Further considerations regarding *Tityobuthus baroni* (Pocock, 1890) with the description of a new species from Ste Marie Island, Madagascar (Scorpiones, Buthidae)

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ABSTRACT
New considerations regarding the species *Tityobuthus baroni* (Pocock, 1890), type species of the genus *Tityobuthus* Pocock, 1893, are proposed. One new species, *Tityobuthus pallidus* n. sp., is described from the Anbohidena Forest Station in Ste Marie Island on the east coast of Madagascar. The new species is characterized by moderate to large size (with respect to the genus), measuring 31 mm in total length. General coloration pale yellow throughout body and appendages. Pectines with 14-14 teeth; fulcra present. Telson globular and round; aculeus long and curved; subaculear tooth moderate and almost rhomboid. Tibial spurs weak. Pedipalp fixed and movable fingers with 8/8 rows of granules. The new description raises the total number of species in the genus *Tityobuthus* to 15. A revised key is given for these species.

KEY WORDS
Scorpiones,
Buthidae,
Tityobuthus,
Madagascar,
new species.

RÉSUMÉ
Nouvelles considérations sur Tityobuthus baroni *(Pocock, 1890) avec la description d'une nouvelle espèce de l'île Ste Marie, Madagascar (Scorpiones, Buthidae).*
Des nouvelles considérations sur la taxonomie et la répartition géographique de *Tityobuthus baroni* (Pocock, 1890), espèce type du genre *Tityobuthus* Pocock, 1893, sont proposées. Une nouvelle espèce, *Tityobuthus pallidus* n. sp., est décrite de la Station forestière d'Anbohidena dans l'île Ste Marie sur la côte est de Madagascar. La nouvelle espèce est caractérisée par une taille entre moyenne et grande (par rapport à d'autres espèces du genre), avec une longueur totale de 31 mm. La coloration générale est jaune pâle sur tout le corps et les appendices. Peignes avec 14-14 dents et présence de fulcres. Telson globuleux et rond ; aiguillon long et encurvé ; épine sous-aiguillonnaire modérée et plutôt rhomboïdale. Éperon tibial réduit. Doigts des pédipalpes avec 8/8 séries de granules. Avec la nouvelle description le nombre d'espèces dans le genre *Tityobuthus* s'élève à 15. Une clé dichotomique révisée des espèces est proposée.

MOTS CLÉS
Scorpiones,
Buthidae,
Tityobuthus,
Madagascar,
nouvelle espèce.

INTRODUCTION

Tityobuthus Pocock, 1893 is a replacement name for *Rhoptrurus* Karsch, 1886. This name was already preoccupied by that of the snake genus *Rhoptrura* Peters, 1858 (Vachon 1979). Confusion existed about the genera *Tityobuthus*, *Pseudobuthus* Pocock, 1893 and *Odonturus* Karsch, 1879 until they were revised by Vachon (1979), who finally included only two species in the genus *Tityobuthus*, i.e. *T. baroni* (Pocock, 1890) and *T. gracilis* (Fage, 1946). The latter was originally included in the genus *Babycurus* Karsch, 1886, but was recently transferred and accorded in its own genus *Troglotityobuthus* Lourenço, 2000.

In the last few years, and in particular since the scorpion fauna of Madagascar was summarised by Lourenço (1996), increasing numbers of new species in the genus *Tityobuthus* have been described. This indicates that this genus of microscorpions is very rich in species. The recent discovery of several additional new species of *Tityobuthus* pointed to the necessity for a revision of this genus (Lourenço 2000). A reanalysis of characters also showed that two species previously associated with *Tityobuthus*, i.e. *T. gracilis* and *T. copalensis* Lourenço, 1996, deserved a separate taxonomic position (Lourenço 2000).

The type species of the genus *Tityobuthus*, *Rhoptrurus baroni* Pocock, 1890, was described on the basis of specimens collected in Madagascar without any indication of their precise locality. In this paper considerations are proposed that bring new evidence concerning the precise area of distribution of *T. baroni*. A further new species, *Tityobuthus pallidus* n. sp., is described from the Anbohidena Forest Station in Ste Marie Island on the east coast of Madagascar. A revised key to the known species of the genus *Tityobuthus* is also provided in this contribution.

THE POSSIBLE REGION OF DISTRIBUTION OF *TITYOBUTHUS BARONI*

The type species of the genus *Tityobuthus*, *Rhoptrurus baroni* Pocock, 1890, was described on the basis of three specimens, collected in Madagascar by the Rev. R. Baron, without giving any details about the locality in which they were found. Subsequently, specimens of *Tityobuthus* collected in several localities in the island, and in most cases from quite diverse biotopes, have been assigned to this single species *T. baroni* (Fage 1929; Vachon 1979). These records proved to be based on misidentification and, in fact, concerned distinct species of this complex genus (Lourenço 1996, 2000). One question, however, can be addressed: what was the original area of distribution of *T. baroni*?

Just one year before the description of *T. baroni*, Pocock (1889) published the description of another scorpion, *Buthus limbatus* (now in genus *Grosphus*), on the basis of four specimens (one male and three females) also collected by Rev. R. Baron in Madagascar, once again without giving any precise locality. The description by Pocock was very precise, however. Fage (1929) identified the same species of *Grosphus* from several distinct localities. More recently a precise study of several species of *Grosphus* closely associated with *G. limbatus* demonstrated the existence of cases of misidentification by Fage (1929), and confirmed its area of distribution as being confined to the Central Plateau of Madagascar.

It is quite possible that the Rev. R. Baron, who was in charge of an evangelistic mission in Madagascar, travelled in the region of the Central Plateau, which was more densely populated than other regions in the island, and close to the capital Antananarivo. *Tityobuthus baroni* does not appear to be present in the region of the Central Plateau where another species, *Tityobuthus lucileae* Lourenço, 1996, is common (Lourenço 1996).

In his revision of the taxonomic position of *Tityobuthus*, Vachon (1979) referred, among other specimens, to a female collected in Fenérive (Fenoarivo), Province of Tamatave, by R. Legendre (Fig. 1). This specimen corresponds quite well with the description given by Pocock (1890). Tamatave was (and still is) one of the major harbours in Madagascar, a natural point of entry to the island and in particular for people travelling to Tananarive (Antananarivo). The

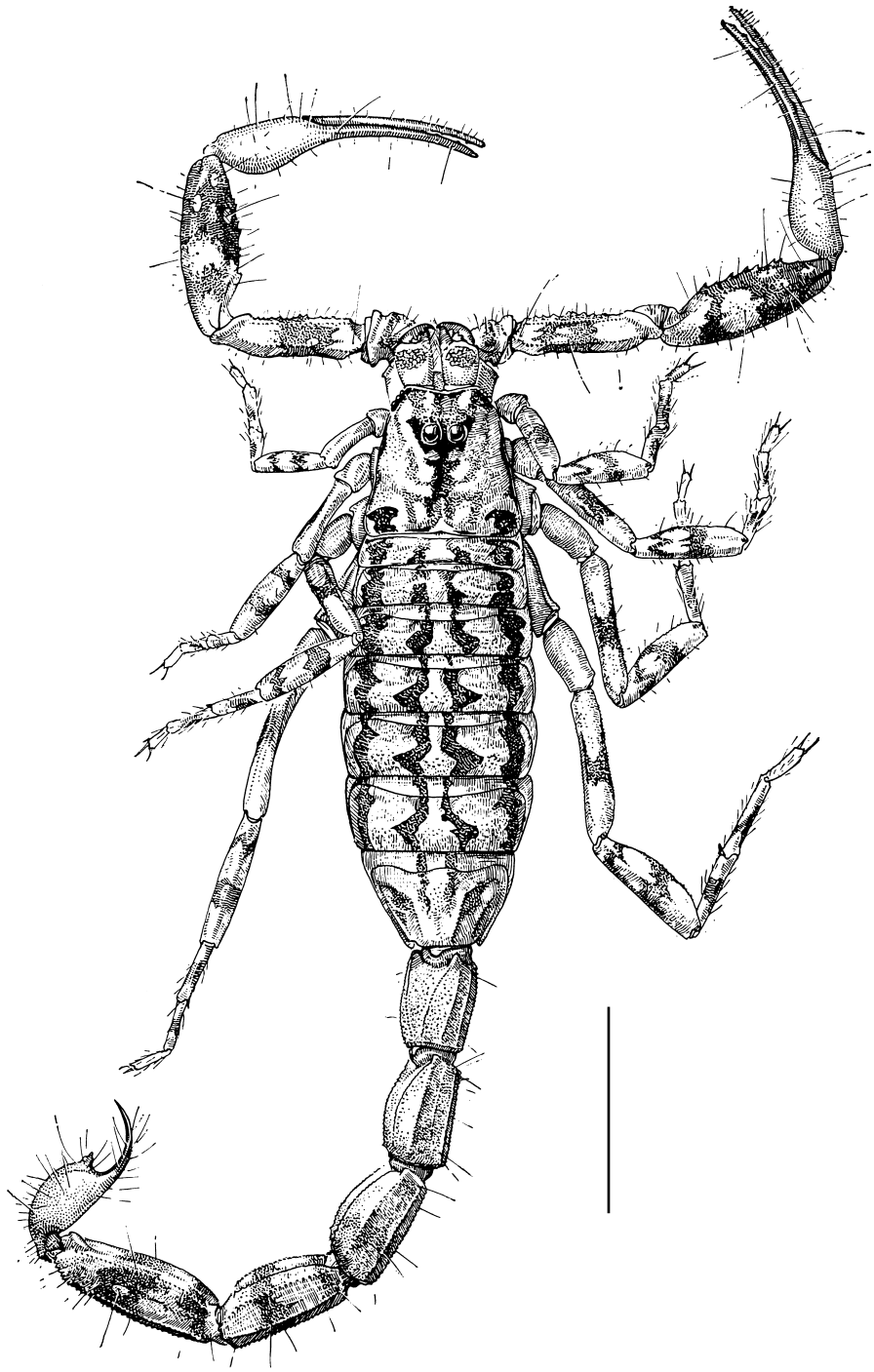

FIG. 1. — Habitus of *Tityobuthus baroni* (Pocock, 1890), ♀ from Fenérive (after Vachon 1979). Scale bar: 5 mm.

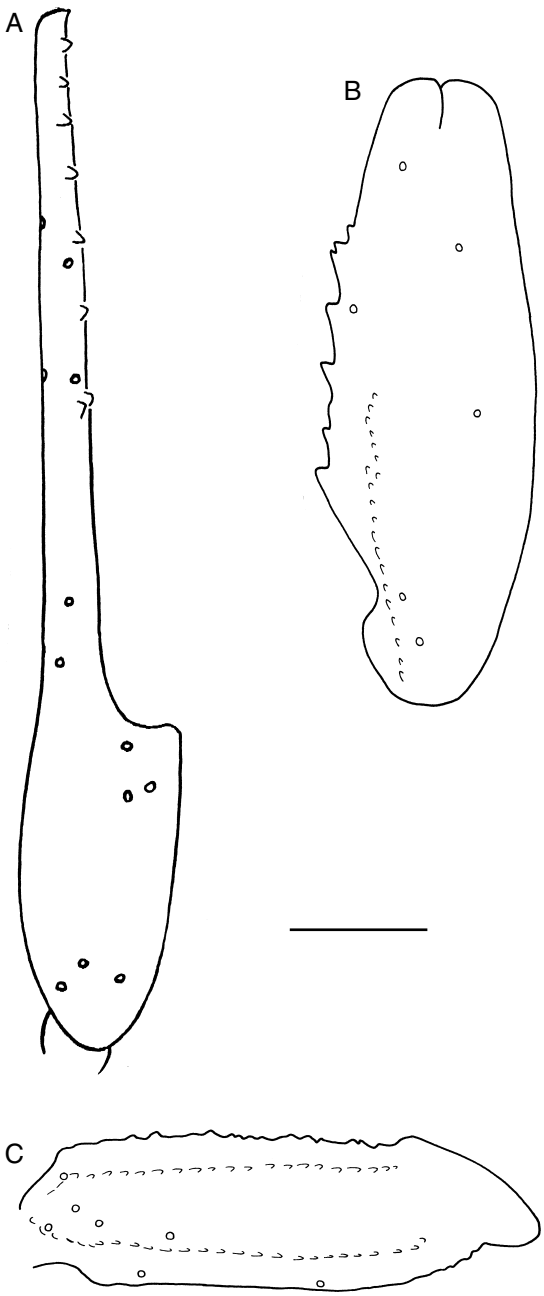

FIG. 2. — *Tityobuthus pallidus* n. sp., ♀ holotype, trichobothrial pattern; **A**, tibia, dorso-external aspect; **B**, patella, dorsal aspect; **C**, femur, dorsal aspect. Scale bar: 1 mm.

Province of Tamatave was most certainly visited by the Rev. R. Baron while he stayed in Madagascar, so the specimens on which the description of *T. baroni* was based were most probably collected somewhere in the eastern coastal region of the island. Other specimens, which correspond well with *T. baroni*, have also been collected on the east coast, but more to the north near to Antongil Bay (Lourenço 1996). The area of distribution of this species is therefore undoubtedly limited to the north-east coastal region of Madagascar.

SYSTEMATICS

Family BUTHIDAE C. L. Koch, 1837
Genus *Tityobuthus* Pocock, 1893

Tityobuthus pallidus n. sp.
(Figs 2; 3A; 4; Table 1)

TYPE MATERIAL. — Holotype: Madagascar, Ste Marie Island, Anbohidena Forest Station, 16°51'S, 49°57'E, 27.XII.1955, IRSM leg., ♀ (Muséum national d'Histoire naturelle, Paris RS-8600).

ETYMOLOGY. — The specific name makes reference to the pale color of the new species.

DIAGNOSIS. — Moderate to large in size (with respect to the genus) reaching 31 mm in length. General coloration pale yellow throughout both the body and the appendages. Carapace with a moderately pronounced concavity, forming a weak angle. Cheliceral dentition with basal teeth of movable fingers reduced and fused. Pectines with 14-14 teeth; fulcra present. Sternites smooth; sternite V without any bright zone on posterior edge. Telson less elongated than in the other species of the genus, more globular and rounded; aculeus and curved; subaculear tooth moderate and more to rhomboid with two basal granules. Tibial spurs very reduced. Pedipalp fixed and movable fingers with 8/8 almost linear rows of granules. Trichobothrial pattern type A-α orthobothriotaxic.

DESCRIPTION BASED ON FEMALE HOLOTYPE

Coloration

Ground color pale yellow throughout the body and appendages; eyes surrounded by black pigment. Cheliceral fingers reddish-yellow.

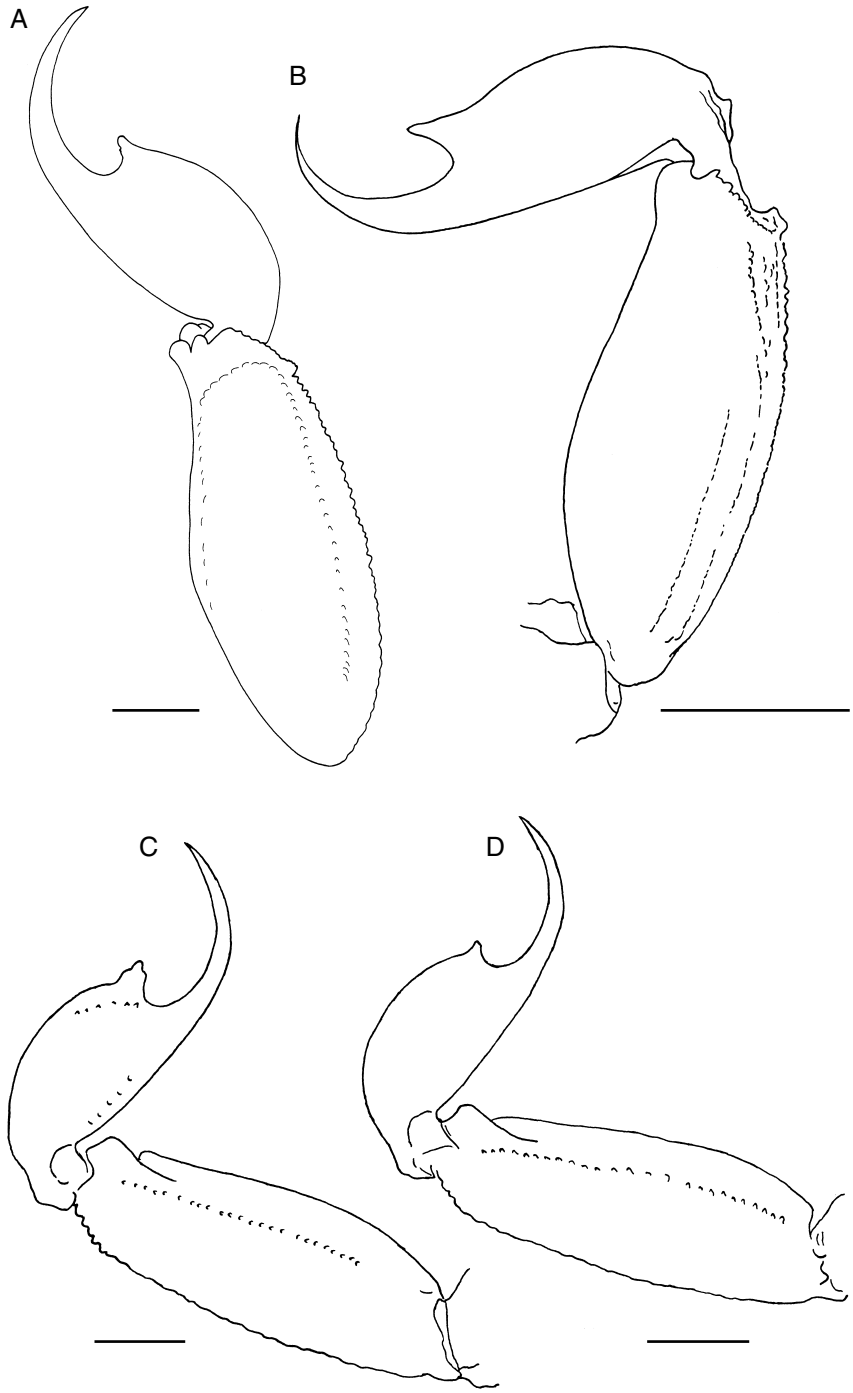

FIG. 3. — Metasomal segment V and telson, lateral aspect; **A**, *Tityobuthus pallidus* n. sp., ♀ holotype; **B**, *T. guillaumeti* Lourenço, 1985, ♀; **C**, *T. baroni* (Pocock, 1890), ♀; **D**, *T. lucileae* Lourenço, 1996, ♀. Scale bars: 1 mm.

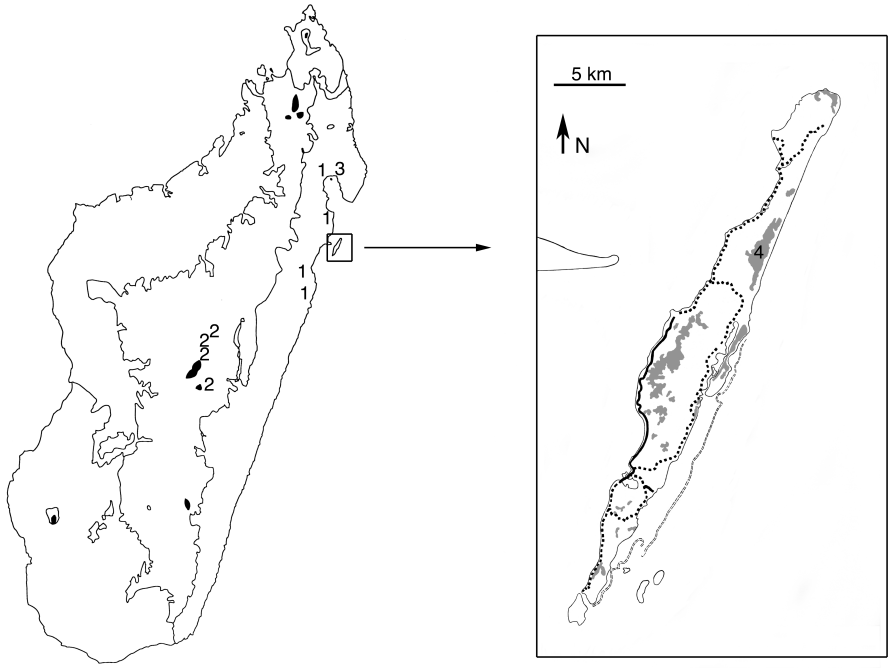

FIG. 4. — Maps of Madagascar and Ste Marie Island, showing the known distribution of *Tityobuthus baroni* (Pocock, 1890) (**1**), *T. lucileae* Lourenço, 1996 (**2**), *T. guillaumeti* Lourenço, 1985 (**3**) and *T. pallidus* n. sp. (**4**).

Morphology

Carapace weakly granular; anterior margin with a moderately pronounced median concavity, forming a weak angle. All carinae weak; furrows moderate to weak. Median ocular tubercle distinctly anterior to the centre of the carapace; median eyes separated by less than one ocular diameter. Three pairs of lateral eyes. Sternum subtriangular to subpentagonal. Mesosoma: tergites weakly granular. Median carina weak on all tergites; other carinae absent. Tergite VII pentacarinate. Venter: genital operculum divided longitudinally, each half being oval-shaped. Pectines: pectinal tooth count 14-14; basal middle lamellae not dilated; fulcra present. Sternites smooth with small, elongate stigmata; VII without carinae. Sternite V without any smooth or bright zone on posterior edge. Metasoma: segments I-III with 10 carinae, moderately crenulate. Segment IV with eight carinae, moderately crenulate. Intercarinal spaces weakly to moderately granular. Segment V with five carinae, rounded and weakly granular except on the ventral surface which shows thin granulation. Telson smooth, with a globular shape and a long strongly curved aculeus; subaculear tooth moderate and tending to rhomboid in shape with two basal granules. Cheliceral dentition characteristic of the family Buthidae (see Vachon 1963); basal teeth of movable fingers reduced and fused; ventral surfaces of finger and manus with setae. Pedipalps: femur pentacarinate; patella and chela with some carinae, weakly crenulate; internal face of patella with five spinoid granules; all faces weakly granular; fixed and movable fingers with 8/8 almost linear rows of granules. Trichobothriotaxy; orthobothriotaxy A-α (cf. Vachon 1974, 1975). Legs: tarsus with numerous fine median setae ventrally. Pedal spurs moderate and tibial spurs very reduced.

RELATIONSHIPS

From its general morphology, and especially in the total lack of pigmentation, *Tityobuthus pallidus* n. sp. appears to be most closely related to *T. guillaumeti* Lourenço, 1995 and *T. judsoni* Lourenço, 1996. The new species can be readily distinguished from the other two by the following features: 1) the presence of fulcra on the pectines of *T. pallidus* n. sp., whereas in *T. guillaumeti* fulcra are absent; 2) a more globular shape of the vesicle in *T. pallidus* n. sp. (in both *T. guillaumeti* [Fig. 3B] and *T. judsoni* the vesicle is elongated); 3) pectines of *T. pallidus* n. sp. have 14-14 teeth whereas those of *T. judsoni* have 18-19 teeth; and 4) tibial spurs are very reduced in *T. pallidus* n. sp. but strongly marked in *T. judsoni*.

TABLE 1. — Morphometric values (in mm) of the female holotype of *Tityobuthus pallidus* n. sp.

Total length		31.1
Carapace length		3.5
	anterior width	2.4
	posterior width	3.8
Metasomal segment I	length	2.3
	width	1.8
Metasomal segment V	length	5.1
	width	1.6
	depth	1.7
Vesicle	width	1.4
	depth	1.4
Pedipalp	femur length	3.6
	femur width	1.0
	patella length	4.6
	patella width	1.5
	chela length	6.6
	chela width	1.2
	chela depth	1.1
Movable finger length		4.6

KEY TO THE SPECIES OF *TITYOBUTHUS* POCOCK, 1893

1. Pectines with fulcra vestigial or absent 2
— Pectines with well developed fulcra 3

2. Fulcra vestigial ..... *T. monodi*
— Fulcra absent ..... *T. guillaumeti*

3. Tibial spurs absent or very reduced 4
— Tibial spurs present 5

4. Pectines with 19-20 teeth ..... *T. baroni*
— Pectines with 14-16 teeth ..... *T. rakotondravonyi*

5. Chelicerae without spots or pigmentation 6
— Chelicerae with dark spots and pigmentation 7

6. Pedipalp chela globular; fingers short ..... *T. judsoni*
— Pedipalp chela slender; fingers elongated ..... *T. pallidus* n. sp.

7. Pectines with 20 or more teeth 8
— Pectines with less than 20 teeth 10

8. A conspicuous smooth, white and bright central zone on sternite V .... *T. manonae*
— No such zone on sternite V 9

9. Body, pedipalps and legs heavily spotted; pedipalpal chela short and robust; internal face of patella with four spinoid granules ..... *T. lucileae*
— Body, pedipalps and legs with only vestigial spots; pedipalpal chela long and slender; internal face of patella with five or six spinoid granules ..... *T. pococki*

10. Pectines with 11 teeth ..... *T. ivohibe*
— Pectines with 12 to 19 teeth 11

11. Pectines with 12 to 14 teeth 12
— Pectines with 15 to 19 teeth 13

12. A smooth and white central zone on sternite V and two small rounded smooth white zones laterally ..... *T. griswoldi*
— Sternite V without any smooth white zone ..... *T. parrilloi*

13. Sternite V with a reduced or conspicuous smooth white zone; total length averaging 20 mm 14
— Sternite V without any smooth white zone; total length averaging 35 mm .... *T. darainensis*

14. Sternite V centrally with a single conspicuous smooth white zone ..... *T. dastychi*
— Sternite V with a reduced smooth white central zone associated with two small rounded smooth white zones laterally ..... *T. petrae*

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