

Tmesiphantes mirim sp. nov. (Araneae: Theraphosidae) from the Atlantic Forest of Bahia, Brazil, biogeographical notes and identification keys for species of the genus

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ABSTRACT. A new species of *Tmesiphantes* Simon, 1892 is described and illustrated, based on eight male specimens collected at the Una Biological Reserve, southern state of Bahia, Brazil. It is distinguished by the morphology of male palpal bulb and tibial apophysis. The new species is very small and is the smallest theraphosid described to date (body length 5.5 mm). It is distinguished from congeners by the size, which vary from 12 mm (*T. riopretano*) to 23.8 mm (*T. nubilus*) in other species of the genus, aspect of palpal bulb, sternal posterior sigillae close to sternal margin and by the aspect of tibial apophysis which lacks the prolateral branch. *Tmesiphantes* presently comprises nine species. Six have been described for the southern region of Bahia, a well known area of endemism in the Atlantic Forest. Identification keys for *Tmesiphantes* males and females are presented.

KEY WORDS. Mygalomorphae; Neotropics; tarantula; taxonomy; Theraphosinae; Una Biological Reserve.

Tmesiphantes comprises small to medium sized tarantula spiders, with labium and maxillae with few cuspules, rounded sternum, urticating setae type III and IV, femur III incrassate, male palpal bulb with curved embolus bearing two keels (prolateral superior and inferior), and spermathecal receptacles with subapical constriction.

Tmesiphantes was originally described by SIMON (1892) for *T. nubilus*, based on a male and a female from the state of Bahia. Later, MELLO-LEITÃO (1923, 1926, 1943) described three species from Brazil: in 1923, *T. montanus* from Itatiaia, state of Rio de Janeiro; in 1926, *T. physopus* from Campina Grande, state of Paraíba; and in 1943, *T. minensis* from Ouro Preto, state of Minas Gerais. CAPORACCIO (1955) described *T. chickeringi*, from Venezuela. GERSCHMANN DE PIKELIN & SCHIAPELLI (1958) revised the genus and described two species from Argentina, *T. serratus* and *T. elegans*. They provided an identification key that included all species but *T. chickeringi*, which was known only from an immature female. Later GERSCHMANN DE PIKELIN & SCHIAPELLI (1972), transferred *T. montanus* and *T. elegans* to *Homoeomma* and considered *H. uruguayense* Mello-Leitão, 1946 as senior synonym of *T. serratus*. RAVEN (1985) considered *Tmesiphantes* as junior synonym of *Dryptopelma* Simon, 1889 (currently under the synonym of *Cyclosternum* Ausserer, 1871 by PÉREZ-MILES et al. 1996: 46) and confirmed the taxonomic changes made by GERSCHMANN DE PIKELIN & SCHIAPELLI (1972). PÉREZ-MILES et al. (1996) revalidated

Tmesiphantes, emphasizing the morphology of the male palpal bulb and femur III incrassate as diagnostic features of the genus. SCHAEFER (1996) described *T. spinopalpus* from Paraguay, which was later transferred to *Cyclosternum* Ausserer, 1871 by RUDLOFF (2000).

As a result of RUDLOFF's (2000) contribution *Tmesiphantes* comprised four species: three from Brazil (*T. nubilus*, *T. physopus* and *T. minensis*) and one from Venezuela (*T. chickeringi*). Two years later, YAMAMOTO et al. (2007) revised *Tmesiphantes* and described three species in it (*T. amadoi*, *T. bethaniae* and *T. caymmii*). They also proposed the following taxonomic changes: they placed *T. chickeringi* as species inquirenda; and transferred *T. physopus* and *T. minensis* to *Plesiopelma* because they have a retrolateral basal nodule on male metatarsus I. GUADANUCCI & SILVA (2012) described two species from Minas Gerais, Brazil (*T. perp* and *T. riopretano*). BERTANI et al. (2013) described *T. hypogeus*, the first troglomorphic tarantula from Brazil, also from Bahia. Recently, GONZALEZ-FILHO et al. (2014) described *T. aridai*, from the state of Pará, Brazil, comprising the first record of the genus for the Amazon Forest. Currently, the genus includes eight species from Brazil: *T. nubilus*, *T. amadoi*, *T. bethaniae*, *T. caymmii*, *T. riopretano*, *T. perp*, *T. hypogeus* and *T. aridai*. The examination of extra material from southern Bahia, deposited at Butantan Institute, revealed two small male spiders that fit the generic definition of *Tmesiphantes*. This species is described here as *Tmesiphantes mirim* sp. nov.

MATERIAL AND METHODS

The material examined belongs to the arachnid collection of Butantan Institute (IBSP, São Paulo, Brazil, A.D. Brescovit). All measurements are in millimeters, taken with a millimetric ocular lens. The length of leg segments was measured between the joints in dorsal view. The lengths and widths of the carapace, eye tubercle, labium and sternum are the maximum values obtained. The total body length does not include chelicerae and spinnerets. The male palpal bulb was removed from the cymbium and photographed in dorsal, prolateral and retrolateral views. The tibial apophysis was photographed in ventral and prolateral views. Abbreviations: (AME) anterior median eyes, (ALE) anterior lateral eyes, (PME) posterior median eyes, (PLE) posterior lateral eyes. Spines: (d) dorsal, (v) ventral, (p) prolateral, (r) retrolateral. The number and disposition of spines follows the terminology of PETRUNKEVITCH (1925); urticating hair types terminology follows COOKE et al. (1972). Pictures and measurements were taken with a stereomicroscope (Leica M205C with DFC295 digital camera and Leica Application Suite v.4.2).

The distributional dataset was based on three distinct sources: the literature, scientific collections (listed below) and field collecting. All records were assembled in Microsoft Excel (xls files). The xls files were converted into shapefile format (shp) and the map was built using DIVA-GIS v.7.5, available at <http://www.diva-gis.org>.

Distributional records from the following scientific collections were used: (IBSP) Instituto Butantan, São Paulo, Brazil; (MZSP) Museu de Zoologia da Universidade de São Paulo, Brazil; (MPEG) Museu Paraense Emílio Goeldi, Belém, Brazil; (MNRJ) Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil; (CAD) Coleção Aracnológica Diamantina, Diamantina, Brazil; (UFMG) Universidade Federal de Minas Gerais, Belo Horizonte, Brazil; (UFPA) Universidade Federal da Paraíba, João Pessoa, Brazil.

The following material was examined: *Tmesiphantes*: male holotype of *T. amadoi* from Jussari, Bahia, Brazil, March 2001 (IBSP 12930). Paratypes of *T. amadoi*: one male with the same data as the holotype (IBSP 11878); four males with the same data as the holotype (IBSP 11859). Male paratypes of *T. caymmii* from Poções, Bahia, Brazil, 3 June 2002, A. Zanotti leg. (MZSP 28194). Male holotype of *T. bethaniae* from Una, Bahia, Brazil, December 1999, K. Kato leg. (MZSP 24226). Paratypes of *T. bethaniae*: two males from Uruçuca, Bahia, Brazil, March 2002, J.P.L. Guadanucci leg. (MZSP 24125; MZSP 24129). Four males of *T. nubilus* from Uruçuca, Bahia, Brazil, March 2002, J.P.L. Guadanucci leg. (MZSP 24241). Male holotype of *T. riopretano* from Parque Estadual do Rio Preto, São Gonçalo do Rio Preto, Minas Gerais, Brazil, 20-25 October 2010, G. Monteiro, F. Sá, W.F. Silva, J.P.L. Guadanucci leg. (CAD 422). Paratypes: one female of *T. riopretano* from the same locality as holotype, 12-19 January 2010, J.P.L. Guadanucci, W.F. Silva, D. Moura leg. (CAD 016). Male holotype of *T. perp* from Parque Estadual do Rio Preto, São Gonçalo do Rio Preto, Minas Gerais, Brazil, 19 January 2010, J.P.L. Guadanucci, W.F. Silva, D. Moura,

R.F. Fonseca, D. Weinmann leg. (CAD 024). Holotype female of *T. hypogeus* from Andaraí, Igatu, Gruta da Parede Vermelha, Bahia, Brazil, 29 October 2010, M.E. Bichuette and J.E. Gallão leg. (MNRJ 04357). Paratypes: one male and two females of *T. aridai* from Floresta Nacional do Tapajós, Santarém, Pará, Brazil, X. 2011, A.D. Brescovit et al. leg. (IBSP 165020, IBSP 149977, IBSP 165996). *Melolleitaoina*: holotype male of *Melolleitaoina crassifemur* from Salta, Argentina, IIX.1947, N. Orfila leg. (MACN-Ar 2285). Holotype male of *Melolleitaoina mutquina* from Mutquín, Catamarca, Argentina, 2.II.1981, E. Maury leg. (MACN-Ar 7737). Holotype male of *Melolleitaoina uru* from Salta, Argentina, undated collection, Goloboff, Coyle & Bennet leg. (MACN-Ar 26042). Paratypes: one female of *Melolleitaoina uru* from Punila, Araguay, Salta, Argentina, IV.1948, Biraben leg. (MACN-Ar 6542). Holotype male of *Melolleitaoina yupanqui* from P. Nacional Calilegua, Jujuy, Argentina, 06-11.XII.2008, C. Grismado, M. Izquierdo, F. Labarque, G. Rubio, M. Burger, P. Michalik, P. Carrera, A. Ojanguren & C. Mattoni leg. (MACN-Ar 26041). Paratypes: one female of *Melolleitaoina yupanqui* from P. Nacional Calilegua, Jujuy, Argentina, 06-11.XII.2008, C. Grismado, M. Izquierdo, F. Labarque, G. Rubio, M. Burger, P. Michalik, P. Carrera, A. Ojanguren & C. Mattoni leg. (MACN-Ar 26044).

TAXONOMY

Tmesiphantes mirim sp. nov.

Figs. 1-7, Table 1

Diagnosis. It differs from the other species by the aspect of palpal bulb (Figs. 2-4), with the embolus inserted perpendicularly to the tegulum, in a way that the inferior prolateral keel is perpendicular to the basal-apical axis in the retrolateral view (Fig. 4).

The apical end of embolus is as wide as the mid portion, resembling representatives of *T. bethaniae* and *T. aridai*. It differs from those species by the sternal posterior sigillae close to sternal margin and by the produced prolateral inferior keel. In addition, by the aspect of tibial apophysis (Figs. 6 and 7), which lacks the prolateral branch, which is present and conspicuous in other species of the genus.

Females are unknown.

Description. Male holotype. Coloration (in ethanol 70%): carapace beige (Fig. 1), abdomen and legs light beige (Fig. 1). Total length 5.5. Cheliceral basal article with 11 teeth each on the promargin. Carapace: length 2.7, width 2.0. Thoracic furrow straight. Clipeus narrow. Eye tubercle: length 0.3, width 0.5. Eyes sizes: AME 0.1, ALE 0.3, PME 0.1, PLE 0.1. Labium: length 0.2, width 0.3, with three cuspules (Fig. 5). Sternum rounded (Fig. 5) length 1.3, width 1.2. Posterior sternal sigillae elongated and next to sternal margin. Maxillae with 34-23 (left-right) cuspules (Fig. 5). Spines: palp articles and leg tarsi without spines. Legs: I – metatarsus v0, p0-1-0, r0. II – tibia v0, p0, r0-1-0; metatarsus v0, p0, r0-1-1. III – metatarsus v0-0-1, p0-1-1-0, r0-1-1-0. IV – tibia: v1-0-0-1, p1-1-1-1, r0-1-0-1; metatar-



Figures 1-7. *Tmesiphantes mirim* sp. nov. male holotype (IBSP 9954): (1) dorsal habitus; (2-4) male palpal bulb: (2) prolateral view; (3) retrolateral view; (4) dorsal view; (5) cephalotorax, ventral view; (6-7) tibial apophysis; (6) lateral view; (7) ventral view. Scale bars: 1, 5-7 = 1 mm, 2-4 = 0.5 mm.

Table 1. *Tmesiphantes mirim* sp. nov. (holotype), legs and palp articles lengths (mm).

	Palp	Leg I	Leg II	Leg III	Leg IV
Femur	1.3	1.9	1.8	1.7	2.2
Patella	0.4	0.7	0.7	0.6	0.5
Tibia	1.2	1.5	1.3	1.0	1.8
Metatarsus	–	1.2	1.2	1.4	2.1
Tarsus	0.5	1.2	1.0	1.0	1.2
Total	3.4	6.5	6.0	5.7	7.8

sus v0-0-1-0, p0-0-0-1, r0-0-1-1. Palpal bulb piriform, with embolus slightly curved, two parallel keels (prolateral superior and inferior), inferior more developed than superior (Figs. 2-4). Tibial apophysis (Figs. 6 and 7) composed of a single branch (namely retrolateral branch in the other species) bearing a short

spine on the apex; a short spine is present, next to the apophysis branch. Urticating hairs type III on the center of abdominal dorsum. Tarsal scopula I-IV entire. Scopula on metatarsi absent. Femur III incrassate. Single tooth on each of the paired claws. PMS absent, apical article of PLS digitiform.

Type material. Holotype male from Una, Bahia, Brazil (IBSP 109954), from X.1999 to IX.2000, M.T. Dias leg. Paratype one male (IBSP 109958), two males (IBSP 111463), one male (IBSP 111482), two males (IBSP 111463) and one male (IBSP 111482).

Distribution. Known only from the type locality.

Etymology. The specific epithet is a word in Tupi, a Brazilian indigenous language, meaning very small.

Key to males of *Tmesiphantes* species

1. Palp bulb with a strong curvature in the apical portion of the embolus (YAMAMOTO et al. 2007: figs. 3-5; GUADANUCCI & SILVA 2012: figs. 11-13) 2

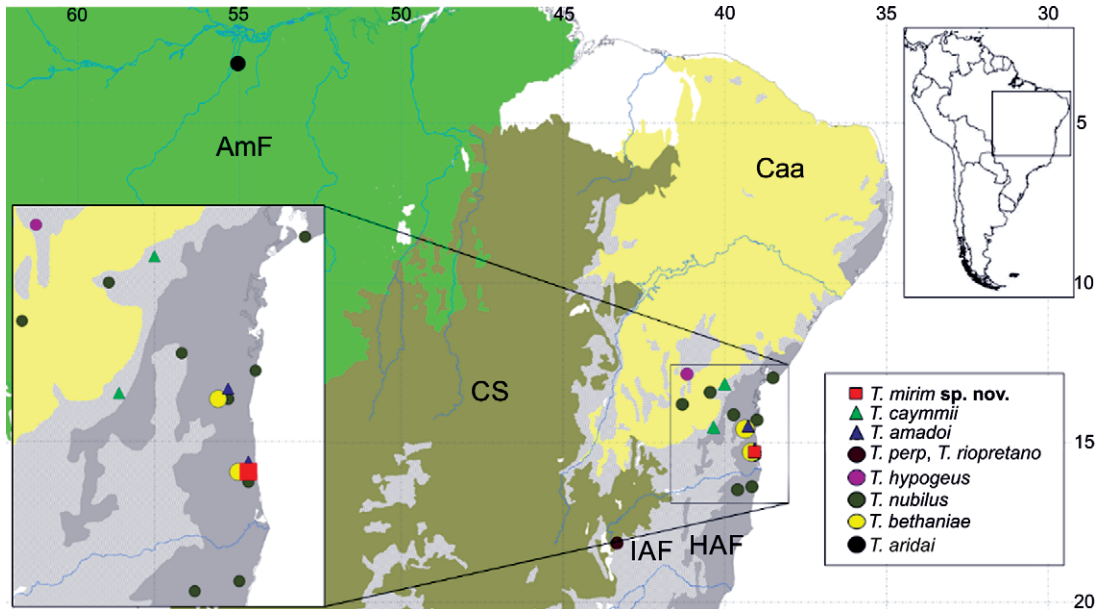


Figure 8. Distribution map of *Tmesiphantes*. (CS) Cerrado/Savanna, (Am) Amazonian Forest, (Caa) Caatinga, (HAF) Humid Atlantic Forest, (IAF) Interior Atlantic Forest.

- 1'. Palp bulb without such curvature in the apical portion of the embolus 3
- 2. Presence of a membrane in the apical portion of embolus, which is thicker than the mid portion (GUADANUCCI & SILVA 2012: figs. 11-13) metatarsus I slightly curved
..... *Tmesiphantes perp* Guadanucci & Silva, 2012
- 2'. Absence of such a membrane, the apical portion of embolus with the same thickness (YAMAMOTO et al. 2007: figs. 3-5) of the mid portion; metatarsus I straight
..... *Tmesiphantes nubilus* Simon, 1892
- 3. Apical portion of embolus wider than the mid portion ... 4
- 3'. Apical portion of embolus of the same width or thinner than mid portion 5
- 4. Presence of serrated keel at apical end of embolus (YAMAMOTO et al. 2007: figs. 9 and 11) *Tmesiphantes amadoi* Yamamoto et al., 2007
- 4'. Presence of a circular patch of short bristles on the mid portion of abdomen (YAMAMOTO et al. 2007: fig. 20)
..... *Tmesiphantes caymmii* Yamamoto et al., 2007
- 5. Apical portion of embolus thinner than the mid portion (GUADANUCCI & SILVA 2012: figs. 3-5)
..... *Tmesiphantes riopretano* Guadanucci & Silva, 2012
- 5'. Apical portion of embolus of the same width as mid portion 6
- 6. Posterior sternal sigillae near sternal margin; very small spiders (not exceed 6 mm of body length)
..... *Tmesiphantes mirim* sp. nov.

- 6'. Posterior sternal sigillae far from sternal margin, medium-sized spiders (more than 22 mm of body length) 7
 - 7. Retrolateral branch of tibial apophysis very small, not longer than half the length of spine next to it (YAMAMOTO et al. 2007: figs. 24)
..... *Tmesiphantes bethaniae* Yamamoto et al., 2007
 - 7'. Retrolateral branch of tibial apophysis longer than spine next to it (GONZALEZ-FILHO et al. 2014: fig. 5)
..... *Tmesiphantes aridai* Gonzalez-Filho et al., 2014
- Males of *T. hypogeus* are unknown.

Key to females of *Tmesiphantes* species

- 1. Spermatheca with receptacles fused at base (YAMAMOTO et al. 2007: fig. 8) *Tmesiphantes nubilus* Simon, 1982
- 1'. Spermatheca with free receptacles 2
- 2. Strong constriction at subapical region of spermatheca receptacles 3
- 2'. Without constriction at subapical region of spermatheca receptacles 4
- 3. Subapical region of the spermatheca receptacles thinner than the base (YAMAMOTO et al. 2007: fig. 19)
..... *Tmesiphantes caymmii* Yamamoto et al., 2007
- 3'. Subapical region of spermatheca receptacles wider than the base (GUADANUCCI & SILVA 2012: fig. 8)
..... *Tmesiphantes riopretano* Guadanucci & Silva 2012
- 4. Anterior median eyes greatly reduced, transparent ocular tubercle (BERTANI et al. 2013: fig. 2C); two patches of

urticating hair type III at dorsolateral areas on the abdomen (BERTANI et al. 2013: figs. 1 and 2A)
 *Tmesiphantes hypogeus* Bertani et al., 2013
 4'. Anterior median eyes of regular size (GONZÁLEZ-FILHO et al. 2014: fig. 8); single urticating hair patch on abdomen
 *Tmesiphantes aridai* González-Filho et al., 2014
 Females of *T. amadoi*, *T. bethaniae*, *T. perp*, and *T. mirim* sp. nov. are unknown.

DISCUSSION

Species of *Tmesiphantes* are present in the Amazon Forest (*T. aridai*), in rocky fields of Cerrado (*T. perp* and *T. riopretano*), in the Atlantic Forest (*T. bethaniae*, *T. amadoi*, *T. caymmii*, *T. nubilus*, and *T. mirim* sp. nov.), and in Caatinga (*T. hypogeus* and *T. nubilus*) (Fig. 8). The species described here is the sixth from southern Bahia and the fifth from the Ombrophilous Dense Forest that covers the southern part of the state. Moreover, *T. bethaniae*, *T. amadoi*, *T. nubilus*, and *T. mirim* sp. nov. are sympatric at the municipality of Una (Una Biological Reserve) (Fig. 8).

Southern Bahia is a well-known area of endemism in the Atlantic Forest (e.g., PRANCE 1982, SILVA & CASTELI 2005, DASILVA & PINTO-DA-ROCHA 2011). There, the forest has remained relatively stable from the late Quaternary to the present, acting as a refuge for forest species (CARNAVAL & MORITZ 2008). The sympatric occurrence of the four species of *Tmesiphantes* at Una and the endemism of three of them in this area (Fig. 8) support the historic biogeographical hypothesis.

The sympatry of *T. bethaniae*, *T. amadoi*, *T. nubilus*, and *T. mirim* is remarkable since it is not a common pattern of geographical distribution among Theraphosidae spiders in the Neotropics. Closely-related spiders in this family are more commonly allopatric or parapatric (e.g., *Catanduba* Yamamoto, Lucas & Brescovit, 2012, *Catumiri* Guadanucci, 2004, *Cyriocosmus* Simon, 1903, *Epebopus* Simon, 1892, *Eupalaestrus* Pocock, 1901, *Homoeomma* Ausserer, 1871, *Plesiopelma* Pocock, 1901, *Proshapalopus* Mello-Leitão, 1923, *Typhochlaena* C.L. Koch, 1850, *Pachistopelma* Pocock, 1901, *Iridopelma* Pocock, 1901, *Nhandu* Lucas, 1983). There are also cases of partial sympatry (e.g., *Magula* Simon, 1892, *Maraca* Pérez-Miles, 2006, *Vitalius* Lucas, Silva & Bertani, 1993, *Acanthoscurria* Ausserer, 1871). *T. mirim* sp. nov. is a tiny theraphosid spider (5.5 mm of body length – the smallest theraphosid described to date) that shares its habitat with congeners (ranging from 19 to 23 of body length). The great difference in the size of this species may be the result of sympatric speciation. It is possible that small spiders avoided competition with larger ones, since they were able to explore smaller microhabitats and food items, which gave them an advantage and eventually led to speciation. This hypothesis, however, needs to be tested with ecological and behavioral approaches.

The intra and inter relationships of *Tmesiphantes* are far from being resolved. As already pointed out (PÉREZ-MILES et al.

1996, YAMAMOTO et al. 2007, GUADANUCCI & SILVA 2012, PERAFÁN & PÉREZ-MILES 2014), representatives of *Tmesiphantes* share the femur III incrassate with spiders of the genus *Melloleitaoina* Gerschman & Schiapelli, 1960. According to PERAFÁN & PÉREZ-MILES (2014), the distinction between the two genera relies on the aspect of the sternal sigillae, which are more rounded in *Melloleitaoina*, and the leg spines, which are more numerous in *Tmesiphantes*. After description of *T. mirim*, along with the examination of all species of both genera, it has become obvious to us that all previous diagnoses fail to separate these genera due to interspecific morphological variation. It is very likely that these two genera are synonyms. In this case, *Tmesiphantes* would be the senior synonym, and for this reason we have chosen to place our new species in it. However, a comprehensive revision and phylogenetic analysis including representatives of all species of both genera, as well as close related genera (*Grammostola* Simon, 1892, *Homoeomma* Ausserer, 1871, *Euathlus* Ausserer, 1875, *Cyriocosmus* Simon, 1903, *Maraca* Pérez-Miles, 2006, *Plesiopelma* Pocock, 1901), is needed to ascertain the generic status of *Melloleitaoina* and *Tmesiphantes*.

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Page 153, second column, line 9:

Where read: Type material.

Should read: Type material. Holotype male from Una, Bahia, Brazil (IBSP 109954), from X.1999 to IX.2000, M.T. Dias leg. Paratype one male (IBSP 109958), two males (IBSP 111463), one male (IBSP 111482), two males (IBSP 111463) and one male (IBSP 111482).

All changes are already incorporated in the online PDF and HTML versions of these articles available at <http://www.scielo.br/zool>