over the body, pedipalps and legs; three longitudinal dark stripes over the tergites. Metasomal segments I to IV reddish-brown to brown; segment V much darker, blackish-brown; with 10-10-8-8-5 carinae. Dentate margins of pedipalp-chela fingers composed of 17 oblique rows of granules. A strong and spinoid subaculear tooth present. Pectines with 20 to 24 teeth; basal middle lamellae of female pectines not dilated (Lourenço & Eickstedt 1984).

Geographical distribution: Only known from the Northeast region of Brazil, States of Bahia to Pernambuco.

Tityus tucurui Lourenço, 1988

Large scorpions from 85 to 100 mm in total length. General coloration blackish-brown with some dark spots over the body, pedipalps and legs. Metasomal segments I to V and telson uniformly blackish-brown; with 10-10-8-8-5 carinae. Dentate margins of pedipalp-chela fingers composed of 16 oblique rows of granules. A strong and spinoid subaculear tooth is present. Pectines with 20 to 21 teeth and the basal middle lamellae strongly dilated in females. *T. tucurui* shows less sexual dimorphism than is observed in *T. obscurus*. Male pedipalps only slightly longer and slender than those of females (Lourenço, 1988b).

Geographical distribution: State of Pará, Brazil.

Tityus dinizi Lourenço, 1997
(Fig. 9)

Large scorpions, from 85 to 100 mm in total length. General coloration uniformly blackish, but with some pale regions on the sternites. Metasomal segments I to V and telson uniformly blackish; with 10-10-8-8-5 carinae. Dentate margins of pedipalp-chela fingers with 16 oblique rows of granules. A short and rhomboid subaculear tooth is present. Pectines with 20 teeth, the basal middle lamellae strongly dilated in females; these of the males weakly dilated. Male pedipalps are shorter and rounder than those of *T. obscurus* (see Lourenço 1997).

Geographical distribution: Rio Negro region, from the Anavilhanas Islands to Barcelos, State of Amazonas, Brazil.



Fig. 7. *Tityus brazilae* Lourenço & Eickelstedt, adult male from Brazil (photo T. Porto).



Fig. 8. *Tityus brazilae* Lourenço & Eickelstedt, adult female from Brazil (photo T. Porto).

Tityus matthieseni Pinto da Rocha & Lourenço, 2000

Large scorpions from 75 to 85 mm in total length. General coloration brownish with some dark spots over the body and pedipalps; legs brownish with yellowish spots. Metasomal segments I to V and telson uniformly blackish-brown; with 10-10-8-8-5 carinae. Dentate margins of pedipalp-chela fingers composed of 16 oblique rows of granules. A moderate to strong and spinoid subaculear tooth is present. Pectines with 20 teeth and the basal middle lamellae not dilated in males (Pinto da Rocha & Lourenço 2000).

Geographical distribution: Only known from its type locality: Boca do Rio Matupiri, Rio Madeira, State of Amazonas, Brazil.

Tityus unus Pinto da Rocha & Lourenço, 2000

Large scorpions, from 70 to 80 mm in total length. General coloration uniformly blackish, with only some pale zones on the sternites. Metasomal segments I to V blackish, with 10-10-8-8-5 carinae; telson paler than segment V. Dentate margins of pedipalp-chela fingers with 17 oblique rows of granules. A moderate to strong spinoid subaculear tooth present. This can be moderate in size in very large specimens. Pectines with 19 to 21 teeth and the basal middle lamellae dilated in females. *T. unus* shows a strong sexual dimorphism, but less marked than on *T. obscurus* or *T. tucurui*. Male pedipalps are longer and more slender than those of the females (Pinto da Rocha & Lourenço 2000).

Geographical distribution: Only known from its type locality: São João de Marauia near to Tapuruçara, State of Amazonas, Brazil.

Tityus apiacas Lourenço, 2002

Large scorpions, from 75 to 100 mm in total length. General coloration reddish-brown, with some yellowish zones on the sternites, sternites. Metasomal segments I to V blackish-brown, with 10-8-8-6(8)-5 darker carinae; absence of ventral carinae on metasomal segment IV of males; telson paler than segment V. Dentate margins of pedipalp-chela fingers with 16 oblique rows of granules. A strong spinoid subaculear tooth present, with two dorsal granules. This can be moderate in size in very large specimens. Pectines with 18 to 20 teeth and the basal middle lamellae dilated in females. *T. apiacas* shows a sexual dimorphism, but less marked than on *T. obscurus* or *T. tucurui*. Male pedipalps are longer and more slender than those of the females (Lourenço 2002b).

Geographical distribution: *T. apiacas* has a southern distribution in Amazonia; always south of the Rio Solimões/Amazonas in the states of Amazonas, Mato Grosso and Pará, Brazil.



Fig. 9. *Tityus dinizi* Lourenço, adult female from Brazil.

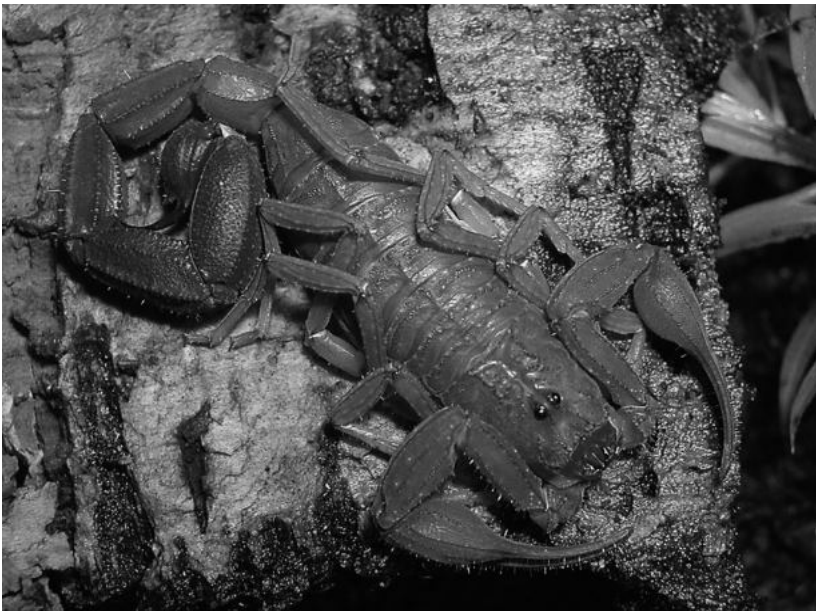


Fig. 10. *Tityus magnimanus* Pocock, adult male from Venezuela (photo E. Ythier).

Subgroup II: '*Tityus androcottoides*'*Tityus magnimanus* Pocock, 1897
(Fig. 10)

Scorpions of medium to large size, ranging from 67 to 80 mm in total length. General coloration reddish-brown to blackish-brown. Metasomal segments I to III reddish-brown, IV and V blackish-brown; telson reddish-brown; with 10-8-8-8-5 carinae. The ventral carinae of metasomal segments II to IV are largely fused, forming a Y-shape configuration. Dentate margins of pedipalp-chela fingers composed of 15 to 17 oblique rows of granules. A short and spinoid subaculear tooth is present. Pectines with 18 to 20 teeth and the basal middle lamellae dilated in females. This species also exhibits strong sexual dimorphism; male pedipalps being larger and more bulky than those of the females (Lourenço 1987, Lourenço & Ramos 2004).

Geographical distribution: This species was originally described only with Brazil as type locality. Subsequently this type locality proved to be erroneous (Lourenço & Ramos 2004). In fact, the distribution of this species is limited to the North of Venezuela.

Tityus elizabethae Lourenço & Ramos, 2004

Scorpions of medium to large size with 70 mm in total length. General coloration reddish to dark reddish overall. Metasomal segments with 10-10-10-8(7)-5 carinae. The ventral carinae of metasomal segments II to IV are largely fused, forming a Y-shape configuration. Dentate margins of pedipalp-chela fingers composed of 15/16 oblique rows of granules. A short and rhomboid subaculear tooth is present. Pectines with 15/16 teeth and the basal middle lamellae strongly dilated in females. Male remains unknown.

Geographical distribution: Only known from the type locality: Brazil, Paracaima on the border between Brazil and Venezuela (Lourenço & Ramos 2004).

Tityus ythieri Lourenço, 2007

Scorpions of medium size, ranging from 50 to 60 mm in total length. General coloration reddish-yellow to dark reddish overall. Metasomal segments with 10-10-8-8(7)-5 carinae. The ventral carinae of metasomal segments II to IV are largely fused, forming a Y-shape configuration. Dentate margins of pedipalp-chela fingers composed of 14 to 16 oblique rows of granules. A short and spinoid subaculear tooth is present. Pectines with 18 to 21 teeth and the basal middle lamellae dilated in females. This species exhibits a less marked sexual dimorphism than that of *T. magnimanus*; male pedipalps are slightly larger and more bulky than those of the females (Lourenço & Ramos 2004).

Geographical distribution: Only known from the type locality: Ecuador, South of Yaupi, Morona-Santiago Province.

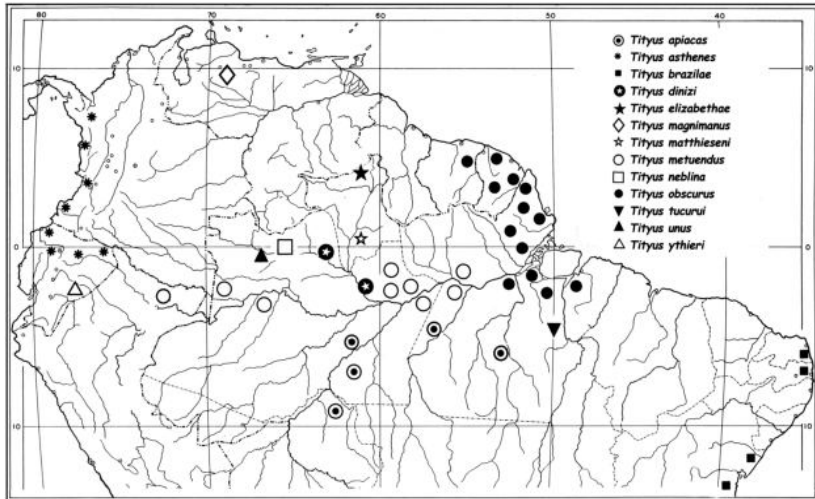


Fig. 11. Map of Northern South America (Amazonian and Guayana regions), showing the known distribution of the *Tityus* (*Atreus*) species listed in this article.

Tityus neblina Lourenço, 2008

Scorpions of medium size, ranging from 45 to 55 mm in total length. General coloration reddish-yellow to reddish-brown overall. Metasomal segments with 10-8-8-8(7)-5 carinae. The ventral carinae of metasomal segments II to IV are largely fused, forming a Y-shape configuration. Dentate margins of pedipalp-chela fingers composed of 13/14 oblique rows of granules. A short and moderately spinoid subaculear tooth is present. Pectines with 19 to 21 teeth; basal middle lamellae inconspicuous dilated in females. This species exhibits a weakly marked sexual dimorphism; male pedipalps are only slightly more bulky than those of the females (Lourenço 2008).

Geographical distribution: Only known from the type locality: Brazil-Venezuela, 'Parque Nacional do Pico da Neblina'.

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References

- Bücherl, W., 1978: Venoms of Tityinae. – Pp. 371-394. In: Bettini, S. (ed.), *Arthropod Venoms*. Springer-Verlag, Berlin/Heidelberg.

- Chavez-Olórtegui, C., Moreira Ferreira, A. M., Nascimento Cordeiro, M., Maria, W. S., Richardson, M. & Diniz, C. R., 1996: Immunological and chemical properties of non-toxic protein purified from the venom of the scorpion *Tityus serrulatus* (Lutz & Mello Campos, 1922). – Pp. 183-195. In: Bon, C. & Goyffon, M. (eds.), Envenomings and their treatments. Edit. Fondation M. Merieux. Lyon.
- Cupo, P., Azevedo-Marques, M. M. & Hering, S. E., 2003: Escorpionismo. – Pp. 198-208. In: Costa Cardoso, J. L., França, F. O. S., Wen, F. H., Málaque, C. M. S. & Haddad Jr. V. (eds.), Animais peçonhentos no Brasil. Sarvier. São Paulo.
- Gentry, A. H. 1990: Editor. – In: Four Neotropical Rainforests (A. H. Gentry ed.). Yale University Press, p. 627. New Haven.
- Hommel D., Hulin, A. & Lourenço, W. R., 2000: Accident scorpionique léthal par *Tityus cambridgei* Pocock; à propos d'un cas en Guyane française. – Le Concours Médical. 7: 481-484. Paris.
- Loret, E. & Hammock, B., 2001: Structure and neurotoxicity of venoms. – Pp. 204-233. In: Brownell, P. & Polis, G. (eds.), Scorpion biology and research. Oxford Univ. Press. New York.
- Lourenço, W. R., 1983a: La faune des scorpions de Guyane française. – Bull. Mus. natn. Hist. nat., 4e sér., 5 (A3): 771-808. Paris.
- Lourenço, W. R., 1983b: Contribution à la connaissance du scorpion amazonien *Tityus metuendus* Pocock, 1897 (Buthidae). – Stud. Neotr. Fauna Envir., 18 (4): 185-193. Lisse.
- Lourenço, W. R., 1986a: Les modèles de distribution géographique de quelques groupes de scorpions néotropicaux. – C. R. Soc. Biogéogr., 62 (2): 61-83. Paris.
- Lourenço, W. R. 1986b: Diversité de la faune scorpionique de la région amazonienne; centres d'endémisme; nouvel appui à la théorie des refuges forestiers du Pléistocène. – Amazoniana. 9: 559-580. Kiel.
- Lourenço, W. R., 1987: Considerações sistemáticas sobre *Tityus magnimanus* Pocock, 1897 (Scorpiones, Buthidae) e espécies associadas. – Rev. Brasil. Biol., 47 (4): 565-572. Rio de Janeiro.
- Lourenço, W. R., 1988a: La faune des scorpions de l'Equateur. I. Les Buthidae. systématique et biogéographie. – Rev. Suisse Zool., 95 (3): 681-687. Geneva.
- Lourenço, W. R., 1988b: Sinópsis da fauna escorpiônica do Estado do Pará, especialmente as regiões de Carajás, Tucuruí, Belém e Trombetas. – Bol. Mus. Par. E. Goeldi, sér., Zool., 4 (2): 155-173. Belém.
- Lourenço, W. R., 1996: The biogeography of scorpions. – Rev. Suisse Zool., 2: 437-448. Geneva.
- Lourenço, W. R., 1997: Additions à la faune de scorpions néotropicaux (Arachnida). – Rev. Suisse Zool., 104 (3): 587-604. Geneva.

- Lourenço, W. R., 2001: Scorpion diversity in Tropical South America: Implications for conservation programs. – Pp. 406-416. In: P. Brownell & G. Polis (eds.), *Scorpion biology and research*. Oxford Univ. Press. New York.
- Lourenço, W. R., 2002a: Scorpions. – Pp. 399-438. In: J. Adis (ed.), *Amazonian Arachnida and Myriapoda*. Pensoft Publishers, Series Faunistica No. 24. Sofia-Moscow.
- Lourenço, W. R., 2002b: Nouvelles additions à la faune de scorpions néotropicaux (Arachnida). – *Rev. Suisse Zool.*, **109** (1): 127-141. Geneva.
- Lourenço, W. R., 2006: Nouvelle proposition de découpage sous-générique du genre *Tityus* C. L. Koch, 1836 (Scorpiones, Buthidae). – *Bol. Soc. Entomol. Aragonesa*, **39**: 55-67. Zaragoza.
- Lourenço, W. R., 2007: A new species of *Tityus* C. L. Koch, 1836 from Ecuador: the first element of the '*Tityus androcottoides*' subgroup for this country. – *Entomol. Mitt. Zool. Mus. Hamburg*, **14** (176): 375-385. Hamburg.
- Lourenço, W. R., 2008: Description of *Tityus (Atreus) neblina* sp. n. (Scorpiones, Buthidae), from the 'Parque Nacional do Pico da Neblina' in Brazil/Venezuela, with comments on some related species. – *Bol. Soc. Entomol. Aragonesa*, **43**: 75-79. Zaragoza.
- Lourenço, W. R. & Eickstedt, V. R. D., 1984: Descrição de uma espécie nova de *Tityus* coletada no Estado da Bahia, Brasil (Scorpiones, Buthidae). – *J. Arachnol.*, **12**: 55-60. New York.
- Lourenço, W. R. & Eickstedt, V. R. D., 2003: Escorpiões de importância médica. – Pp. 182-197. In: Costa Cardoso, J. L., França, F. O. S., Wen, F. H., Málaque, C. M. S. & Haddad Jr. V. (eds.), *Animais peçonhentos no Brasil*. Sarvier, São Paulo.
- Lourenço, W. R. & Leguin, E.-A., 2008: The true identity of *Scorpio (Atreus) obscurus* Gervais, 1843 (Scorpiones, Buthidae). – *Euscorpius*, **75**: 1-9. Huntington, West Virginia (online publication).
- Lourenço, W. R. & Ramos, E. C. B., 2004: New considerations on the status of *Tityus magnimanus* Pocock, 1897 (Scorpiones Buthidae), and description of a new species of *Tityus* from the State of Roraima, Brazil. – *Rev. Ibérica Arachnol.*, **10**: 285-291. Zaragoza.
- Marty, C., 2002: *Animaux venimeux de Guyane*. – CRESTIG Editeur, 121 pp. Cayenne.
- Mori, S. A., 1991: The Guayana lowland floristic Province. – *C. R. Soc. Biog.*, **67**: 67-75. Paris.
- Pinto da Rocha, R. & Lourenço, W. R., 2000: Two new species of *Tityus* from Brazilian Amazonia (Scorpiones, Buthidae). – *Rev. Arachnol.*, **13** (13): 187-195. Aramon.
- Prance, G. T. 1982: Editor. – In: *Biological Diversification in the Tropics* (G. T. Prance ed.). Columbia University Press, p. 714. New York.
- Simard, J. M. & Watt, D. D., 1990: Venoms and toxins. – Pp. 414-444. In: Polis, G. A. (ed.), *The biology of scorpions*. Stanford Univ. Press. Stanford.

Wilson, E. O. (Editor). 1988: Biodiversity. – National Academy of Sciences. 521 pp. Washington.

Author's address:

Dr. W. R. LOURENÇO, Muséum national d'Histoire naturelle, Département Systématique et Evolution, UMR7205, CP 053, 57 rue Cuvier, 75005 Paris, France (e-mail: arachne@mnhn.fr).