Some additional comments on the Ananterinae or 'Ananteris group' and description of a new species of Ananteris Thorell, 1891 from Central Brazil (Scorpiones: Buthidae)

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Abstract. Some additional comments are proposed on the historical aspects of the subfamily Ananterinae (sensu Pocock, 1900). The worldwide pattern of distribution of the elements associated to this subfamily is briefly discussed. The biogeographic patterns presented by extant and fossil elements of this subfamily confirm not only the characteristics of a group presenting a typical Gondwanian distribution, but may also correspond to older Pangaean patterns. One unexpected new species is described for the genus *Ananteris* Thorell from the State of Goiás in Central Brazil, suggesting that the diversity levels of the Cerrados formations are most certainly higher than what is normally admitted.

Key-Words: Scorpion, Ananterinae, biogeographic pattern, *Ananteris*, new species, Central Brazil.

Introduction

As already outlined in previous publications (Lourenço, 2015), the familial/subfamilial placement of the genus *Ananteris* appears to be complex. The acceptance of subfamilies within the family Buthidae C. L. Koch has always been a matter of controversy. Kraepelin (1891) recognized three subfamilies in the family Androctonidae C. L. Koch (Androctonini C. L. Koch, Isometrini Kraepelin and Centrurini Kraepelin). Subsequently, he used the family name Buthidae and listed only two subfamilies Buthinae C. L. Koch and Centrurinae Kraepelin, distinguishing them by the presence or absence of tibial spurs on the legs (Kraepelin, 1899). The subfamily Ananterinae was first proposed by Pocock (1900) to better situate the genus *Ananteris* Thorell (Thorell, 1891). Pocock wrote as follows: 'I propose to eliminate from this subfamily (Buthinae) the isolated Neotropical genus *Ananteris*, which differs strikingly from the rest of the family in the structure of the pectines. The subfamily Ananterinae may be created for its reception'. A few years later, Kraepelin (1905), accepted the Ananterinae, previously described by Pocock (1900) and included it with the Tityinae Kraepelin in the family Buthidae. The Ananterinae were diagnosed by the absence of fulcra on the pectines, while the diagnosis of other subfamilies was based mainly on differences in the dentition of the pedipalp chela fingers. Another author, Birula (1917) distinguished three

subfamilies (Buthinae, Isometrinae Kraepelin and Orthochirinae Birula) using a completely different set of diagnostic characters. Nevertheless, most of the authors which subsequently worked with the Old World Buthidae (Werner, 1934; Vachon, 1952, Levy & Amitai, 1980) finally followed the classification proposed by Kraepelin (1905). One of the last authors who discussed these issues was Mello-Leitão (1945); he clearly rejected the scheme of Kraepelin (1905) and explicitly accepted the one proposed by Birula (1917), and finally listed all the Neotropical buthids under the Isometrinae.

After the description of the genus *Ananteris*, other genera were discovered and described showing characteristics which associate them to Ananterinae, or the '*Ananteris* group' - as preferred by some authors. These characters were discussed by Lourenço (2011). Therefore the following genera may be associated to the subfamily Ananterinae: *Ananteris* Thorell, *Tityobuthus* Pocock, *Ananteroides* Borelli, *Lychasiodes* Vachon, *Himalayotityobuthus* Lourenço, †*Palaeotityobuthus* Lourenço & Weitschat, †*Palaeoananteris* Lourenço & Weitschat, *Microananteris* Lourenço and †*Archaeoananteroides* Lourenço (Lourenço, 1985, 1997, 1999, 2003, 2011; Lourenço & Weitschat, 2000, 2001; Lourenço et al., 2016). The association of all these different genera within the subfamily Ananterinae, clearly indicates a Gondwanian or even broader pattern of distribution for this undoubtedly ancient lineage of buthid scorpions. The discovery of fossil elements in both Baltic and Burmite amber such as

Palaeoananteris, *Palaeotityobuthus* and *Archaeoananteroides*, which can have some closely relations to *Ananteris,* brought further evidence for both the Gondwanian or even broader pattern of distribution and the antiquity of the Ananterinae lineage (Lourenço, 2011; Lourenço & Weitschat, 2000, 2001; Lourenço & Velten, 2016; Lourenço et al., 2016).

Back to the genus *Ananteris*, and as underlined before (Lourenço et al., 2013), this genus was originally created for the species *Ananteris balzanii* Thorell, 1891, described from the State of Mato Grosso in Brazil (for more precisions refer to Lourenço, 2020). A second species *Ananteris festae* Borelli, 1899 was described from the forests of the Rio Peripá in Ecuador, followed by a third species *Ananteris cussinii* Borelli, 1910 from Cagua in Venezuela. In one of his studies about South American scorpions, Mello-Leitão (1932) stated that the distribution of the known species of *Ananteris* in South America was particularly disjunctive and consequently it could be expected that many new species would be discovered in the intermediate zones. The number of *Ananteris* species remained unchanged until the early 1970s when a fourth new species *Ananteris venezuelensis* Gonzaléz-Sponga, 1972 was described from Venezuela. It was however with the revision by Lourenço (1982) that the number of new species described increased continuously. The pace of description of new species was even accelerated in recent years, mainly from the faunas of Venezuela (Gonzalez-Sponga, 2006) and Guianas (Ythier et al., 2020), but to

some extent also for the Brazilian fauna (*e. g.* Giupponi et al., 2009; Lourenço et al., 2013; Lourenço & Motta, 2019). In a recent synopsis, Dupré (2020) indicates that 92 species were described up to 2020. With such numbers, *Ananteris* occupies the third rank among scorpion genera, being only surpassed by genera *Centruroides* Marx (95 species) and *Tityus* C. L. Koch (220 species) species. The validity of a number of species can obviously be questioned, in particular among those described from Venezuela and Colombia. Venezuela holds on its own about half of the known species. Nevertheless, the biogeographic patterns of distribution presented by many *Ananteris* species seem to support this concentration of species in some limited zones of distribution. The species are highly endemic and can be observed in sympatry with other species of the genus (Lourenço, 1982; Lourenço & Motta, 2019, 2020-in-press).

In the present note one more new species is described from the Central region of Brazil (Fig. 1-map). Originally only one species *Ananteris balzanii* was reported from this region, but others were discovered, such as *Ananteris mariaterezae* Lourenço, 1982 from the Bananal Island or *Ananteris carrasco* Lourenço & Motta, 2019 from Bahia. In fact new inventories attest that this region of Brazil is yet poorly prospected.

Material and methods

Illustrations and measurements were produced using a Wild M5 stereo-microscope with a drawing tube and an ocular micrometer. Measurements follow Stahnke (1970) and are given in mm. Trichobothrial notations follow Vachon (1974), morphological terminology mostly follows Vachon (1952) and Hjelle (1990), and chelicerae dentition follows Vachon (1963). The type material described in this paper will be deposited in the collections of the 'Museu Nacional', Rio de Janeiro, Brazil.

Taxonomic treatment

Family Buthidae C. L. Koch, 1837

Genus *Ananteris* Thorell, 1891

Ananteris martensi sp. n. (Figs. 2-7,9,11-12,15)

Type material. Brazil, State of Goiás, Pirénopolis (15°51'09.2" S – 48°54'05.6" W), 14/X/2018 (Marcelo Lovato leg.). In Humid Gallery Forest, 840 m (Figs. 16-17). Male-holotype; will be deposited in the Arachnological collections of the 'Museu Nacional', Rio de Janeiro, Brazil.

Name: The specific name honours Dr J. Martens (Frankfurt), for his significant contribution to the study of arachnids.

Diagnosis. Species of moderate size when compared with the average size of the other species of the genus; male with 24.1 mm in total length (see measurements after the description). General coloration dark brown over body and appendages; pedipalps and legs with conspicuous yellow surfaces; chelicerae yellow with a variegated pigmentation covering only the anterior and lateral edges. Pedipalps moderately long and slender; fixed and movable fingers of pedipalps with 6-6 rows of granules; the first row on fixed finger represented by only 2-3 granules; male pectines with respectively 17-17 teeth. Carapace, tergites and metasomal

segments strongly granulated; telson weakly granulated, almost smooth, with a few granules on the ventral carina; slender and elongated. Trichobothrial pattern of the type A-Beta, orthobothriotaxic with femur trichobothrium **e_1** in a proximal position in relation to **d_5**; patella trichobothria **$esb_{1,2}$** not at the same level, with **esb_2** in a proximal position.

Description based on male holotype

Coloration. The general coloration is dark-brown marked with yellow spots; lateral pleura only slightly pigmented. Prosoma: carapace dark brown with some yellow spots on its entire surface; eyes surrounded by black pigment. Mesosoma dark-brown with conspicuous confluent yellow spots. Metasomal segments I to V reddish-yellow; all segments marked with diffused brown spots; spots less intensely marked on segments IV and V. Vesicle reddish-yellow without darker zones; base of the aculeus reddish-yellow with a red tip. Venter yellow; sternites V-VII with diffused brownish spots laterally, more conspicuous on VII; anterior zone of coxapophysis marked with brown spots. Chelicerae yellow with reticular dark brown spots on the anterior and lateral edges only; yellow with dark spots; teeth reddish. Pedipalps dark brown with yellow spots; chela with yellow fingers. Legs brownish with conspicuous yellow spots.

Morphology. Carapace with an intense granulation; anterior margin not emarginated with a minute central convexity. Anterior median superciliary and posterior median carinae weak. All furrows moderate to weak. Median ocular tubercle distinctly anterior to the centre of the carapace; median eyes large and separated by approximately one ocular diameter. Three pairs of lateral eyes. Sternum subpentagonal. Mesosoma: tergites with an intense granulation. Median carina moderate in all tergites. Tergite VII pentacarinate. Venter: genital operculum divided longitudinally, each plate more or less semi-oval in shape. Pectines: pectinal tooth count 17-17 in male; basal middle lamellae of the pectines not dilated; fulcra absent. Sternites almost smooth; spiracles weakly elongate; setation weak; sternite VII with moderately marked carinae and some granulations. Metasomal segment I with 10 carinae, strongly crenulate. Segments II to IV with 8 carinae, strongly crenulate. Intercarinal spaces moderately to strongly granular. Segment V slightly rounded with 5 carinae. Telson strongly elongated and slender, almost smooth; ventral carina moderately marked with some granules; aculeus long and moderately curved; subaculear tooth strong and spinoid. Cheliceral dentition characteristic of the family Buthidae (Vachon, 1963); fixed finger with two strong basal teeth; movable finger with two well marked basal teeth; ventral aspect of both finger and manus with dense, long setae. Pedipalps: femur pentacarinate; patella and chela with moderate to weak carinae; internal face of patella with 5-6 minute spinoid granules; all faces moderately to weakly granular. Fixed and movable fingers

with 6-6 almost linear rows of granules; the first row on fixed finger represented by only 2-3 granules; two small external and one internal accessory granule present at the base of each row; three conspicuous granules in the extremity of the fingers; Trichobothriotaxy; orthobothriotaxy A-β-beta (Vachon, 1974, 1975); femur trichobothrium $\mathbf{e_1}$ in a proximal position in relation to $\mathbf{d_5}$; patella trichobothria $\mathbf{esb_{1,2}}$ not at the same level, with $\mathbf{esb_2}$ in a proximal position. Legs: tarsus with very numerous fine median setae ventrally. Tibial spurs strongly developed on legs III and IV.

Comparative morphometric values of one male of *Ananteris balzanii* from Urucum (Brazil) and the male holotype of *Ananteris martensi* n. sp.

Total length including the telson, 20.1/24.1. Carapace: length 2.3/2.6; anterior width 1.5/1.7; posterior width 2.3/2.6. Mesosoma length: 5.1/6.4. Metasomal segments. I: length 1.3/1.5, width 1.3/1.5; II: length 1.4/1.7, width 1.2/1.4; III: length 1.6/1.9, width 1.2/1.4; IV: length 2.1/2.5, width 1.2/1.4; V: length, 3.3/4.0, width 1.1/1.3, depth 1.2/1.3. Telson length 3.0/3.5; vesicle: width 0.6/0.8, depth 0.6/0.6. Pedipalp: femur length 2.0/2.4, width 0.6/0.8; patella length 2.4/2.9, width 0.8/1.0; chela length 3.2/3.9, width 0.5/0.6, depth 0.4/0.5. Movable finger length 2.3/2.8.

Relationships. *A. martensi* n. sp. can be associated to *A. balzanii* Thorell, described from the state of Mato Grosso, Brazil, but also present in the state of Goiás (see Lourenço, 2020), and also to *Ananteris mariaterezae* Lourenço (Lourenço, 1982) only known from its type locality, a dry-forest in the Bananal Island, Brazil. The new species can be distinguished from the other two by a number of features: (i) a different pattern of pigmentation; spots more intensely marked on the ventral aspect of pedipalps; telson and metasomal segment V much less spotted; anterior zone of coxapophysis spotted; reticular dark brown spots on chelicerae covering only the anterior and lateral edges (Fig. 15); the pigmentation pattern of chelicerae being a key character in the identification of *Ananteris* species (Lourenço, 1982), (ii) male telson slender and longer than that in *A. balzanii*, (iii) carapace and tergites more intensely granular than in *A. balzanii*, (iv) the position of some trichobothria are distinct; femur trichobothrium $\mathbf{e_1}$ in a proximal position in relation to $\mathbf{d_5}$; patella trichobothria $\mathbf{esb_{1,2}}$ not at the same level, with $\mathbf{esb_2}$ in a proximal position (Figs. 2-8).

Ecological notes

The Central region of Brazil is covered mainly by open vegetation formations, namely the Cerrados formations (Eiten, 1978). These open formations are not however uniform and can be divided in a number of natural physiognomies, from pure grassland called 'Campo-Limpo', through several densities and heights of savanna in a more strict sense, with shrubs called 'Campo-Sujo' or with low trees called 'Campo-Cerrado'; closed scrubs with tree-and-scrub woodlands in which the trees do not form a continuous canopy, 'cerrado strict sense', and finally arboreal woodlands with closed tree canopy, called 'Cerradão' (Eiten, 1982). The different *Ananteris* species described from this region can however be located in precise gradients of the Cerrados, as for example under termite mounds of *Silvestritermes euamignathus* (Silvestri, 1901), for *A. balzanii* or in dry forest formations and under stones for *A. mariaterezae* in the Bananal Island (Lourenço, 1981, 1982). The new species described here was found in a Humid Gallery Forest formation which generally borders small streams in the lower portions of the cerrado's relief, nearby gradients of Campo-Limpo (Figs. 16-17).

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Captions to figures

Fig. 1. Map of the Central region of Brazil showing the original localities of *Ananteris balzanii* (Urucum), *Ananteris mariaterezae* (Bananal Island) and *Ananteris martensi* sp. n. (Pirénopolis).

Figs. 2-7. *Ananteris martensi* sp. n. Male holotype. Trichobothrial pattern. 2-3. Femur, dorsal and internal aspects. 4-5. Chela, dorso-external and ventral aspects. 6-7. Patella, dorsal and external aspects. 8. Idem, *Ananteris mariaterezae*, female holotype (scale = 1 mm).

Figs. 9, 11-12. *Ananteris martensi* sp. n., Male holotype. 10. *Ananteris balzanii*, male from Urucum. 9-10. Metasomal segment V and telson, lateral aspect 11. Carapace, dorsal aspect. 12 Cutting edge of movable finger with rows of granules (scales = 1 mm and 0.5 for figure 12).

Figs. 13-15. Chelicera, dorsal aspect, showing the pigmentation patterns. 13. *Ananteris balzanii* (female). 14. *Ananteris mariaterezae* (female holotype). 15. *Ananteris martensi* sp. n. (male holotype). (scales = 0.5 mm).

Fig. 16. Typical vegetation of a Campo-Sujo formation with termite mounds of *Silvestritermes euamignathus* (Silvestri); in the lower portion of the relief a typical Humid Gallery Forest can be observed.

Fig. 17. A Humid Gallery Forest formation, natural habitat of the new species, bordered by a small stream in the lower portion of the cerrado's relief, surrounded by the Campo-Limpo gradient.